UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105

SEP 2 2 2006

Mr. Paul Zianno
Department of the Army USACE – Sacramento District
1325 J Street, CESPK-PM-M
Sacramento, CA 95814-2922

Re: Final Second Five Year Review Report of Riverbank Army Ammunition Plant, City of Riverbank, Stanislaus County, California, September 2006

Dear Mr. Zianno:

The U.S. Environmental Protection Agency (EPA) Region 9 has received the Final Second Five Year Review Report of Riverbank Army Ammunition Plant, City of Riverbank, Stanislaus County, California, dated September 2006. This document addresses completed and ongoing remedial actions taken pursuant to the Superfund decision documents. EPA agrees with the findings, conclusions, and recommendations provided in the Report as they relate to protectiveness, and concurs with the Army that the remedies for groundwater and soil remain protective of human health and the environment under the current land use at Riverbank Army Ammunition Plant.

In order to remain protective in the long term, the Report identifies a suite of institutional controls (ICs) that must be implemented. The Report indicates these will be identified, evaluated, and documented in the forthcoming Property Management Plan. As a component of the remedy, it is also appropriate to memorialize the ICs in the appropriate post-Record of Decision (ROD) document (e.g., ROD Amendment). In addition, please provide EPA with an updated list of milestone dates for follow-up actions listed in Table 7. We look forward to discussing these issues at the upcoming project manager's meeting.

Enclosed is the signature page for the Final Second Five-Year Review Report. If you have any questions, please contact Xuan-Mai Tran, Remedial Project Manager, at (415) 972-3002.

Sincerely,

Kathleen H. Johnson
Chief, Federal Facilities and Site Cleanup Branch
Superfund Division (SFD-8)

cc (See Distribution List)

RIVERBANK AMRY AMMUNITION PLANT DISTRIBUTION LIST

Jim Pinasco
Department of Toxic Substances Control
8800 Cal Center Drive
Sacramento, CA 95826-3200

Brian Taylor
State of California, Regional Water Quality Control Board
Central Valley Region
11020 Sun Center Drive, #200
Rancho Cordova, CA 95670-6114

Linda Gumas
Riverbank Army Ammunition Plant
P.O. Box 670
Riverbank, CA 95367-0670

Mike Kipp
Department of the Army, SFIM-AEC-CDS
5179 Hoadley Road
Aberdeen Proving Ground, MD 21010-5401

Jim Gansel
SOTA Environmental Technology
2116 Churchill Avenue
Modesto, CA 95350-2700

Christine Dougherty
Ahtna Government Services Corporation
3680 Industrial Boulevard, Suite 600H
West Sacramento, CA 95691-6504

Neil Morgan-Butcher
ARCADIS G&M Inc.
155 Montgomery Street, Suite 1510
San Francisco, CA 94104-4120

SECOND FIVE-YEAR REVIEW REPORT
FINAL

RIVERBANK ARMY AMMUNITION PLANT
CITY OF RIVERBANK
STANISLAUS COUNTY
CALIFORNIA

PREPARED BY:

RIVERBANK ARMY AMMUNITION PLANT

September 2006

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List of Acronyms

AGSC	Ahtna Government Services Corporation
ALCOA	Aluminum Company of America
AOC	Area of Concern
ARAR	Applicable or relevant and appropriate requirement
BRAC	Base Realignment and Closure (Commission)
bgs	Below ground surface
CCR	California Code of Regulations
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	Contaminant of concern
COE	U.S. Army Corps of Engineers
DTSC	California Department of Toxic Substances Control
E/P	Evaporation-percolation (ponds)
EPA	U.S. Environmental Protection Agency
gpm	Gallons per minute
GWTP	Groundwater Treatment Plant
GWTS	Groundwater Treatment System
IGWTS	Interim Groundwater Treatment System
IWTP	Industrial Waste Treatment Plant
LLNL	Lawrence Livermore National Laboratory
MCL	Maximum contaminant level
µg/L	Micrograms per liter
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List

