PB94-964316
EPA/ROD/R07-94/081
April 1995

EPA Superfund Record of Decision:

Cornhusker Army Ammunition Plant (O.U. 1), Hall County, NE 9/29/1994

INTERIM ACTION RECORD OF DECISION DECLARATION

SITE NAME AND LOCATION

Operable Unit 1 - Groundwater
Old Potash Highway
Cornhusker Army Ammunition Plant
Grand Island, Hall County, Nebraska 68803

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected interim remedial action for the groundwater operable unit at the Cornhusker Army Ammunition Plant (CAAP). This action was chosen in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the administrative record for the site and additional information supporting the selected interim remedial action for Operable Unit 1 - Groundwater, is contained in the administrative record for this site.

The letter from the Nebraska Department of Environmental Quality (NDEQ) regarding concurrence of the selected remedy as an interim action for this site is attached.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this interim action Record of Decision (ROD), may present a current or potential threat to public health, welfare, or the environment.

DESCRIPTION OF THE SELECTED INTERIM REMEDY

Operable Unit One encompasses the explosives groundwater plume(s), both on-post and off-post. Explosives of concern in the contaminant plume include RDX, TNT, HMX, and their decomposition products.

The objective of this interim action is to contain the plume and prevent further migration of contaminants, and does not encompass full restoration of the plume of contaminated groundwater. The recommended alternatives provide an approach to containing and removing contaminant mass from the groundwater plume. This approach will control further migration of the plume and reduce the levels of the contamination in groundwater. The overall interim action for OU 1 addresses two areas of groundwater contamination, the on-post source areas and the off-post or distal end. The substances detected in the source area groundwater are primarily explosives, metals, and nitrates, however the objective of this action is to focus on the containment of the explosives contaminant plume. The treatment for metals and nitrates will be applied as necessary to meet the surface water discharge criteria. The groundwater at the distal end of the plume in the off-post area contains primarily RDX at low concentrations.

The interim groundwater remedies were developed to protect public health, welfare and the environment by controlling the migration and reducing the volume and mass of contaminants present in the groundwater beneath and downgradient of the facility. Operable unit interim actions will be consistent with all planned future remedial activities. The final remedial action for groundwater will augment and expand upon this interim remedial action to provide an effective overall groundwater remediation project.

The major components of the selected interim remedies include:

Source Area: Groundwater will be extracted from multiple extraction wells at a total estimated extraction rate of 1000 gallons per minute (gpm). The extraction of the contaminated groundwater will contain the source contamination and prevent further migration. The extracted groundwater will be treated with granular activated carbon for explosives, granular media filtration for suspended solids, chemical precipitation (as needed to meet NPDES limits), and wetlands for nitrates (as needed to meet NPDES limits). Treated water will be routed via pipeline through the easement of the proposed Wood River Diversion Channel to the Platte River. The system will be designed to actively control migration of more highly contaminated groundwater in the source area and to rapidly remove contaminant mass from the aquifer. Contaminant mass removal will be monitored by using new or existing monitoring wells. A schedule of sampling and analysis of the groundwater will be initiated to observe the effectiveness and progress of the remediation system.

Distal End: Groundwater will be extracted at a rate sufficient to prevent further migration of the explosives plume at the distal end. Groundwater will be extracted from multiple wells at an estimated total rate of 3000 gpm at the end of the contaminant plume and 1000 gpm at the tongue of the 20 ppb isopleth (intermediate location). The distal end treatment system uses some of the same technology as the Source Area, but due to differences in the groundwater quality does not require as extensive treatment. This system will prevent further migration of the end of the contaminant plume and the intermediate tongue. The pumped groundwater will be treated with granular activated carbon for the explosives. The treated water will be routed via pipeline through the easement of the proposed Wood River Diversion Channel to the Platte River. Contaminant mass removal will be monitored by using new or existing monitoring wells. A schedule of sampling and analysis of the groundwater will be initiated to observe the effectiveness and progress of the remediation system.

DECLARATION

This interim action is protective of public health, welfare and the environment. The action complies with action-specific and chemical-specific federal and state applicable or relevant and appropriate requirements, are cost effective, and address public concerns. Although the interim action is not intended to fully address the statutory mandate for permanence and treatment to the maximum extent practicable, this interim action utilizes treatment and thus is in furtherance of that statutory mandate. This action does not constitute a final remedy for the site, therefore the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element (although partially addressed by this remedy), will be more fully addressed by the final response action. Subsequent actions are planned to fully address the principal threats posed by providing comprehensive remediation of Operable Unit 1 - Groundwater.

This interim remedy will result in hazardous substances remaining on site above the health-based levels, therefore if the final remedy is not underway prior to the five year review, then the requirement of the five year review is applicable to the interim action. Review of this interim remedy will be ongoing as the Army continues to develop the final comprehensive remedial action for CAAP.

Date Sept. 29, 1994

Dennis Grams
Regional Administrator
US Environmental Protection Agency
Region VII

Date 27 Sep 94

LTC Mary G. Goodwin
Commanding Officer
Cornhusker Army Ammunition Plant

Date 11/18/94

Lewis D. Walker
Deputy Assistant Secretary of the Army
(Environment, Safety, and Occupational Health)

Attachments: Decision Summary
Responsiveness Summary - Attachment A

STATE OF NEBRASKA

DEPARTMENT OF ENVIRONMENTAL QUALITY
Randolph Wood
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P.O. Box 98922
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Phone (402) 471-2186

DEC 2 1994

E. Benjamin Nelson
Governor

Mr. Dennis Grams
Regional Administrator
EPA Region VII
726 Minnesota Avenue
Kansas City, Kansas 66101

Dear Mr. Grams:

Upon consideration of the Decision Summary for Cornhusker Army Ammunition Plant Operable Unit One - Groundwater dated September 20, 1994, the Nebraska Department of Environmental Quality (NDEQ) concurs with the Interim Action Record of Decision remedy selection for the groundwater at the Cornhusker Army Ammunition Plant (CAAP) site.

NDEQ believes this interim remedy will contain and remove groundwater contaminated with explosive compounds posing a threat to human health and the environment. This interim remedy, when implemented, will prevent the future spread of contaminated ground water in the northwest area of Grand Island.

NDEQ appreciates the opportunity for involvement in the remedy selection process and the Army and EPA's consideration of NDEQ's input throughout this investigation. NDEQ considers the development of this document and the participation of the citizens of Grand Island and surrounding counties to exemplify a high degree of productive cooperation.

Sincerely,

Randolph Wood, P.E.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1.0 SITE LOCATION AND DESCRIPTION

Cornhusker Army Ammunition Plant (CAAP) is located in south-central Nebraska 2 miles west of the city of Grand Island and lies near the eastern margin of the Great Plains Physiographic Province. The site lies approximately 7 miles north of the Platte River, within the flood plain. The terrain is nearly level to slightly undulatory. The ground surface at CAAP and the surrounding vicinity slopes gently from southwest to northeast with elevations ranging from 1,950 ft above sea level in the southwest to 1,850 ft in the northeast (Figure 1-1). The facility was constructed and fully operational in 1942 as a U.S. government-owned, contractor-operated (GOCO) facility. The facility produced artillery shells, mines, bombs, and rockets for World War II and the Korean and Vietnam Conflicts. CAAP comprises 11,936 acres consisting of five munitions production facilities (load lines), two munitions storage areas (magazine areas), a pistol range, sanitary landfill, burning grounds, shop area, ammonium nitrate production area, administration area, and railroad holding yard (Figure 1-2).

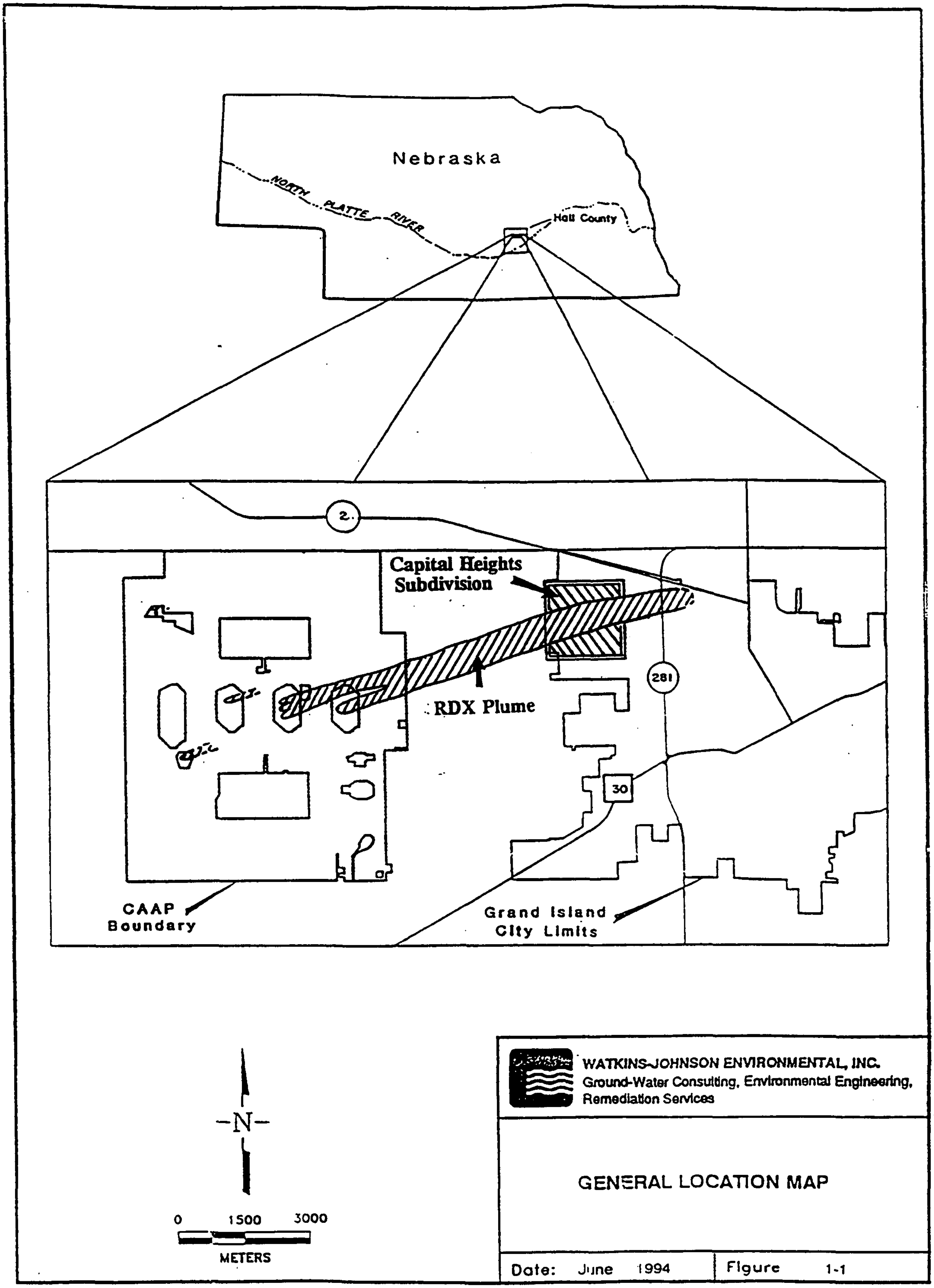
Activities at the site have resulted in contamination of groundwater with explosives compounds. Groundwater is the primary drinking water source in Grand Island and the surrounding areas. The explosives contaminant plume has migrated to the east-northeast approximately four miles beyond the installation boundary, contaminating domestic wells in northwestern Grand Island. Between CAAP and the Grand Island city limits, a distance of approximately two miles, the explosives contaminant plume underlies stockyards and irrigated row crops. The sources of groundwater contamination were unlined cesspools and leaching pits used to dispose of explosives contaminated wastewater from ordnance production activities.

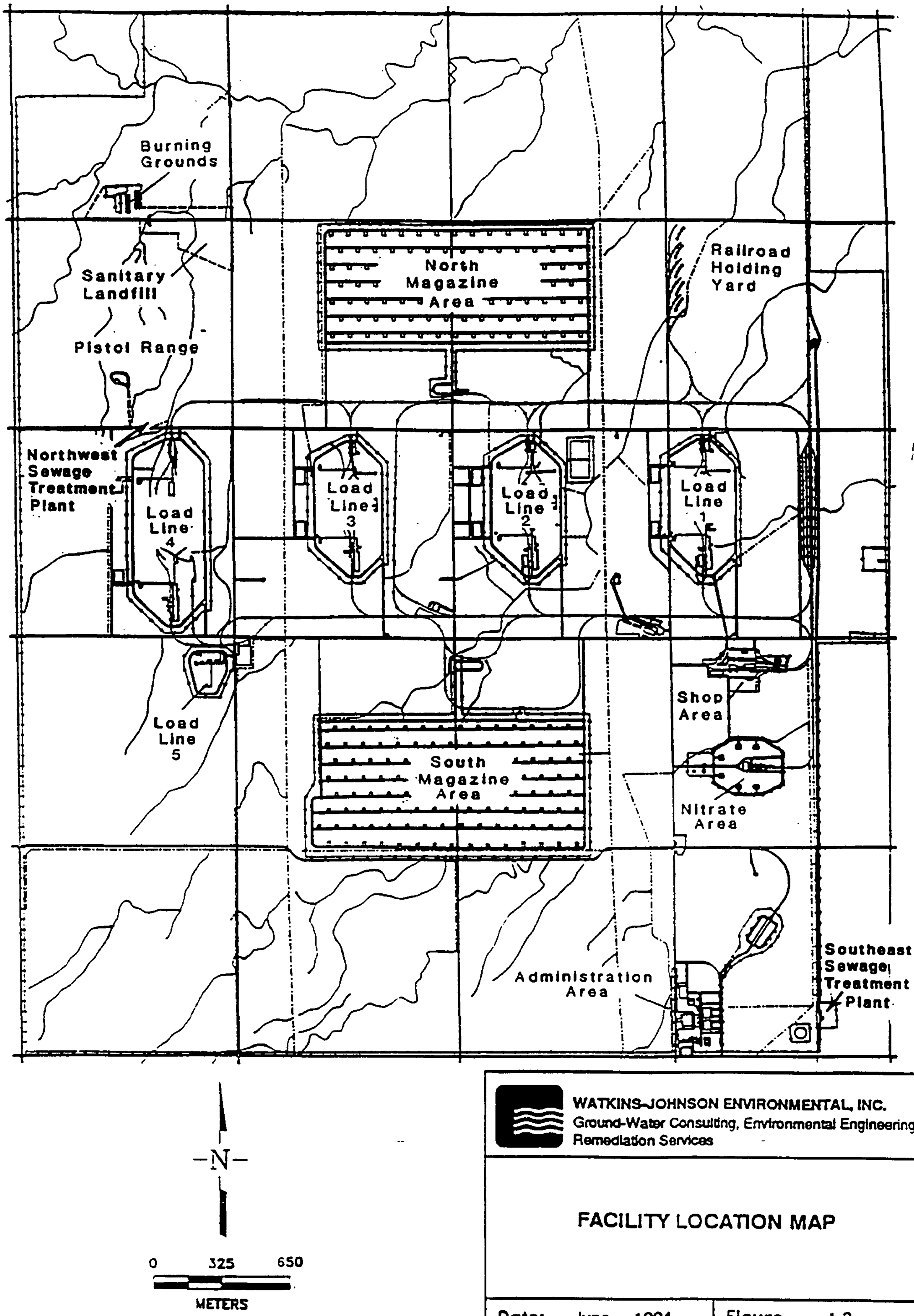
2.0 SITE HISTORY, OPERATIONS, PREVIOUS INVESTIGATIONS AND REMEDIAL ACTIONS

The following sections present a summary of the history of CAAP, describe the operations that occurred at the site that resulted in contamination, and discusses previous investigations and remedial actions conducted at CAAP.

2.1 SITE HISTORY

CAAP was operated from 1942 through 1945 by the Quaker Oats Ordnance Corporation, a subsidiary of the Quaker Oats Company. CAAP was placed on standby status for munitions production from 1945


Nebraska
NORTH PLATTE RIVER
Hall County
2
Capital Heights
Subdivision
RDX Plume
281
30
CAAP
Boundary
Grand Island
City Limits
N
0
1500
3000
METERS
WATKINS-JOHNSON ENVIRONMENTAL, INC.
Ground-Water Consulting, Environmental Engineering,
Remediation Services
GENERAL LOCATION MAP
Date: June 1994
Figure 1-1



WATKINS-JOHNSON ENVIRONMENTAL, INC.
Ground-Water Consulting, Environmental Engineering, Remediation Services

FACILITY LOCATION MAP

Date: June 1994	Figure 1-2

through 1950. From 1945 through 1948, the ammonium nitrate production area was used for the production of fertilizer.

CAAP was reactivated in 1950 to produce munitions for the Korean conflict. Operations were directed by Mason & Hanger-Silas Mason Company (Mason & Hanger) until 1957 when CAAP was again placed on standby status. In 1963 a total of 809 acres from three parcels of land the northeast, northwest, and southeast corners of the facility were sold to the State of Nebraska for use as wildlife management areas. CAAP was reactivated from 1965 through 1973 to produce munitions for the Vietnam Conflict. Mason & Hanger was retained as the operator during this period of operation. CAAP was placed on standby status when ordnance production operations ceased in 1973. Standby status was terminated on January 30, 1989 when AMCCOM declared CAAP "Excess". The Excessing process was begun and is currently in progress. Activities at CAAP are currently limited to maintenance operations, leasing of property for agriculture, leasing of buildings for storage, limited manufacturing, and wildlife management.

CAAP was listed as a site on the National Priorities List (NPL) on July 22, 1987. As required under CERCLA of 1980 and amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986, The U.S. Army initiated a Remedial Investigation/Feasibility Study (RI/FS). A Federal Facility Agreement (FFA) was signed between the U.S. Army, USEPA, and the State of Nebraska (effective September 4, 1990) to set terms for the RI/FS effort. The FFA provided the terms, listed documents to be generated, and established target dates for the delivery of reports. A number of investigations and studies to address environmental impacts of activities at CAAP were conducted during the 1980's and are continuing today. These are summarized in Section 2.3.

2.2 OPERATIONS

The principal explosive compounds used during munitions production at CAAP were 2,4,6-trinitrotoluene (246TNT), cyclotrimethylenetrinitramine (RDX) and, to a lesser extent, cyclotetramethylenetetranitramine (HMX). Other chemical materials used to support munitions production include freon, paints, grease, oil, and solvents. Solvents reportedly used at CAAP include acetone (ACET), trichloroethylene (TRCLE) (TCE), and 111-trichloroethane (111TCE) (TCA).

Major operations conducted in Load Lines 1 through 4 included screening, melting and mixing, rod and pellet manufacturing, and remelting and refilling. These operations generated explosives dust (246TNT and RDX). Ventilation systems with Schneible wet scrubbers removed explosives dust from the air.

Process water from the Schneible units was circulated through settling tanks and recycled through the scrubbers. Wastewater from this process was disposed via interior-building open drains into concrete pits equipped with filter bags called sack sumps. The bags, made of canvas-like material, were designed to filter out solid explosives particles. The filtered wastewater flowed through open concrete channels into circular earthen impoundments (cesspools). The walls of these impoundments were masonry lined, with the bottom open to the sand and gravel strata. Water that did not infiltrate through the bottom of the impoundment was routed through an overflow pipe into a leaching pit.

The limited filtering effectiveness of the sack sumps allowed explosive particles to flow into the earthen impoundments. The residue was periodically scraped from the bottom of the earthen impoundments and leaching pits and ignited at the Burning Grounds. Wastewater was also generated from periodic washing of machinery, interior building surfaces, and carts used for transporting the munitions during the production process. This wash water was also discharged to the sack sumps, cesspools, and leaching pits.

2.3 PREVIOUS INVESTIGATIONS

Several investigations relating to the characterization and remediation of contamination at CAAP have been completed. As part of the U.S. Army's Installation Restoration Program, USATHAMA completed an installation assessment of CAAP. A follow-on contamination survey was completed in 1982.

Results from sampling and analysis of soils and groundwater indicated that some of the leaching pits and cesspools were highly contaminated with explosives (especially 246TNT and RDX) resulting in contamination of the shallow aquifer. The explosives contamination was found to have migrated at least to the installation boundary and potentially migrated off site. The Army during 1983 through 1986 performed groundwater sampling and analysis and monitored water table elevations at CAAP and in the downgradient offpost area. The sampling network included up to 472 wells, including monitoring wells, irrigation wells, and domestic water supply wells. Sampling and analysis conducted in 1984 confirmed that RDX was migrating northeast, and had moved at least 3 mi offpost. It was confirmed that at least 200 domestic water supply wells in the Capital Heights residential area were contaminated with RDX. In 1984 the Army evaluated remedial solutions to the groundwater contamination and extension of the City of Grand Island water supply system into the affected area was selected. The extension action was carried out during 1984 through 1986. In 1985 the Army collected samples from eight locations at Load Lines 1, 2, 3, and 4 including leaching pits, french drains, cesspools, and sack sumps. Detections of explosives, predominantly 246TNT, 135TNB, and RDX, were found in most samples.

Sampling and analysis of groundwater for explosives contamination was conducted eleven times from September 1986 through June 1991. In 1991 an Remedial Investigation/Feasibility Study was initiated by the Army in accordance with the Interagency Agreement with the U.S. Environmental Protection Agency (USEPA) and the Nebraska Department of Environmental Quality (NDEQ). The results of this investigation relating to explosives contamination in groundwater are discussed in Section 5 of this document.

2.4 REMEDIAL ACTIONS

Confirmation of offpost migration of explosives contaminated groundwater led to response actions to remove the source(s) of contamination and provide water to households whose water supplies were affected. The following sections summarize these response actions.

2.4.1 ALTERNATE WATER SUPPLY

Bottled water was supplied from January 1984 through June 1986 by the Army to those households affected by explosives contamination in groundwater. In July 1984 the Army entered into a contract with the City of Grand Island to extend the city water system to the affected area and provide a permanent water supply for the impacted area.

Construction of the Northwest Grand Island Water Supply Extension commenced in August 1984. Residential water hookups were completed by December 1986. Approximately 800 residences, both in the affected area and adjacent areas, were given the opportunity to hook up to the Northwest Grand Island Water Supply Extension.

As a result of the continued groundwater monitoring, the Army recommended a second extension of the Grand Island Water Supply. This action was carried out in accordance with the removal action provisions of CERCLA/SARA. An Engineering Evaluation/Cost Analysis (EE/CA) was issued for public comment. Following the comment period and public meeting, the decision to extend the water supply system to an additional 65 residents was selected. This action started in the fall of 1993 and will be completed in the fall of 1994.

2.4.2 INSTALLATION RESTORATION INCINERATION PROGRAM

Fifty-eight impoundments (cesspools and leach pits) were identified as containing contaminated soil resulting from munitions manufacturing at CAAP. The Installation Restoration Incineration Program (IRIP) was an onsite CERCLA removal action, implemented to remove contamination at these sites. Incineration of contaminated soil began in August, 1987. Excavation of contaminated soil was performed by Mason & Hanger personnel, and incineration of contaminated soil was performed by International Technology (IT).

Incineration, decontamination, and demobilization were completed by August 8, 1988. Ash from the incineration was placed into trenches northeast of Load Line 2 and south of the North Magazine Area. A 2-ft cap of topsoil was applied and the site was fertilized and seeded. Excavated impoundments were backfilled with sand taken from a sand pit located on State Land (Nebraska State Game and Parks Commission) along the eastern boundary of the facility. Excavations were covered with 2 ft of rich black loam, fertilized, and seeded.

Clean-up action levels for incinerated soils were set jointly by U.S. Army and the Nebraska Department of Environmental Quality (NDEQ). These levels were as follows: 246TNT, 5 ppm; RDX, 10 ppm; 135TNB, 15 ppm; 24DNT, 0.5 ppm; and 26DNT, 0.4 ppm. Excavation and incineration were carried out until these action levels were met or until soil had been removed to a depth of 5 ft below the water table. Verification sampling and analysis was accomplished using composite samples comprised of subsamples from the bottoms and sides of the excavations. Since vertical excavation was limited by high water table and the discharge requirement action levels were almost always achieved laterally, inclusion of subsamples from the excavation sidewalls in the composite sample tended to underestimate contaminant content of the soils. In order to determine whether any of the 58 excavated impoundments are continuing sources of explosives contamination in groundwater, groundwater samples were collected upgradient and downgradient of the locations of these impoundments. Results from this sampling are forthcoming.

3.0 HIGHLIGHTS OF COMMUNITY PARTICIPATION

CERCLA Section 113(K)(2)(B)(i-v) requirements for public participation were met through the following activities. Community relations activities for the CAAP site were initiated by the Army in 1984. Early community relations activities included meeting with City and state officials to discuss the extension of the water line to homes with contaminated domestic wells. A Public Meeting was held on July 25, 1985 to explain the dewatering process and health risks of RDX. As part of the remedial action plan for CAAP, the Army conducted thermal treatment of the explosive-contaminated soils and debris. In order to keep the community informed of Army actions, the Army established information repositories at CAAP and at the Grand Island Public Library.