O&M	Operation and maintenance
OSHA	Occupational Safety and Health Administration
POC	Point of Control
QAPP	Quality Assurance Project Plan
QA/QC	Quality assurance/quality control
RBAAP	Riverbank Army Ammunition Plant
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
ROD	Record of Decision
RWQCB	California Regional Water Quality Control Board, Central Valley Region
SWMU	Solid Waste Management Unit
TPH	Total petroleum hydrocarbons
TTLC	California Total Threshold Limit Concentration
WDR	Waste Discharge Requirement

Executive Summary

The second Five-Year Review (FYR) for the Riverbank Army Ammunition Plant (RBAAP) in Riverbank, California was completed in April 2005. The RBAAP is now officially on the Base Realignment and Closure (BRAC) list.

Overall, the groundwater extraction and treatment system and landfill cover remedial actions are functioning as designed and are operated and maintained in an appropriate manner. A few issues that do not immediately impact the protectiveness of the remedy were noted during the FYR process; however, the majority of these issues have been resolved. A summary form identifying these issues follows this Executive Summary.

Appropriate health and safety and emergency response protocols are in place at the RBAAP facility and are being implemented properly to control risks. The landfill and the groundwater remedial actions are operating as designed and are protective of human health and the environment. Protection of human health and the environment through the landfill and groundwater remedial actions at RBAAP are discussed in more detail below.

The Army has implemented, maintained and enforced land use controls [LUCs] / institutional controls [ICs] consistent with the selected remedial actions in the 1994 Record of Decision for the Riverbank Army Ammunition Plant. To address the comments on the Draft second 5-year review related to LUC [IC] issues and as previously planned, the Army will develop a document to serve as a Property Management Plan ("Plan") to address all relevant and necessary LUCs [ICs] associated with the RBAAP remedial actions as described in the ROD and/or with the existing RCRA Permit. Details regarding the LUCs / ICs implemented, maintained, and enforced are presented in Section X of this FYR Report.

Landfill

The landfill cap as installed is effective in containing contaminants through preventing infiltration of rainwater and preventing direct contact with soils. Institutional controls and access controls at the landfill remain in place and are effective. The access controls at the RBAAP facility consist of fencing, a manned gate and security patrols. The institutional controls consist of warning signs at the landfill. The landfill remedy is currently protective of human health and the environment, but deed restrictions are required in order for the remedy to remain protective in the long term.

Groundwater

Immediate threats to human health and the environment have been addressed through the implemented groundwater remedy. The groundwater extraction and treatment system is operating and functioning as designed. Containment of the contaminated areas has been achieved through establishment of inward gradients that limit migration of the groundwater plumes. Contaminant levels throughout the Site have decreased, and the area of contamination continues to reduce in size as expected. The groundwater remedial action is currently protective of human health and the environment, but some form of institutional control is needed to prevent inappropriate use of the contaminated groundwater while the groundwater remediation is occurring.

Deed Restrictions

The deed restrictions would take the form of a future restrictive covenant on the landfill site at the time of transfer. Regarding other sites, sites AOC 12-(Industrial Wastewater Collection System) and SWMU-12 (Industrial Wastewater Treatment Plant) will be addressed under the RCRA Permit closure requirements. At the time of transfer of the property, the responsible party (i.e., transferee or Army) held responsible for addressing future permit closure requirements will be identified and this requirement will be incorporated into the transfer documents.

Public Notices

As required, a public notice regarding the FYR report and its availability for public review at the Riverbank Library was published on May 19, 2006, in the local newspaper (Modesto Bee). A copy of the notice is included in Attachment 5 of this Report.

Ecorisk Screening

An evaluation of the ecological risk was performed by Mr. Ned Black, PhD, Regional CERCLA Ecologist/Microbiologist with EPA.

The ecorisk assessment concluded that "the original evaluation of ecological risk at this site remains valid. Therefore, the remedy under five year review for this site is adequately protective of the environment." Details of this evaluation are provided in Attachment 6.

Analysis for Perchlorate

The US Army Environmental Center (USAEC) exempted RBAAP from sampling as per DoD Policy which did not authorize analysis for perchlorate unless a reasonable basis existed to suspect a potential for perchlorate contamination. At RBAAP there was never a source for perchlorate since explosives were never handled at the facility. Operations at RBAAP were limited to metal working related to the manufacturing of casing shells only.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site name *(from WasteLAN)*: Riverbank Army Ammunition Plant		
EPA ID *(from WasteLAN)*: CA7210020759		
Region: 09	**State: CA**	**City/County: Riverbank / Stanislaus County**
SITE STATUS		
NPL status: ☒ Final ☐ Deleted ☐ Other (specify)		
Remediation status (choose all that apply): ☐ Under Construction ☒ Operating ☒ Complete		
Multiple OUs?* ☐ YES ☒ NO	**Construction completion date:** *09 / 29 / 1997*	
Has site been put into reuse? ☒ YES ☐ NO Portions of the facility have been leased to private tenants		
REVIEW STATUS		
Lead agency: ☐ EPA ☐ State ☐ Tribe ☒ Other Federal Agency U.S. Army		
Author name: Neill Morgan-Butcher		
Author title: Project Manager	**Author affiliation: ARCADIS G&M, Inc., on behalf of Ahtna Government Services Corporation (U.S. Army Contractor)**	
Review period:** March to April 2005		
Date(s) of site inspection: 04/07/2005		
Type of review: ☐ Post-SARA ☐ Pre-SARA ☐ NPL-Removal only ☐ Non-NPL Remedial Action Site ☐ NPL State/Tribe-lead ☐ Regional Discretion ☒ Statutory		
Review number: ☐ 1 (first) ☒ 2 (second) ☐ 3 (third) ☐ Other (specify) _____		
Triggering action: ☐ Actual RA Onsite Construction at the Landfill ☐ Actual RA Start at OU#____ ☐ Construction Completion ☒ Previous Five-Year Review Report ☐ Other (specify)		
Triggering action date *(from WasteLAN)*: 09/21/2001		
Due date *(five years after triggering action date)*: 09/21/2006		

* ["OU" refers to operable unit.]
** [Review period should correspond to the actual start and end dates of the Five-Year Review in WasteLAN.]

Five-Year Review Summary Form, cont'd.

Issues:

Several Issues were identified during the second five-year review:

- Although there are currently no institutional controls in place for the landfill area to prevent inappropriate uses in the future that could impact the integrity of the cap, the Army intends to identify LUCs which will be documented in the Property Management Plan. The Property Management Plan will identify land use controls with specific implementation actions to be used to implement, maintain and enforce the LUCs by the Army, by any subsequent property owners and users that are transferees of the property under BRAC 05, and, if necessary, by the state and local jurisdictions.

- Although there are currently no institutional controls in place to ensure that no inappropriate use of contaminated groundwater occurs while the groundwater remediation is occurring, the Army intends to analyze options for groundwater institutional controls, identify any necessary LUCs and document the results in the Property Management Plan. Any existing LUCs and any LUCs which will need to be implemented in the future are identified in this FYR. The forthcoming Property Management Plan will document and provide implementation details for all applicable LUCs. However, it should be pointed out that specific deed restrictions will be applied to the deed as restrictive covenants at the time of property transfer in the future.

- The O&M Plan Update should be approved by EPA.

- Landfill O&M, including storm water monitoring and reporting, was not consistently performed in accordance with site requirements at the time of the 5-year review. However, as of November 2005, the storm water monitoring procedures and reporting activities were formalized to ensure O&M is consistent and meets the requirements.

- Rodent burrows at the EW113 well cluster appear to be impacting these structures. An inspection of the EW113 well cluster indicates that an aggressive rodent destruction program needs to be implemented in this area.