In 1985, the Army provided funding for a waterline extension to affected residences. The Army offered access to city water for those residents whose wells were in the approximate area of the contaminated plume. In an ongoing effort to assure protection of human health, the Army is currently extending the waterline to 65 additional residences. Estimated completion of this project is in the fall of 1994.

In January 1991 the Army and EPA conducted interviews with the community and in March of 1991 a community meeting was held to announce the Interagency Agreement between the Army, EPA, and the State. A Technical Review Committee (TRC) was formed in November, 1991 with local citizens participating in these meetings. The TRC has met periodically throughout the RI/FS process. The Community Relations Plan for CAAP was prepared in November 1991 and approved in January 1992. The public notice for this interim action for OU1 - Groundwater was issued on April 19, 1994. This notice announced the availability of the Administrative Record for public review and the location of the public repositories at CAAP and at the Grand Island Public Library, the public comment period and set dates for the public meetings.

The Army held a public comment period from April 26, 1994 to May 26, 1994 following the release of the Proposed Plan for this Interim Action for OU1- Groundwater. The Proposed Plan identified the preferred alternative for the Interim Action for OU1 - Groundwater. On May 4, 1994 the Army held a public availability session, a less formal open house to allow visitors to speak one-on-one with representatives of the Army, NDEQ, and EPA. The public meeting was conducted on May 5, 1994, to discuss the preferred alternative and to receive citizens' comments and questions. Agency responses to these comments received at the meetings and otherwise during the public comment period are included in the Responsiveness Summary.

4.0 SCOPE AND ROLE OF OPERABLE UNIT

The purpose of the Interim Action for this Operable Unit 1 -Groundwater is to contain the plume and prevent further migration of contaminants. It is the first of two operable units planned for the site. According to the NCP, the EPA regulation which establishes procedures for the selection of response actions, an interim action is appropriate where a contamination problem will become worse if left unaddressed and where the interim action will be consistent with a final remedial action. Consistent with the principles of the NCP, this Interim Action is designed to promptly initiate an interim remedial action response which will prevent further degradation of the aquifer, and contain the plume, thereby preventing further migration of contaninants.

The implementation of the Interim Action for OU1 is key to the stabilization of groundwater leading to the final remedy. Remedial activities planned for OU2 will consist of actions necessary to remediate the soils and groundwater to final clean-up goals, for explosives and any other contaminants determined to be present as a result of past activities at CAAP.

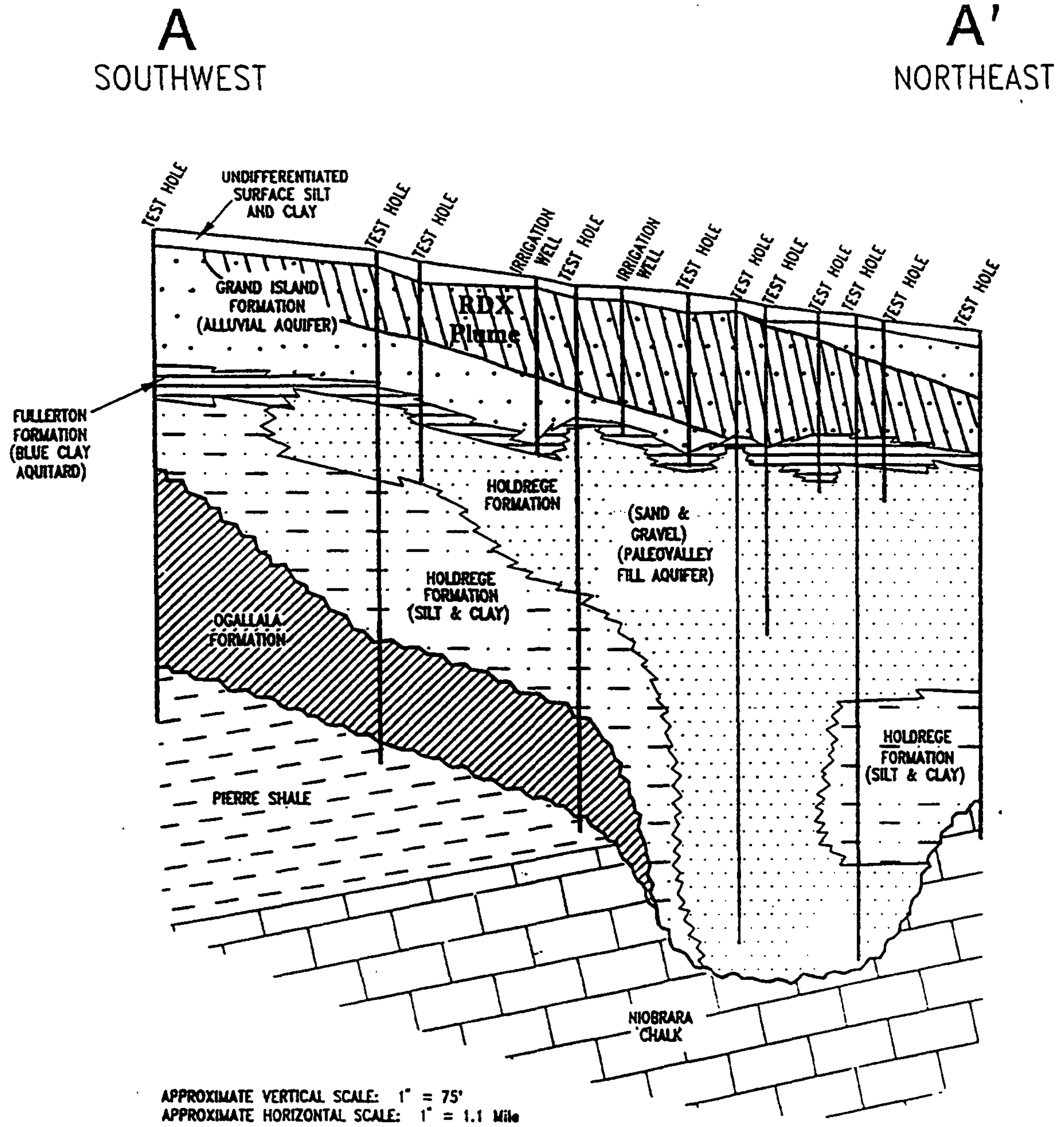
5.0 SITE CHARACTERISTICS

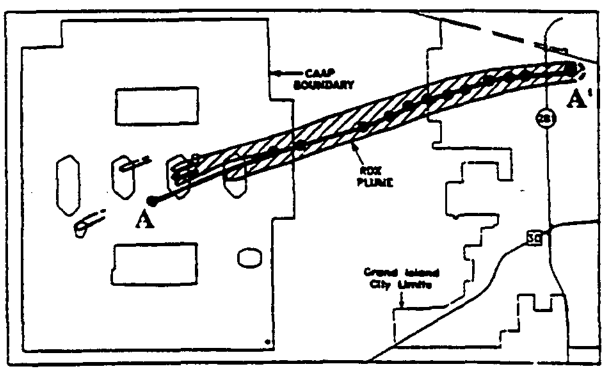
The following sections describe the geology and hydrogeology of the site, the nature and extent of the RDX groundwater plume, and the results of the contamination assessment conducted as part of the Site Characterization Study.

5.1 GEOLOGY

The RDX plume area is underlain by Quaternary deposits of unconsolidated eolian, fluvial, and lacustrine silt and clay and fluvial sand and gravel (Figure 5-1). These units rest on an erosional surface carved into the Tertiary Ogallala Formation, a heterogeneous deposit of poorly lithified to unconsolidated fluvial sand, silt, and clay. In most of the offpost explosives plume area, the Ogallala was completely removed by erosion prior to deposition of Quaternary deposits, exposing the underlying Cretaceous Pierre Shale and Niobrara Chalk.

The Quaternary deposits are comprised, in descending order, of the Peorian Loess and the Grand Island, Fullerton, and Holdrege Formations. The Peorian Loess consists of silt and silty clay which covers most of the onpost area. It ranges from 5 to 25 ft in thickness and thins to the east. The Grand Island





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GEOLOGIC CROSS SECTION OF THE RDX PLUME AREA

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Date: June 1994 | Figure 5-1

Formation is a laterally persistent, fluvial sand and gravel and ranges from 40 to 65 ft thick in the RDX plume area. The Grand Island Formation is underlain by the Fullerton Formation, locally referred to as the Blue Clay. The Fullerton consists predominantly of bluish green, silty clay of eolian, fluvial, and/or lacustrine origin and ranges from 5 to 25 ft in thickness. East of the plume area, the Fullerton has been locally removed by erosion which occurred prior to deposition of the Grand Island Formation. The Fullerton Formation is underlain by the Holdrege Formation, a heterogeneous unit consisting of fluvial sand and gravel and silt and clay of fluvial, lacustrine, and eolian origin. The Holdrege was deposited on an erosional surface developed on the Tertiary and Cretaceous bedrock units. The Holdrege is thicker and contains proportionately more sand and gravel where the erosional surface is most deeply incised into the underlying bedrock. These erosional lows are paleovalleys. In the explosives plume area the Holdrege ranges from 30 ft in thickness, over the erosional high, to greater than 220 ft in the paleovalley.

5.2 HYDROGEOLOGY

The Quaternary sand and gravel deposits are the primary source for groundwater in the Grand Island area. In the explosives plume area, Quaternary deposits consist of three hydrostratigraphic units: the Alluvial aquifer, the Blue Clay aquitard, and the Paleovalley Fill aquifer (Figure 5-1). The Alluvial aquifer is comprised of the saturated sand and gravel of the Grand Island Formation. The silty clay of the Fullerton Formation is the Blue Clay aquitard. The sand and gravel deposits of the Holdrege Formation constitute the Paleovalley Fill aquifer. East of the explosives plume, and other areas where the Fullerton Formation is not present, the Alluvial and Paleovalley Fill aquifers comprise one aquifer.

The Alluvial aquifer is an unconfined aquifer and has a saturated thickness ranging from approximately 28 to 65 ft in the study area. Analysis of data obtained during a constant rate pumping test of the Alluvial aquifer at CAAP yielded hydraulic conductivities ranging from 263 to 337 ft/day. The Blue Clay aquitard separates the Alluvial and Paleovalley Fill aquifers and is laterally continuous throughout CAAP and the explosives plume area. Detailed analysis of all available lithologic logs from subsurface penetrations in the RDX plume area and surrounding vicinity indicate that the Blue Clay aquitard is continuous in this area. Groundwater sampling results indicate that the Blue Clay is an effective barrier to the vertical migration of contamination in the RDX plume area. Analysis of potentiometric surface data, aquifer testing in the plume area, and laboratory permeability testing of the Blue Clay support this conclusion. The Paleovalley Fill aquifer consists of laterally discontinuous deposits of sand, gravel, silt, and clay. Analysis of data obtained during slug tests of the Paleovalley Fill aquifer both on and offpost yielded hydraulic conductivities ranging from 10 to 147 ft/day. The thickness and relative proportion of coarser sediments, and therefore transmissivity, of the Paleovalley Fill aquifer are greatest over the paleovalley axis.

The water table slopes uniformly with an average gradient of 0.001 from southwest to northeast in the explosives plume area (Figure 5-2). Depth to groundwater ranges from 5 to 20 ft. Since groundwater pumpage and recharge occur over broad areas, consequent changes in groundwater flow direction and lateral hydraulic gradients are minimal. Recharge of the Alluvial aquifer occurs by seepage of streamflow, infiltration of precipitation and irrigation water, and lateral movement of groundwater from areas west of CAAP. Except for water-supply and irrigation wells, there are no groundwater discharge areas at CAAP.