- Community members expressed an interest in learning more about the status of the remedial actions and the implications of the proposed closure for the ongoing remediation. Following regulatory agency acceptance of this Response to Comments (RTC) on the Draft Second FYR Report ("Report"), a public meeting will be held to fully advise the interested parties of the review process. This meeting also will include an update of the recent actions taken. An administrative record is kept at the RBAAP, which is always available for review by the public. Recent community involvement has been limited to visits to several local residents to share information regarding the progress of the RBAAP program. The completion of notices, fact sheets and meetings has not been accomplished at this time due to the high volume of changes and additions that are part of the FYR. Following regulatory agency approval of the FYR Report, all measures mentioned in the RTC will be implemented immediately. Also, due to the complexity of this review, an effective exchange of information is more readily accomplished with an open public meeting of the interested parties. Following completion of the RTC, the FYR Report will be completed and made available for the planned public meeting. Prior to completion of the FYR a copy of the public notice published in the local newspaper will be included as an attachment in the Final FYR Report.

The information on this notice (e.g., the date that the notice was published) and the information on the planned public meeting will be included in the text of the Final FYR Report.

- The Army's onsite information repository did not have all required documents readily available. These documents are in the process of being added to the repository.

The identified issues currently do not affect the protectiveness of the landfill or groundwater remedies.

Recommendations and Follow-up Actions:

These actions are required to correct these issues and ensure that protectiveness is maintained in the future:

- Implement deed restrictions at the landfill area.
- Analyze options for groundwater institutional controls; select and implement ICs to restrict residential use of the site if appropriate.
- EPA approval should be obtained for the O&M Manual Update.
- Review adequacy of revised landfill O&M procedures and reporting to confirm that site requirements are being met.
- Restore area around extraction well cluster EW1 13 and implement a rodent destruction program, as necessary.
- Prepare a factsheet to update the community on the status of the site remediation.
- The information repository at RBAAP needs to be updated with missing reports, and kept current.

At present, the Army does not intend to complete the evaluation of ozone and sodium dithionite technologies as originally proposed. The use of these technologies at RBAAP was focused on treatment of residual unsaturated A-zone chromium and cyanide. However, the declining water levels at the site make this evaluation unnecessary, and the discontinuation of these technologies will allow limited resources to be focused elsewhere.

The Army currently is implementing a Characterization Study at RBAAP, which is required to not only more fully identify any existing contaminant plumes, but also provide a method to more effectively address them.

Five-Year Review Summary Form, cont'd.

Protectiveness Statement:

The landfill remedial action is currently protective, based on continued O&M and groundwater monitoring results.

The groundwater remedial action is operating as designed and is currently protective.

However, in order for the remedy to remain protective in the long term, institutional controls must be implemented as follows:

Deed restrictions that prevent inappropriate use of the landfill area are needed, and the Army will analyze options for groundwater institutional controls and will document the findings in the Property Management Plan.

Because both of the remedial actions are protective, the overall remedy of the RBAAP is protective of human health and the environment.

Long-Term Protectiveness:

Long-term protectiveness of the remedial actions will be maintained through continued O&M. In addition, pending Congressional approval, if RBAAP closure proceeds under the BRAC 2005 recommendations, deed restrictions will be implemented for the landfill.

Other Comments:

None.

RBAAP – Riverbank Army Ammunition Plant Five-Year Review Report
Protectiveness Statement and Regulatory Concurrence

PROTECTIVENESS DETERMINATION

The remedies employed at RBAAP – Riverbank Army Ammunition Plant are expected to be protected of human health and the environment upon completion; in the interim, exposure pathways that could result in unacceptable risks are being controlled. Completed remedies are considered protective of human health and the environment.

13 SEP 06

B.F. Turner, Commander's Representative
U.S. Department of the Army
Riverbank Army Ammunition Plant

Date

11-6-06

Anthony J. Landis, P.E.
Chief, Northern California Operations
Office of Military Facilities
Department of Toxic Substances Control

Date

11/17/06

Antonia K.J. Vorster
Chief of Site Cleanup Program
California Regional Water Quality Control Board

Date

9/22/06

Kathleen Johnson, Chief
Federal Facilities and Site Cleanup Branch
U.S. Environmental Protection Agency

Date

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I. Introduction

The U.S. Army has conducted a five-year review of the remedial actions implemented at the Riverbank Army Ammunition Plant (RBAAP) in Riverbank, California. This review was conducted during March and April of 2005. This report documents the results of the review. The U.S. Army was supported in performance of this second formal five-year review by Ahtna Government Services Corporation (AGSC) under contract to the Army Environmental Center at Aberdeen Proving Ground, Maryland, and its subcontractor, ARCADIS G&M Inc.(ARCADIS).