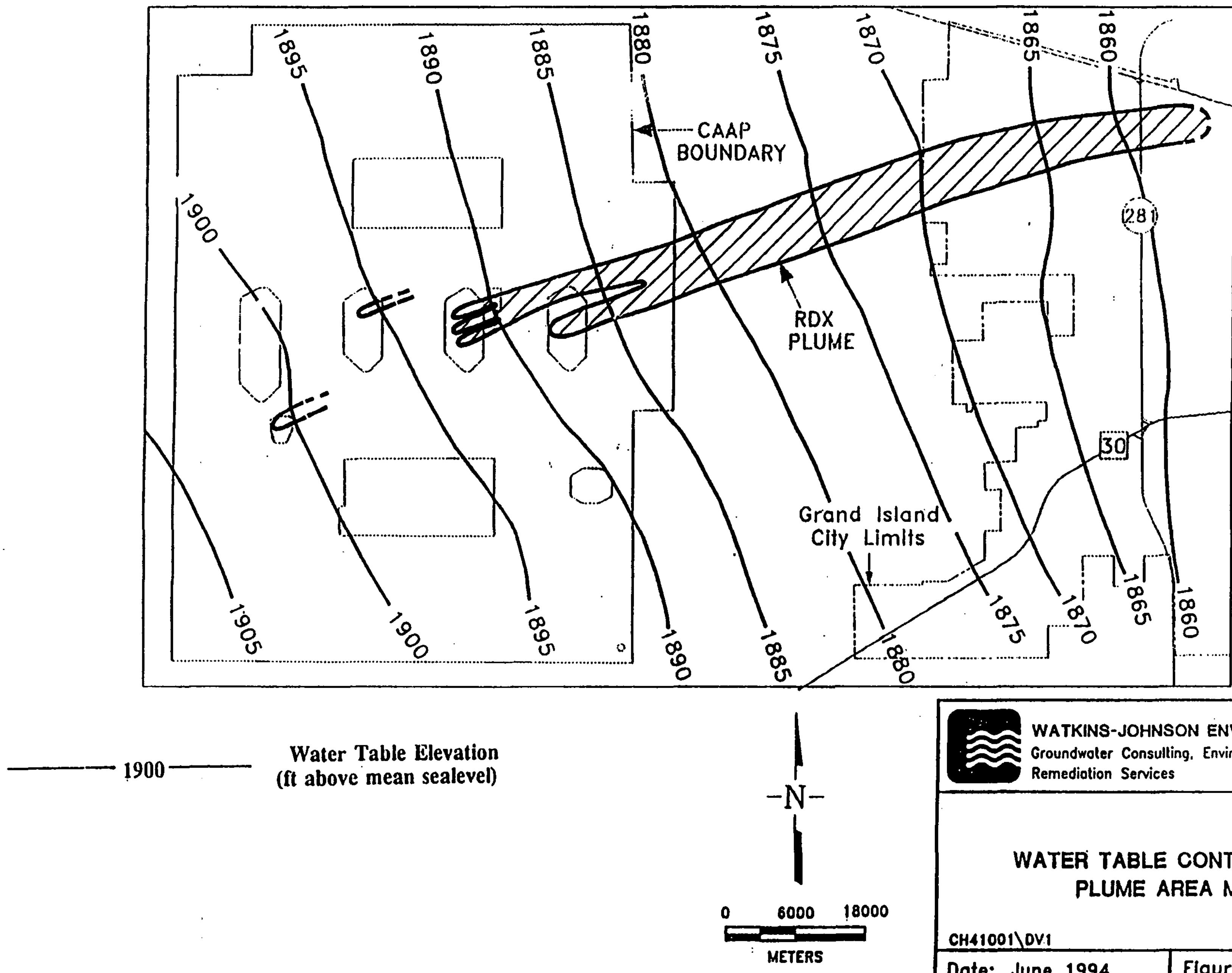
5.3 RDX Groundwater Plume

The RDX groundwater plume is approximately six miles long and one half mile wide. The main plume originates in the ordnance production facilities at CAAP and trends east-northeast to a point about 4 miles beyond the eastern boundary of CAAP (Figure 5-2). Past investigations have noted that the depth to the maximum contamination increases with distance from CAAP. This apparent downward migration of RDX with distance from the source is not a density phenomenon, but a function of aquifer recharge at the surface from infiltration of precipitation and irrigation water.

5.4 Contamination Assessment

During the RI process, several areas were identified in the load lines which were potentially associated with explosives contamination of groundwater. These include wastewater impoundments; areas where explosives were produced, handled, or stored; interior floor drain outlets; surface depressions and drainage ditches associated with munitions productions areas; and nonexplosive wastewater impoundments.

During the RI process 96 groundwater monitoring wells, including 25 well clusters were sampled in the explosives plume area. Forty-six of the wells were installed during the RI process. Well clusters were designed to provide groundwater samples from the upper, middle, and lower portions of the Alluvial aquifer. Four clusters located along the axis of the plume in the offpost area included a well screened in the upper portion of the Paleovalley Fill aquifer. One onpost well (G0070), located along the plume axis, is also screened in this aquifer. Each well was sampled two times and analyzed for a variety of



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WATER TABLE CONTOUR/RDX PLUME AREA MAP

CH41001\DV1

Date: June 1994	Figure 5-2

contaminants, including explosives compounds. Evaluation of these analytical results and previous groundwater investigations at the site yields the following conclusions.

1. The most extensive explosive compound detected in all zones of the Alluvial aquifer is RDX. RDX has migrated at least 4.2 mi beyond the CAAP boundary. HMX has migrated at least 2.2 mi beyond the CAAP boundary. Although 246TNT and several of its breakdown products were detected at the installation boundary, they were not detected in the next tier of monitoring wells approximately 1 mi downgradient.

2. The primary sources of explosives contamination in groundwater are located in Load Lines 1 and 2.

3. Explosives have not contaminated the Paleovalley Fill aquifer. The wells screened in this aquifer, all located along the RDX plume axis, did not yield any detections of explosives compounds during the Remedial Investigations.

4. The depth to the maximum concentration of RDX in the plume increases with distance from CAAP. At and near CAAP, groundwater contamination is detected only in the upper and middle part of the Alluvial aquifer. At the far end of the plume, RDX is detected only in the lower part of this aquifer.

6.0 SUMMARY OF SITE RISK

The chemicals detected in the groundwater are presented in Table 6-1. A statistically designed background study will be performed to refine the final list of site-specific chemicals of concern (COCs). Any additional COCs identified will be addressed by the final remedial action. The volume of the affected groundwater is estimated to be approximately 7.2 billion gallons.

Table 6-1 Concentrations of Chemicals of Potential Concern for CAAP

Chemical	Groundwater Concentration ($\mu g/L$) Minimum	Maximum	Average	No. of Detections
12DCLE	31.000	31.000	31.000	1
135TNB	0.839	180.000	54.963	7
13DNB	2.310	2.310	2.310	1
246TNT	0.898	820.000	101.028	11
24DNT	0.106	24.000	6.750	7
2A46DT	0.203	87.000	11.366	16
B2EHP	0.920	23.000	2.938	20
CH2CL2	30.000	30.000	30.000	1
HMX	1.590	79.200	11.746	19
NB	1.230	1.230	1.230	1
RDX	2.060	96.400	14.664	28
TCLTFE	70.000	1000.000	423.333	3
TFDCLE	7.000	10.000	8.500	2
AS	2.100	17.900	4.734	72
AL	270.000	8050.000	1948.920	25
SB	26.000	60.100	37.680	40
BA	61.700	1130.000	348.694	99
BE	2.190	2.190	2.190	1
CD	11.800	24.300	19.022	9
CL	1690.000	190000.000	32842.581	93
F	1070.000	1310.000	1190.000	2
FE	116.000	14000.000	1545.871	62
PB	6.980	14.200	11.160	3
MN	21.400	1640.000	246.816	55
HG	1.340	1.340	1.340	1
NI	29.200	59.500	45.850	4
NIT	14.300	270000.000	14719.143	82
SE	2.930	17.800	6.139	35
SO4	7190.000	970000.000	110503.978	93
V	8.360	57.600	17.110	56
ZN	21.400	107.000	38.914	14

The results of the site characterization indicate that the levels of RDX in groundwater at the distal end are continuing to migrate to east-northeast at levels above the drinking water health advisory. In addition, high levels of 246TNT, RDX, and HMX have been located on the CAAP facility. The health advisories for these compounds are 2 ppb for 246 TNT, 2 ppb for RDX, and 400 ppb for HMX. The results of the sampling conducted during the 1986 through 1992 time-frame, indicate that the compounds will continue to migrate and affect additional drinking water sources. Refer to the Focused Feasibility Study (1994) (FFS) and the Site Characterization Report (1993) for sampling data. Concentrations of explosive compounds in groundwater samples range from 2 ppb to 95 ppb RDX, 0.8 ppb to 820 ppb 246-TNT, and 1.6 ppb to 79.2 ppb HMX. The high stability and high mobility RDX compound warrants the need to contain and prevent further degradation of the aquifer. If left unchecked, further spread of the contaminants in groundwater would increase human exposure to explosives and further degrade the drinking water aquifer. Increased exposure could result from additional residential drinking water wells, additional irrigation wells, and a City of Grand Island supply well becoming affected by the contaminant plume.

A baseline risk assessment will be included in the site-wide RI/FS and in the subsequent final action ROD. The risk assessment will determine the final remedial action criteria for the aquifer. The proposed interim remedy is consistent with the expected final remedy in that this interim action contains the contaminant plume and prevents its spread into unaffected areas.

Information on the human health effects resulting from over-exposure to explosive compounds comes primarily from workers exposed during munitions production. At sufficient concentrations, explosive compounds can affect the Central Nervous System (CNS) and may cause headaches, irritability, anorexia, insomnia, seizures and in extreme cases unconsciousness. The primary contaminants which are TNT and RDX are listed as EPA Group C, possible human carcinogens. Lifetime feeding studies in rats and mice showed increased mortality, weight loss, anemia, liver and kidney toxicity, testicular degeneration, and prostate inflammation.

7.0 ALTERNATIVES EVALUATION

A total of fourteen remedial action alternatives were developed for groundwater containment at the on-post source area (load line). A total of five remedial action alternatives were developed for the distal end. These alternatives were developed in the FFS and summarized in the Proposed Plan, prior to public comment. Modification of these alternatives, based on public review and comment is addressed in Section 8.0. Except for the No Action and Limited Action alternatives, all remedial action alternatives involve pumping and treatment of groundwater. The remedial action alternatives were developed to meet the interim discharge requirements for groundwater remediation. The pump and treat options for groundwater consists of the following steps:

- pumping of the contaminated groundwater from the source area. and the distal end of the plume.
- groundwater containment to meet interim action standards
- discharge of treated water to meet NPDES requirements

Discharge limits would be established during the NPDES permit process by NDEQ and the Army. This process is applicable due to the necessity of discharging of treated water.

A groundwater monitoring system would be established to evaluate the extraction system's effectiveness in containing the plume.

7.1 DESCRIPTION OF REMEDIAL ACTION ALTERNATIVES

Based on the FFS. this section presents a description of the remedial action alternatives analyzed for OU1. The explosives contaminated groundwater extends from the load lines at the CAAP through the Capital Height subdivision to approximately 2 miles into the Grand Island city limit in the off-post areas. Two separate treatment facilities have been proposed for the pump and treat options. A treatment facility is proposed to be installed near the load lines which are the sources of contamination for groundwater. Another treatment facility would be installed to treat contaminated groundwater from the distal end of the plume.

Response of the groundwater system was evaluated with the aid of a three-dimensional flow model (MODFLOW) and a corresponding flowpath model (PATH3D). Model development and use is documented in Appendix A of the FFS (WJE, 1994). The groundwater flow model was calibrated to the measured distribution of hydraulic heads during 1993. Water-level variations as large as 5 ft occurred in response to seasonal variations in recharge and discharge. The difference between measured and model estimated hydraulic head was generally less than 1 ft. Recharge and discharge was simulated using the Nebraska soil-water program (NEB_SWP). Results of flowpath simulations corresponding to long-term average recharge and discharge conditions were compared to the present-day plume configuration. This comparison demonstrated that the model is a reliable means of estimating advective contaminant migration. The developed models were used to estimate the capture zones and cones of depression associated with various groundwater extraction rates and well-field locations.

Source Area: The substances detected in the groundwater at the source area are primarily explosives, other organics, metals and nitrates. Treatment for explosives are required at the CAAP. Metals and nitrates in the groundwater may have to be treated if during the implementation phase, the levels exceed discharge requirements. Except for the No Action and Limited Action alternatives, all alternatives represent pump and treat option and involve extraction and treatment of the groundwater. The components for the pump and treat options are described as follows:

Groundwater Extraction:

• **Extraction Wells**: Based on preliminary modeling, the groundwater extraction rate from the source area is approximately 1,000 gpm. The actual extraction rate would be determined during remedial design.

Metals Removal:

• **Chemical Precipitation**: The extracted groundwater would be fed to a chemical precipitation unit, if required. This technology would be employed to remove metals and other inorganics from the groundwater. The process includes addition of a precipitating agent followed by coagulation, flocculation, and sedimentation. The metals and other inorganics would precipitate as sludge and would be removed from groundwater. The sludge would be tested and disposed of in accordance with RCRA standards as applicable.

The effluent from the chemical precipitation unit would be pumped through sand filters where any flocs which were not settled in the sedimentation process would be removed. The filter media would be periodically backwashed to remove trapped suspended particles. Filtration would be employed following precipitation and before carbon adsorption or Enhanced Oxidation.

Organics Removal:

The explosives and other organics from the groundwater would be removed using either Granular Activated Carbon or Enhanced Oxidation.

• **Granular Activated Carbon:** This is one of the two technologies selected for removal of explosives and other organics. This technology can remove dissolved organics, including explosives, to levels below 1 μg/L. The groundwater leaving the granular media filters would flow through GAC columns which would adsorb the explosives from the groundwater. The GAC columns would be designed based on average flowrate of 1,000 gpm. Regarding disposal of spent carbon, the first protocol would be to look at fuel amendment recycling. The spent carbon would be tested in accordance with TCLP protocols, if TCLP is not triggered subtitle C standards would be applied for disposal of the spent carbon. Treatability studies would be performed to determine the performance efficiency of the GAC system, carbon usage rates, breakthrough time and other operating parameters prior to remedial design.

• **Enhanced Oxidation:** Enhanced Oxidation would be employed to destroy organic contaminants dissolved in water by chemical oxidation with or without the presence of ultraviolet radiation. Chemicals such as ozone and hydrogen peroxide may be used alone or in combination to generate hydroxyl radical. The hydroxyl radicals destroy organic contaminants by initiating a series of oxidative reactions that eventually lead to destruction of organics including explosives. If complete oxidation is achieved, explosives and other organic contaminants would be oxidized to simpler non-toxic forms. If oxidation is not complete, small chain aliphatics compounds, organonitrogen intermediates and other undesirable by-products may form. Treated effluent from the Enhanced Oxidation will be subject to neutralization prior entering the ion-exchange unit or constructed wetland.

Nitrates Removal

After the groundwater has been treated for metals and explosives, the nitrates in the groundwater would be treated if required. The following treatment technologies were considered:

• **Ion Exchange:** Following removal of explosives and other organics either using GAC or Enhanced Oxidation, the treated effluent would enter ion exchange units or flow through constructed wetlands. Multiple ion-exchange units consisting of 3 to 5 feet of anionic resin beds would be used to remove nitrate from the groundwater. Once resin has been exhausted, one of the two actions may be taken. Some vendors offer regeneration services. This service replaces the entire ion exchange unit with a new one, thereby avoiding downtime caused by regeneration cycles. Another option is to set up a number of permanent units which would be occasionally rinsed with brine to remove nitrate. This process would prolong the life of the resin and reduce the frequency of resin change-out. The second option has been considered in the costing of alternatives. Brine used for regeneration of the resin beds is not expected to be hazardous because all contaminants in the groundwater except nitrate is essentially treated prior entering the ion-exchange units. Brine would be disposed to an appropriate facility or reclaimed. The treated effluent from ion-exchange units would be discharged either to an infiltration basin or to surface water.

• **Constructed wetlands:** Wetlands (80 to 160 acres) would be designed and constructed specifically to remove nitrate from the groundwater. The bed of the constructed wetland would be compacted in-situ to prevent infiltration of nitrates into the groundwater. Plant uptake and microbial activities would remove nitrates from the groundwater. The plants used most frequently in constructed wetland include cattails, reeds, rushes, bulrushes, and sedges. The plants would be periodically harvested and disposed of at a landfill, by composting, or burning. Cold weather slows the nitrates removal process but does not stop it all together. To compensate for the slowing of the removal process, the cells are designed with extra capacity for operations during the winter months. Constructed wetlands have been used to treat nitrates in municipal wastewater treatment facilities and are becoming increasingly popular. Constructed wetlands are a proven technology with low maintenance requirements. Infiltration of nitrates, if any, from the constructed wetlands into the groundwater would be monitored using one upgradient and two downgradient wells which would be sampled twice a year.

Discharge Options The treated effluent from the treatment facility at the source area would be discharged either to an infiltration basin or to surface water.

•Surface Water Discharge

The Proposed Plan recommended that the treated groundwater would be discharged to surface water.

• Infiltration Basin

The treated effluent would be applied through an infiltration area. Soil with permeabilities of 1.0 in/hr or more are necessary for successful rapid infiltration. It is estimated that approximately 80 acres of land would be required for infiltration.

The combination of the above treatment components for each alternative is shown in Table 7.1-1. Alternatives T-3 to T-6 are similar to Alternatives T-7 to T-10 except for the variation in the discharge option.

Distal End: The groundwater at the distal end of the plume contains primarily RDX at low concentrations. Should metals or other inorganics be detected in the influent groundwater above the interim discharge standards, appropriate treatment units would be incorporated at the distal end treatment system. This system uses some of the technologies as described above for the source area. Based on preliminary modeling, the groundwater would be extracted at an approximate rate of 3,000 gpm in order to prevent further migration of the contaminants. The actual extraction rate would be determined during remedial design. The pumped groundwater at the distal end would be treated using either GAC or Enhanced Oxidation System. The treated water would be discharged to surface water.

The combination of the treatment components for each of the five alternatives for the distal end are presented in Table 7.1-2.

7.2 SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

The NCP sets forth nine evaluation criteria which serve as a basis for comparing the remedial action alternatives for final actions. Interim actions, such as proposed here, may not achieve final discharge requirement levels for groundwater although they are effective in the short-term in preventing further degradation of the groundwater and initiating reduction in toxicity, mobility or volume. The following is a discussion on the comparison of the remedial action alternatives with respect to the nine evaluation criteria.

TABLE 7.1-1 COMPONENTS OF REMEDIAL ACTION ALTERNATIVES FOR SOURCE AREA

Remedial Action Alternatives	Groundwater Monitoring	Administrative Control	Groundwater Extraction	Chemical Precipitation	Granular Media Filtration	Granular Activated Carbon	Enhanced Oxidation	Wetland	Ion Exchange	Discharge To Infiltration Basin	Discharge To Surface Water	Cost ($)
T-1	X											1,016,000
T-2	X	X										1,068,400
T-3[a]	X		X	X	X	X		X		X		17,244,000[b]- 17,714,000[c]
T-4[a]	X		X	X	X	X			X	X		17,057,000[b]- 17,528,000[c]
T-5	X		X	X	X		X	X		X		28,129,000
T-6	X		X	X	X		X		X	X		27,941,000
T-7[a]	X		X	X	X	X		X			X	16,398,000[b]- 16,870,000[c]
T-8[a]	X		X	X	X	X			X		X	16,210,000[b]- 16,681,000[c]
T-9	X		X	X	X		X	X			X	27,282,000
T-10	X		X	X	X		X		X		X	27,094,000

(a) For GAC units, both regeneration/reuse and disposal of spent carbon have been studied. Carbon regeneration/reuse considered for Alternatives: T-3A, T-4A, T-7A, and T-8A. Carbon disposal considered for Alternatives: T-3B, T-4B, T-7B, and T-8B. (b) Cost for alternative based on regeneration/reuse of spent carbon. (c) Cost for alternative based on disposal of spent carbon.

TABLE 7.1-2 COMPONENTS OF REMEDIAL ACTION ALTERNATIVES FOR DISTAL END

Remedial Action Alternatives	Groundwater Monitoring	Administrative Control	Groundwater Extraction	Granular Activated Carbon	Enhanced Oxidation	Discharge to Surface Water	Present Worth
T-1	X						\$ 217,000
T-2	X	X					\$ 270,000
T-3			X	X		X	\$ 9,320,000[b]-10,747,000[c]
T-4			X		X	X	\$38,406,000

(a) For GAC units, both regeneration/reuse and disposal of spent carbon have been studied. Carbon regeneration/reuse considered for Alternatives: T-3A.

(b) Cost for alternative based on regeneration/reuse of spent carbon. (c) Cost for alternative based on disposal of spent carbon.

7.2.1 COMPARISON OF REMEDIAL ACTION ALTERNATIVES FOR THE SOURCE AREA

A. Threshold Criteria

1. Protection of Human Health and the Environment

Alternative T-1, No Action would not meet this criterion since no actions are taken to eliminate, reduce or control exposure pathways. Alternative T-2, Limited Action, does provide some protection in that it limits access to, and use of the contaminated groundwater through institutional controls. However, these controls do not prevent further migration of COCs present in the groundwater.

The remaining alternatives would provide adequate protection of human health and the environment as defined by the interim action objectives. The objective is to contain and prevent migration which would result in further degradation of the aquifer. When implemented with an extraction system, the contaminated groundwater would be contained and migration of COCs would be prevented. These alternatives would be able to meet the interim action objectives focused to protect human health and the environment.

2. Compliance with ARARs

Alternatives T-1 and T-2 would not comply with chemical-specific ARARs. Over a long period of time, the concentrations of explosives and other organics may decrease due to natural degradation and dilution. In this case, eventual compliance with the ARARs may be achieved. However, the length of time before this occurs may be extensive. Alternatives T-3 to T-6 would be designed to meet chemical specific ARARs (Nebraska Groundwater Standards, Federal MCLs, TBCs). Alternatives T-4 to T-10 would be designed to meet NPDES permit limits to be specified by the regulatory agencies. Alternatives T-3B, T-4B, T-7B and T-8A would comply with RCRA requirements for pre-transportation and transportation of hazardous wastes. A detailed analysis of the ARARs is presented in chapter 3 of the Focused Feasibility Study and chapter 8 of this Record of Decision.

B. Primary balancing Criteria:

1. Long-Term Effectiveness and Permanence

Alternatives T-1 and T-2 would not provide long-term effectiveness and permanence. The remaining alternatives T-3 to T-10 would provide long-term effectiveness and permanence to varying degrees.

Alternatives T-3 and T-7 incorporating GAC and constructed wetland as treatment units for removal of organics and nitrate respectively, would offer moderate long-term effectiveness and permanence. Under this alternative, explosives and other organics would not be permanently destroyed, but transferred from the groundwater to GAC. Nitrate would be effectively removed in the constructed wetland system through plant uptake and biological denitrification. These reactions are irreversible and would result in permanent removal of nitrate from the groundwater.

Alternatives T-4 and T-8 which include GAC and ion exchange as treatment units would offer lesser long-term effectiveness and permanence than Alternative T-3 and T-7 respectively. This is because both organics and nitrate would not be destroyed, but transferred from the groundwater to GAC and ion-exchange resin respectively. Both the GAC and ion exchange units combined would generate larger quantity of spent residuals which may be regenerated, recycled or disposed.

Alternatives T-5 and T-9 incorporating Enhanced Oxidation and constructed wetlands would offer very high long-term effectiveness and permanence. The reactions involving organics and nitrate are irreversible and result in permanent transformation of the COCs. The treatment residual generated by this alternative is minimum compared to Alternatives T-3, T-4, T-6, T-7, T-8 and T-10.

Alternatives T-6 and T-10 are similar to Alternatives T-5 and T-9 respectively, except that ion exchange would be used to remove nitrate instead of constructed wetlands. These alternatives would offer moderately long-term effectiveness and permanence. Explosives and other organics would be completely mineralized. Nitrate would be transferred to resins and eventually to brine solution through the regeneration process.

2. Reduction of Toxicity, Mobility and Volume Through Treatment

Alternatives T-1 and T-2 do not result in any reduction of toxicity, mobility and volume of the contaminants, because removal and treatment are not components for this alternative. With effective extraction process as implemented in all the pump and treat options, there would be considerable reduction of toxicity, mobility and volume of COCs present in the groundwater.

Alternatives T-3 and T-7 would offer moderate reduction of toxicity, mobility and volume through treatment. The concentration, mobility or the volume of the explosives and other organics would not be reduced by GAC treatment. This constructed wetland treatment would result in reduction of toxicity, mobility and volume of nitrate present in the treated groundwater.

Alternatives T-4 and T-8 would result in lower reduction of toxicity, mobility and volume than Alternative T-3 and T-7, respectively . Explosives and other organics, and nitrate would not be transformed; these contaminants would be transferred from the groundwater to either GAC or ion exchange resin.

Alternatives T-5 and T-9 would result in very high reduction of toxicity, mobility and volume. Explosives and other organics would be completely mineralized to carbon dioxide, nitrogen oxides and water. Nitrate would be converted to organic nitrogen (plant assimilation) and molecular nitrogen.

Alternatives T-6 and T-10 would be less effective than Alternatives T-5 and T-9, respectively, in the reduction of toxicity, mobility and volume. Although explosives and organics would be destroyed through Enhanced Oxidation, nitrate will be not be destroyed or transformed. Nitrate would be eventually transferred to brine which will be disposed.

3. Short-Term Effectiveness

This criterion is not applicable for Alternatives T-1 or T-2.

Alternatives T-3 to T-10 would require approximately equal amount of time, similar construction equipment and effort, and none would entail any additional risk beyond those inherent in construction projects. The short-term effectiveness for Alternatives T-3 to T-10 is the same because no additional risks are incurred in the implementation of one alternative as compared to another.

4. Implementability

All alternatives are implementable. However, some alternatives are easier to implement then others. In some instances, requirement of administrative approval may make an alternative less implementable. Administrative requirements can encompass property easements, permits for off site discharge, and/or waivers. From the administrative standpoint, Alternative T-1 is the least implementable, since a waiver would very likely not be granted.

5. Cost

Among the alternatives implementing surface water discharge, Alternative T-8A has the lowest cost. The cost of Alternative T-7A exceeds that of Alternative T-8A by one percent.

Of those alternatives developed for discharge to infiltration basins (T-3 to T-6), Alternative T-3A has the lowest present worth value. The overall costs of Alternative T-5 and T-6 are significantly higher than Alternatives T-3 and T-4. This is primarily due to the considerably high capital Cost of Enhanced Oxidation compared to GAC units. The cost of pump and treat options incorporating discharge to infiltration basin range between $17,056,400 and $28,128,900; those incorporating discharge to Silver Creek range between $16,209,800 and $27,094,200.

7.2.2 COMPARISON OF REMEDIAL ACTION ALTERNATIVES FOR THE DISTAL END

A. Threshold Criteria

1. Overall Protection of Human Health and the Environment

Alternative T-1. No Action would not meet this criterion since no actions are taken to eliminate, reduce or control exposure pathways. Alternative T-2, Limited Action, does provide some protection in that it limits access to, and use of the contaminated groundwater through institutional controls. However, institutional controls would be difficult to implement at the distal end of the plume which is located at the off-post areas of CAAP.

The remaining alternatives are capable of providing adequate protection of the human health and the environment. The explosives contaminated groundwater would be contained and prevented from further migration. These alternatives would be able to meet the interim discharge requirements which would be focused to protect human health and the environment.

2. Compliance with ARARs

Alternatives T-1 and T-2 would not comply with chemical-specific ARARs.

Alternatives 3 and 4 would be designed to meet the NPDES permit limits. Both these alternatives would comply with all Federal and State air quality standards.

Primary Balancing Criteria:

1. Long-Term Effectiveness and Permanence

Over a period of time. Alternatives T-1 and T-2 may be able to meet the criterion of long-term effectiveness and permanence due to natural or biological degradation and dilution.

Alternative T-3 incorporating GAC for removal of explosives would offer moderate long-term effectiveness and permanence. Explosives would not be permanently destroyed. but transferred from the groundwater to the GAC media.

Alternative T-4 incorporating Enhanced Oxidation would offer high long-term effectiveness and permanence. The organics would be transformed into simpler non-toxic by-products.

2. Reduction of Toxicity. Mobility and Volume through Treatment

The Alternatives T-1 and T-2 would not result in any reduction of toxicity. mobility and volume of organics. except through natural degradation or dilution over a period of time.

The GAC treatment by itself in Alternative T-3 would not reduce the toxicity. mobility and volume of explosives. If spent carbon is utilized for fuel amendment. there would be a significant reduction in the toxicity. mobility and volume of contaminants adsorbed by the GAC units. If spent carbon is disposed to a permitted facility. there would no such reduction in the toxicity. mobility or volume of contaminants.

Alternative T-4 would result in very high reduction of toxicity. mobility and volume of explosives which will be mineralized to simpler non-toxic by-products.

3. Short-Term Effectiveness

This criterion is not applicable for Alternatives T-1 and T-2.

Alternatives T-3 and T-4 would require approximately equal period of time, similar construction equipment and effort, and would not entail any additional risk beyond those inherent in construction projects. The short-term risks for both these alternatives are the same because no additional risks are incurred in implementation of one alternative as compared to another.

4. Implementability

From the administrative standpoint, Alternative T-1 is the least implementable. All alternatives are technically implementable.

5. Cost

Alternative T-4 incorporating Enhanced Oxidation has the highest present worth. The cost of remedial action alternatives ranges between $217,400 and $38,405,900.

Modifying Criteria

1. State Acceptance

The letter from the Nebraska Department of Environmental Quality (NDEQ) regarding concurrence of the selected remedy as an interim action for this site is attached.

2. Community Acceptance

The Army held a public meeting and public comment period to allow the community to comment on the preferred alternative as set forth in the Proposed Plan and the alternatives considered. Many community members were opposed to the discharge of treated effluent to Moores Creek. The residents were concerned that continuous discharge of 3,000 gpm of water would potentially flood their basement and property, and would result in significant loss of property, crops and livestock. The residents and City of Grand Island representatives were also concerned that extraction of groundwater at the distal end would induce contaminant migration from intermediary locations of the plume to the distal end.

In response, the Army has decided to extract an additional 1,000 gpm of groundwater from intermediary location under the Capital Heights area. The total discharge of treated water will be transferred through a pipeline constructed to and through the easement of the Wood River Diversion Channel to the Platte River. The rationale supporting this amendment is documented in Section 8.1.

7.3 PROPOSED REMEDY

The Army has selected the following interim actions (Alternative T-7A for the source area and T-3A for the distal end of the plume) to address groundwater contamination (OU 1):

A. Source Area

- Extraction of contaminated groundwater.
- Treatment of contaminated groundwater using chemical precipitation, granular media filtration, granular activated carbon, and constructed wetlands.
- Discharge of treated effluent to surface water

The flow diagram for this alternative is presented in Figure 7-2.

B. Distal End

- Extraction of contaminated groundwater
- Treatment of contaminated groundwater using granular activated carbon.
- Discharge of treated effluent to surface water

Should nitrate and metal concentrations in the groundwater at the point of discharge exceed the discharge limits, then contingencies for nitrate and metal treatment will be implemented.

The flow diagram for this alternative is presented in Figure 7-3.

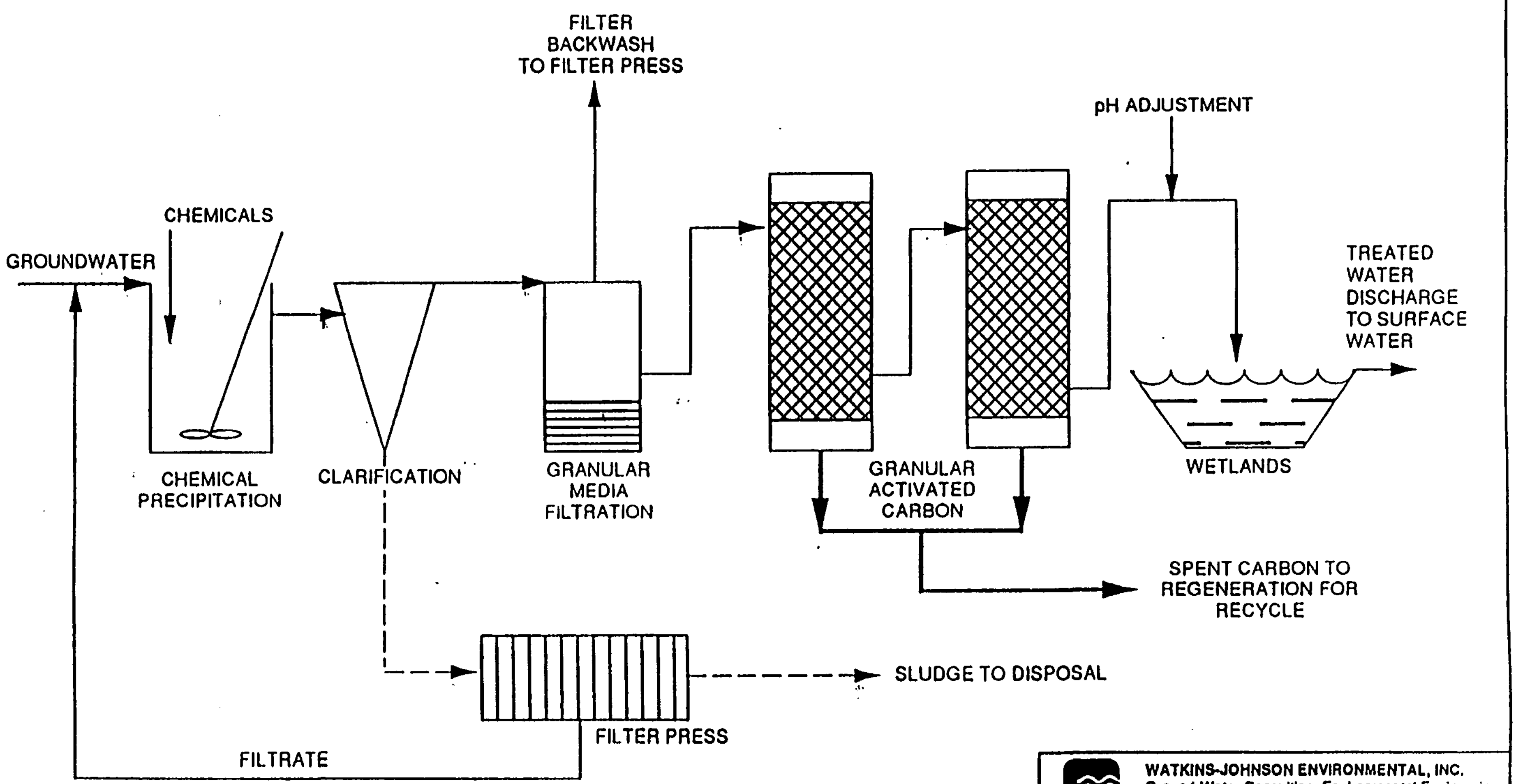
The groundwater plume would be monitored to determine effectiveness of the Alternative T-7A (source area) and Alternative T-3A (distal end) as selected interim action remedies.

The Army has identified these interim actions as its selected alternatives because they provide the best balance among other alternatives with respect to the evaluation criteria based on the information available. The Army believes that these interim actions are protective of human health and the environment.

implementable, and effective in reducing the toxicity, mobility and volume of contamination present in the groundwater plume. This approach will contain and prevent further migration of the contaminant plume. This approach has been modified based on public comment. Discussion of the modifications is found in Section 8.1.

For treatment of explosives, the Army considers the GAC a better option than Enhanced Oxidation since it is a proven technology, which is half the cost of Enhanced Oxidation for this site. The GAC technology has been used by the Army since the mid 70's to treat explosive contaminated discharge water from production facilities.

Chemical precipitation was the proposed metals treatment process, should it be needed. The Army has proposed to carry a metals process as a contingency should the metals levels in the extracted groundwater be determined to be above discharge levels. A statistically designed background study is being conducted and should be finalized prior to the design of the selected remedy. The background study will be used to determine if chemical precipitation of metals is necessary as a part of the final action.



LEGEND
- - - - - SLUDGE
——— GROUNDWATER
━━━ SPENT CARBON

M1193064

WATKINS-JOHNSON ENVIRONMENTAL, INC.
Ground-Water Consulting, Environmental Engineering, Remediation Services

ALTERNATIVE T-7A
SCHEMATIC DIAGRAM OF GROUNDWATER EXTRACTION, CHEMICAL PRECIPITATION, GRANULAR MEDIA FILTRATION, GRANULAR ACTIVATED CARBON (SPENT CARBON RECYCLED), WETLANDS TREATMENT AND DISCHARGE TO SURFACE WATER

Date: June 1994

Figure 7-2

Figure 7-3 Schematic Diagram of Groundwater Extraction, Chemical Precipitation, Granular Media Filtration, Granular Activated Carbon (Spent Carbon Recycled), Constructed Wetlands Treatment and Discharge to Surface Water

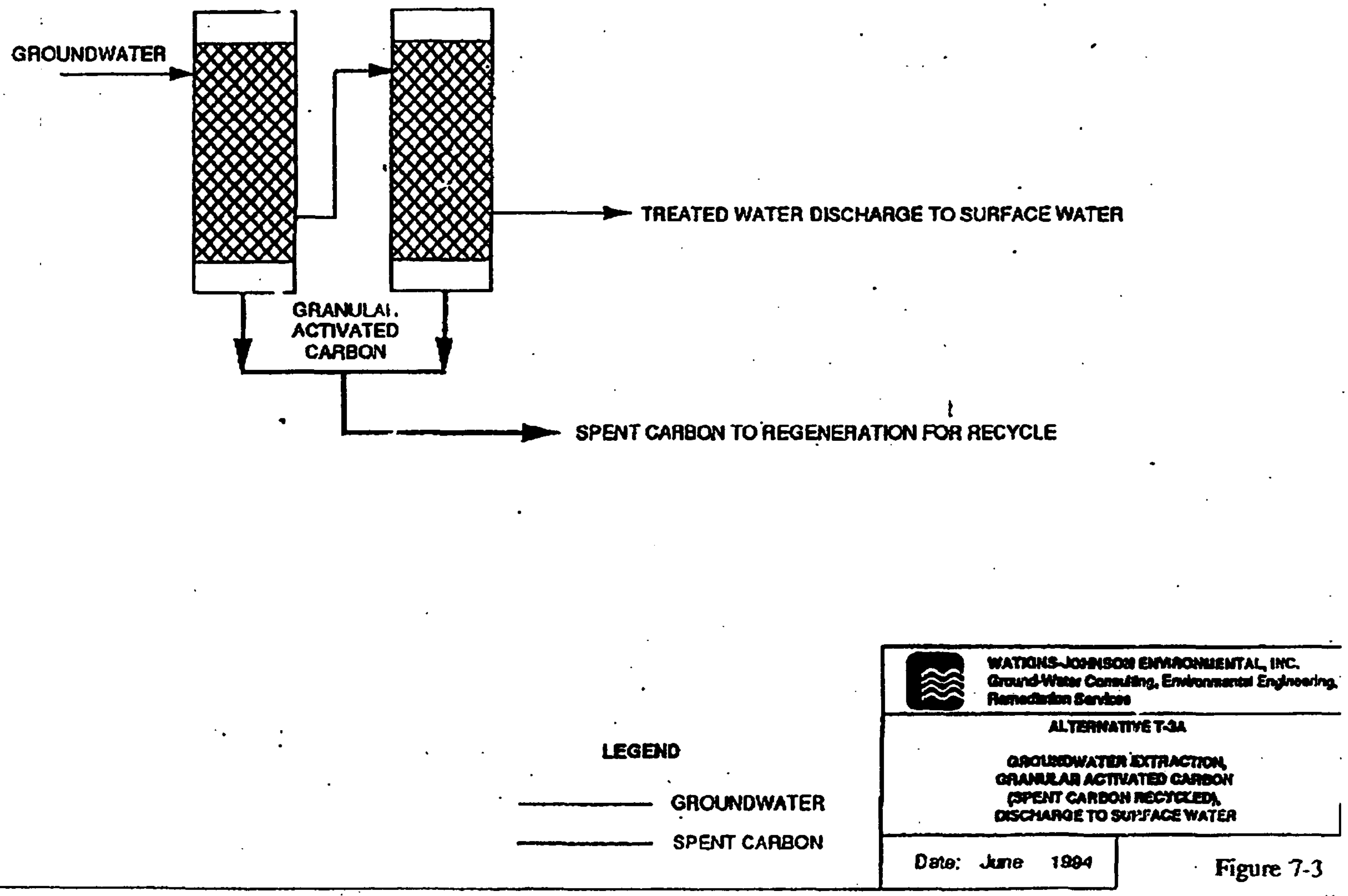


Figure 7-3

M1193069a

Constructed wetlands were compared to ion exchange, which removes the nitrates through the use of synthetic resins. The ion exchange technology is effective but is prone to clogging which increases maintenance requirements over that of constructed wetlands approach. Constructed wetlands have been used to treat nitrates in municipal wastewater treatment facilities and are becoming increasingly popular. The Army viewed constructed wetlands as a better option for on-post remediation.

Surface water discharge is the selected discharge option. The alternative to surface water discharge is reinjection through infiltration basins which is a proven technology, but prone to clogging and requires higher maintenance than surface water discharge.

The Army estimates that the interim actions for the source area and the distal end are $16.398.100 and $9.320.000 respectively. The cost breakdown for these alternatives is presented in Tables 7.3-1 and 7.3-2. Based upon the cost of the alternatives and the degree of protectiveness that one alternative affords as compared to the other alternative. the Army has selected the most cost effective alternatives which meet the evaluation criteria.

Table 7.3-1 Summary Cost Estimate for Source Area, Alternative T-7A.

ITEM		CAPITAL COST	ANNUAL O&M COST	PRESENT WORTH OF ANNUAL COSTS 30 YEARS,5%	30 YEARS,7%
1. Site Preparation/Support		$103,300			
2. Extraction Wells		$31,200	$17,600	$270,600	$218,400
3. Chemical Precipitation		$510,400	$409,900	$6,301,200	$5,086,400
4. Granular Media Filtration		$387,000	$115,600	$1,777,000	$1,434,500
5. Sludge Disposal			$28,900	$444,300	$358,600
6. Granular Activated Carbon		$180,000	$151,100	$2,322,700	$1,875,000
7. Wetlands Treatment		$929,800	$37,100	$570,300	$460,300
8. Surface Water Discharge		$552,000	$26,600	$408,900	$330,100
9. Piping, Connections, and Pumping		$569,900			
10. Treatment Systems Operator			$58,400	$897,800	$724,700
11. Groundwater Sampling			$576,200	$1,045,900	$933,100
	Subtotal	$3,263,600	$1,421,400	$14,038,700	$11,421,100
12. Contingency	35% of total Capital Costs	$1,142,300			
13. Contingency	5% of total Annual Costs		$71,100	$701,900	$571,100
A. TOTAL CAPITAL COSTS		$4,405,900			
B. TOTAL ANNUAL COSTS			$1,492,500		
C. TOTAL PRESENT WORTH OF ANNUAL COSTS				$14,740,600	$11,992,200
TOTAL PRESENT WORTH OF CAPITAL AND ANNUAL COSTS (A + C)				$19,146,500	$16,398,100

Table 7.3-2 Summary Cost Estimate for Distal End, Alternative T-3A.

ITEM			CAPITAL COST	ANNUAL O&M COST	PRESENT WORTH OF ANNUAL COSTS 30 YEARS,5%	PRESENT WORTH OF ANNUAL COSTS 30 YEARS,7%
1.	Site Preparation/Support		$117,700			
2.	Extraction Wells		$33,800	$49,700	$764,000	$616,700
3.	Granular Activated Carbon		$540,000	$496,300	$7,629,300	$6,158,600
4.	Surface Water Discharge		$283,000	$26,600	$408,900	$330,100
5.	Piping, Connections, and Pumping		$188,500			
6.	Treatment Systems Operator			$8,300	$127,600	$103,000
7.	Groundwater Sampling			$13,900	$213,700	$172,500
		Subtotal	$1,163,000	$594,800	$9,143,500	$7,380,900
8.	Contingency	35% of total Capital Costs	$407,100			
9.	Contingency	5% of total Annual Costs		$29,700	$457,200	$369,000
A.	TOTAL CAPITAL COSTS		$1,570,100			
B.	TOTAL ANNUAL COSTS			$624,500		
C.	TOTAL PRESENT WORTH OF ANNUAL COSTS				$9,600,700	$7,749,900
TOTAL PRESENT WORTH OF CAPITAL AND ANNUAL COSTS (A + C)					$11,170,800	$9,320,000

8.0 STATUTORY DETERMINATIONS

The selected interim remedy will contain and prevent further migration of the contaminant plume. which left uncontained would result in further degradation of the aquifer. This will be accomplished by pumping and treating the groundwater.

All ARARs potentially considered for this action are listed in section 3.0 of the Focused Feasibility Study. The requirements determined to be Applicable or Relevent and Appropriate are listed in tables 8-1A, 8-1B, 8-2 and 8-3 which respectively are the chemical-specific, location-specific and action-specific ARARs. The numeric standards for the containment criteria for explosives are presented in Appendix B. In the absence of chemical-specific ARARs for explosives; health advisories and risk concentrations are utilized for determining the containment goals.

The selected remedy consists of extraction of contaminated groundwater from three areas of the plume: source area, intermediary and distal end. The objective is to capture the groundwater at the source area containing relatively high concentrations of contaminants, primarily RDX and prevent migration of these contaminants. The extraction rate will be ascertained during the preliminary implementation stages based on the ability of the well network to capture the contaminants. Groundwater exposure is likely through the usage of private wells in the Capital Heights area. therefore, groundwater will be extracted an intermediary location before the plume enters Webb Road and Capital Avenue. In this area. RDX concentrations range between 4.2 and 21.0 µg/L. Continuous extraction of groundwater at an approximate rate of 1.000 gpm is expected to result in significant decrease in both the concentrations and volume of contaminants. The distal end contains RDX at concentrations slightly above the health advisory of 2 µg/L. The extraction of groundwater at the distal end will prevent migration of the plume to a municipal supply well located approximately 1.5 miles down gradient. Extraction of groundwater at the distal end will also prevent impact to additional downgradient residential and irrigation wells.

Table 8-1A Chemical-Specific ARARs for Groundwater Containment

Standard Requirement, Criteria, or Limitation	Citation	Description	Applicable/ Relevant and Appropriate	Comments
National Primary Drinking Water Standards	40 CFR Part 141 Maximum Contaminant Levels	Establishes maximum contaminant levels (MCLs) which are health-based standards for public water systems.	No/Yes	The MCLs for organic and inorganic contaminants are relevant and appropriate for deriving the NPDES discharge levels.
National Secondary Drinking Water Standards	40 CFR Part 143	Establishes secondary maximum contaminant levels (SMCLs) which are non-enforceable guidelines for public water systems to protect the aesthetic quality of the water. Relevant and appropriate for establishing discharge limits.	No/Yes	SMCLs may be relevant and appropriate for deriving the NPDES discharge levels.
Maximum Contaminant Level Goals (MCLGs)	Stat. 642 (1986)	Establishes drinking water quality goals set at levels of no known or anticipated adverse health with an adequate margin of safety.	No/Yes	MCLGs for organics and inorganic contaminants may be relevant and appropriate for deriving the NPDES discharge levels. SB, BA,CD,BE,CD,F,HG have non-zero MCLGS.
Groundwater Quality Standards and Use Classification	NDEQ, Title 118, Chapter 5, Appendix A	Establishes standards and use classifications for groundwater sources of drinking water.	Yes/--	Is applicable because groundwater is a drinking water source.

Table 8-1B Chemical-Specific ARARs for Surface Water Discharge

Standard Requirement, Criteria, or Limitation	Citation	Description	Applicable/ Relevant and Appropriate	Comments
Water Quality Standards for Surface Water of the State	NDEQ, Title 117 Chapter 4	Establishes standards for the surface waters of the state.	Yes/--	Applicable because treated water will be discharged to surface water. More relevant than Federal ambient water quality criteria. Contains antidegradation clause and numeric waste quality standards for water bodies in the state. Does not contain standards for explosives. Antidegradation policy apply to discharge to Platte River. Discharge standards will be established in accordance with (IAW) NPDES permit.

Table 8-2 Location-Specific ARARs

Standard Requirement, Criteria, or Limitation	Citation	Description	Applicable/ Relevant and Appropriate	Comments
Federal				
Floodplain Management	40 CFR 6.302(D) Executive Order 11988 and 40 CFR, Part 6, Appendix A	Establishes requirements for federal agencies to reduce risk of flood loss, minimize the impacts of floods on human safety, health and welfare, and restore and preserve the natural and beneficial values of floodplains.	Yes/--	Applicable, the treatment facility will be is located within a floodplain. Executive Order 11988 is TBC guidance.
Fish and Wildlife Coordination Act 6	16 USC 661 et seq.	Establishes requirements for actions taken to prevent, mitigate, or compensate for project-related damages or losses to fish and wildlife resources.	No/Yes	Relevant and appropriate if project related activities affect fish and wildlife resources.
Farmland Protection Policy Act	7 USC 420 et seq.	Establishes requirement for federal agencies for acquiring, managing and disposing of lands and facilities; or provide criteria that identify and take into account the adverse effects of actions on the preservation of farmland.	No/Yes	Relevant and appropriate if treatment facility location and project related activities affect farmland.
Protection of Wetlands	40 CFR Part 6, Appendix A, Part (j) Executive Order 11990 Part 7(c)	Establishes requirements for federal agencies to avoid or minimize adverse impacts on wetlands.	Yes/--	Wetlands are likely to be present in the vicinity of the piping route to the Platte River. Executive Order 11990 Part 7(c) is TBC guidance.

Table 8-3 Action-Specific ARARs (page 1 of 3)

Standard Requirement, Criteria, or Limitation	Citation	Description	Applicable/ Relevant and Appropriate	Comments
Federal				
Hazardous Waste Classification	40 CFR Part 261	Provides determination of hazardous waste; procedures for delisting of wastes.	No/Yes	Relevant and appropriate if treatment residuals such as sludge/spent carbons are determined to be hazardous.
Hazardous Waste Determination	40 CFR 262.11	Requires hazardous waste generator to determine if a waste is hazardous pursuant to 40 CFR Part 261.	Yes/--	Potentially applicable to sludge from dewatering and backwash residue.
Hazardous Waste Management	40 CFR Part 264	Establishes requirement that affects generation, transportation, treatment, storage and disposal of hazardous waste.	No/Yes	Relevant and appropriate if treatment residuals are determined to be hazardous.
Land Disposal	40 CFR Part 268	Establishes regulations on land disposal restrictions and treatment standards for land disposal of RCRA hazardous waste.	Yes/No	Relevant and appropriate if treatment residuals such as sludge are determined to be hazardous.

Table 8-3 Action-Specific ARARs (page 2 of 3)

Standard Requirement, Criteria, or Limitation	Citation	Description	Applicable/ Relevant and Appropriate	Comments
Standards Applicable to Transporters of Hazardous Waste	40 CFR Part 263	Establishes standards which apply to transporters of hazardous wastes.	No/Yes	Relevant and appropriate if treatment residuals such as sludge/spent carbon are determined to be hazardous.
Wetlands Protection	Clean Water Act 404, 40 CFR 230.3(1) 33 CFR 328(b)	Establishes requirement to avoid degradation of wetlands due to construction activities.	Yes/No	Applicable to construction activities near the wetlands which may be present near the Platte River.
<u>State</u>				
Waste Management Rules	NDEQ, Title 126, Chapter 18	Establishes regulations on releases of oil or hazardous substances into water or land.	Yes/No	Applicable to sludge from dewatering, backwash, and residues that are hazardous substances and could be spilled or leaked to land or water during treatment operations.
Hazardous Waste Management	NDEQ, Title 128, Chapter 3	Establishes requirement for notification of hazardous waste activity.	No/Yes	Relevant and appropriate if treatment residuals are determined to be hazardous.

Table 8-3 Action-Specific ARARs (page 2 of 3)

Standard Requirement, Criteria, or Limitation	Citation	Description	Applicable/ Relevant and Appropriate	Comments
Hazardous Waste Management	NDEQ, Title 128, Chapter 17	Establishes requirement that affects generation, transportation, treatment, storage and disposal of hazardous waste.	No/Yes	Relevant and appropriate if treatment residuals are determined to be hazardous.
Air Pollution Controls Rules & Regulations	NDEQ, Title 129. Chapter 32	Pertains to generation of dust and air-borne particulate matter.	Yes/No	Dust/air borne particulate matter may generate during construction, transportation or handling.
Air Pollution Control Rules and Regulations	NDEQ, Title 129, Chapter 20	Establishes standards on particulate matter emissions.	No/Yes	Relevant and appropriate if treatment residuals are determined to be hazardous.
Groundwater Monitoring Wells Requirements	Neb. Rev. Stat 46-602, 46-1201, 46-651 to 46-655	Provides requirements/restrictions for groundwater monitoring wells.	Yes/No	Potentially applicable for all groundwater wells to be used for extraction.
Groundwater Management or Control	Neb. Rev. Stat 46-656 et. seq.	Restricts access to groundwater from certain surface areas.	Yes/No	Potentially applicable.

The selected treatment processes consisting of extraction, chemical precipitation, GAC and constructed wetlands which are capable of meeting discharge criteria and containing the contaminant plume to the levels as prescribed in attachment B. However, the actual design and configuration of these treatment units will be based on the required discharge limits to be specified by the regulatory agencies during the NPDES permitting process for off site surface water discharge. The treatment process will utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. The treatment processes will result in reduction of toxicity, mobility and volume of contaminants present in the groundwater extracted from the different locations of the plume. This action will stabilize the risk and prevent further degradation of the environment, therefore protecting human health and the environment. This selected alternative based on capital and operational costs balanced with community acceptance and compliance with ARARs provides for an implementable and cost effective alternative.

It is expected that the final remedy would be implemented prior to the five-year review period. If the final remedy is not underway within five years after the commencement of this interim action, a review would be conducted to ensure that the remedies continue to contain the plume and reduce the risk associated with the contaminated groundwater.

8.1 Documentation of Significant Changes

The FFS and Proposed Plan recommended that groundwater would be extracted from the source area (1000 gpm) and the distal end (3000 gpm), treated, and discharged to surface water in the areas of Silver Creek and Moores Creek respectively. During the public meeting held on May 5, 1994, the residents of Merrick County were concerned that continuous discharge of 4000 gpm of water would exceed the creeks' capacity and potentially flood their basements and property. The discharge of treated groundwater to the creeks was found to be unacceptable by the local residents. In addition, the residents were concerned that extraction of groundwater at the distal end would induce contaminant migration from intermediary locations of the plume to the distal end.

In response, the Army evaluated potential flooding problems that may result due to discharge of treated water to the creeks. It was estimated that flooding would most likely occur during winter months (culvert icing is expected) and also during temperate months when high flow events occur. During high flows, the additional 7000 gpm discharged from the treatment facility would make the natural problem worse. A gross estimate based on a visual site inspection and discussions with the local community, estimated that approximately 1900 acres of land and about 90 residences could be potentially affected by flooding due to discharge of treated water to the Silver and Moores creeks. The loss of crops that could result due to flooding of property is estimated to be $ 1,000,000 each year. Based on new information obtained during the public meeting, the Army re-evaluated the surface water discharge point and determined discharge to Silver or Moores Creek may not comply with 40 CFR Part 6, which has been determined to be an ARAR.

In response to the concerns raised by the citizens, the Army evaluated the option of discharging the treated water directly to the Platte River by means of pipeline. A piping system was evaluated based on a total discharge rate of 7000 gpm including an additional 1000 gpm of groundwater extracted from the groundwater plume before it enters the intermediary area under the Capital Heights area. This additional 1000 gpm of extracted groundwater would prevent migration of contaminants, particularly RDX from the central portion of the plume where RDX concentration exceeds 20 μg/L. Note that additional discharge capacity will be designed into the pipe line as a contingency for the final remedial action selection. The pipeline traverses a total distance of 25 miles and the present worth (7%,30 years) ranged between $10,392,000 and $14,041,300. The surface water discharge of treated water to Platte River will eliminate potential flooding impacts and will become cost comparative over the system life-cycle should the metals and nitrate treatment not be needed to meet the discharge levels at the Platte River.

The treated effluent discharged to the Silver and Moores creek would have had to meet MCLs, where applicable, due to the fact that both Silver Creek and Moores are hydraulically connected to the aquifer. If discharged directly to Platte River, the treated effluent would be required to meet NPDES permit limits. It is expected that effluent limits for the NPDES at the Platte may not warrant the treatment for metals and nitrates. This reduced treatment requirement would offset the cost associated with piping the treated effluent to the Platte River.

If for any unforseen reasons the Wood River Diversion Channel is not implemented, the Army will undertake the responsibility of completing the piping route (not the diversion channel) and provide the piping system for discharge of treated water to the Platte River. This may require additional time for construction of the selected treatment system.

8.2 SUMMARY OF SELECTED REMEDY AFTER MODIFICATION

A. Source Area

- Extraction of contaminated groundwater.

- Treatment of contaminated groundwater using granular activated carbon and granular media filtration; and chemical precipitation and constructed wetlands, if necessary.
- Discharge of treated effluent to the Platte River through Wood River Diversion Channel easement.

B. Distal End/Intermediary Area

- Extraction of contaminated groundwater at the distal end and the intermediate area.
- Treatment of contaminated groundwater using granular activated carbon and granular media filtration.
- Discharge of treated effluent to Platte River through Wood River Diversion Channel easement.

GROUNDWATER - OPERABLE UNIT ONE
CORNHUSKER ARMY AMMUNITION PLANT
RESPONSIVENESS SUMMARY

SUMMARY OF COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD AND AGENCY RESPONSES

The public comment period on the preferred interim remedial action alternative for Groundwater - Operable Unit One, Cornhusker Army Ammunition Plant extended from April 26 to May 26, 1994. A public availability session took place on May 4, 1994 from 4pm to 8pm at the Grand Island City Hall, Grand Island, Nebraska. The Public Meeting took place on May 5, 1994 from 7pm to 9pm, also at the Grand Island City Hall. Approximately 16 people attended the public availability session with 7 people making oral statements or asking questions. 19 people attended the Public meeting on May 5, 1994, with 7 people making oral statements or asking questions. Seven written statements were received during the comment period. The transcript of the Public Availability Session and the Public Meeting for the Proposed Plan is attached. During the question and answer session, the Army, EPA, and the State of Nebraska representatives responded to questions from the audience. These responses are contained the transcript of the proceeding, which is included in the Administrative Record for the site. A summary of the written comments and the Army's response is provided herein.

<u>Overview</u>

Four of the seven written comments reflect the opinion that the groundwater should be cleaned up, but the discharge of treated water should not be to the local drainage due to chronic flooding problems along these drainages. One comment received voiced a concern about the lack of extraction wells in the central portion of the plume and one comment concerned the effect infiltration basins would have on the water table in Capitol Heights.

<u>Comments on the Discharge Options</u>

1. Several citizens of Merrick County commented that any water discharged to Moores or Silver Creek would adversely impact them by causing flooding. The area where these individuals reside along Moores Creek is prone to flooding. The citizens also opposed the discharge because they believed that the added water to the creeks would raise the water table sufficiently to prevent farming of adjacent land.

    Army's Response: Prior to the Public Meeting and Public Availability Session the Army's estimates of stream capacity and ability to bear the additional water did not indicate flooding problems would occur if the treated water would be discharged into these drainage. Due to the concern of Merrick County residents voiced during the 2 day public information gatherings, the Army has reassessed the discharge options for the treated groundwater. Information about the planned diversion channel for Wood River has been collected to develop other viable discharge options which were assessed according to the same criteria used in the Focused Feasibility Study. Through this evaluation the Army has determined that discharge of treated water via pipeline through the easement for the diversion channel to the Platte River is a viable alternative and the Army has changed the discharge option for the selected remedy as documented in this ROD.

Other Comments

1. One citizen asked what effect the infiltration basins would have on the groundwater table in the Capital Heights area.

Army's Response: Computer modeling indicates that the areas beneath and immediately adjacent to the basins would see a 1 to 2 foot rise in the water table, causing what is referred to as a groundwater mound. This mounding effect would dissipate by the time the groundwater reached the site boundary. Therefore, no impact on the water table would occur in the Capital Heights area.

2. The City of Grand Island voiced a concern over the lack of extraction wells in the central portion of the plume. They were concerned that pumping at the distal end would cause groundwater with higher concentrations of RDX to migrate at an accelerated rate, causing an increase in RDX levels in areas which currently have detections at or around the detection limit. The City expressed that the accelerated migration of the plume would cause a reduction in property values and would cause problems if any dewatering had to be done for construction projects due to discharge of more highly contaminated groundwater into ditches. They expressed a concern that potential for growth and development would be hindered due to the complications of providing construction dewatering due to the anticipated increases in contaminant levels in this area of the plume.

Army's Response: The Army has reconsidered the option to control migration of the 20 ppb RDX zone in the central portion of the plume. Currently it is anticipated that 3 wells would be utilized to contain the explosive contaminants in this area. Actual well placement and extraction rates will be ascertained during the final design phase.

3. The NDEQ raised the issue of the applicability of the State's Title 118 to the proposed action and requested the Army to clarify its position on Title 118.

Army's Response: The Army has since requested the State's action specific ARAR determinations and their interpretation. The Army has since included Title 118 as an applicable ARAR for this selected action.

ATTACHMENT B

GROUNDWATER CONTAINMENT STANDARDS

COMPOUND	STANDARD (ppb)
2,4,6,-trinitrotoluene	2.0 (b)
HMX	400.0 (b)
RDX	2.0 (b)
nitrobenzene	3.5 (c)
1,3-dinitrobenzene	1.0 (b)
1,3,5-trinitrobenzene	3.5 (c)
2-amino-4,6-dinitroluene	0.4 (d)
2,4-Dinitrotoluene	0.05 (a)

Note:
a. USATHAMA. Assessment of ARARs. January 1992 (Based on Carcinogenic Slope Factor)
b. USEPA. Office of Drinking Water Lifetime Health Advisory (72 year Lifetime advisory)
c. WJE. Modified USATHAMA's Assessment of ARAR's. December 1991 (Based on Estimated RfD)
d. Based on provisional RfD of 6E-05 mg/kg-day. USEPA/ECAO 1993