The purpose of the five-year review is to evaluate whether the selected remedy at a site is protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in five-year review reports. In addition, five-year review reports identify issues found during the review, if any, and provide recommendations to address them.

This five-year review report is prepared pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) §121 and the National Contingency Plan (NCP). CERCLA §121 states:

> *If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action.*

The U.S. Environmental Protection Agency (EPA) interpreted this requirement further in the NCP; the Code of Federal Regulations Part 40(40 CFR)§300.430(f)(4)(ii) states:

> *If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.*

This is the second formal five-year review for the RBAAP, and generally covers the operational period from January 2001 through December 2004. Although the Army prepared an initial five-year review report dated August 1996, the first formal five-year review was conducted in February 2001. The triggering action for the first formal five-year review was the initiation of remedial action on the landfill at RBAAP on June 5, 1995. The first Five-Year Review Report was finalized on September 21, 2001, which made this second Five-Year Review Report due no later than September 21, 2006. This second five-year review was required because hazardous substances, pollutants, or contaminants remain at the RBAAP site above levels that allow for unrestricted use and unlimited exposure.

II. Site Chronology

Table 1 lists the chronology of events for the RBAAP site.

Table 1: Chronology of Site Events

Date	Event
1980	The Army published an Installation Assessment that identified potential hazardous materials release sites at RBAAP.
1984 to 1986	A Contamination Survey was completed in three phases. Chromium and cyanide were identified in groundwater at concentrations exceeding background levels.
1987 to 1991	A three phase Remedial Investigation (RI) program was completed. The RI confirmed that chromium and cyanide were the only contaminants of concern (COCs) in groundwater.
1989	Interim response action was initiated. Design of the Interim Groundwater Treatment System (IGWTS) was completed.
2/21/1990	RBAAP was added to the National Priorities List (NPL).
1990	Construction of the IGWTS was completed.
4/5/1990	The Federal Facility Agreement was signed.
10/1991	IGWTS operation commenced with extraction from onsite wells.
12/1992	City of Riverbank water supply lines were extended to residential area west of RBAAP.
12/1993	Evaporation-Percolation (E/P) Ponds Removal Action was completed.
3/23/1994	The Record of Decision (ROD) was signed.
2/13/1995	Remedial design for the landfill cap was approved.
6/5/1995	Remedial action was initiated for the landfill. This action was the triggering event for First Five-Year Review.
10/3/1996	Construction of the landfill cap, including drainage systems, was completed.
11/1996	Construction of the expanded groundwater treatment system (GWTS) was completed.
9/15/1997	Final offsite groundwater extraction well of the initial remedial design was installed and operational.
9/29/1997	Construction completion was achieved.
9/30/1997	A Preliminary Close Out Report was submitted and approved.
1999	Groundwater Treatment Plant (GWTP) operations went to ion exchange only operation for removal of both chromium and cyanide.
7/2001	The California Regional Water Quality Control Board (RWQCB) issued revised Waste Discharge Requirements (WDRs), Order No. 5-01-200.
9/21/2001	The First Five-Year Review Report was finalized.
6/21/2002	A Corrective Action Consent Agreement was signed between the California Department of Toxic Substance Control (DTSC) and the Army.
6/2004	Monitoring well MW109B was converted to a groundwater extraction well to provide more efficient cyanide capture.

III. Background

Physical Characteristics

The RBAAP facility is located at 5300 Claus Road, Riverbank, Stanislaus County, California. The Site is about 1 mile south of the Stanislaus-San Joaquin County boundary and approximately 5 miles northeast of the City of Modesto (Figure 1). The main plant consists of 145 acres situated in a primarily rural area (Figure 2). Four evaporation-percolation (E/P) ponds cover an additional 28 acres and are located on the banks of the Stanislaus River, which is approximately 1 mile north of the main plant. The topography of RBAAP and the surrounding area is flat valley land.

Land and Resource Use

RBAAP is a government-owned, contractor-operated facility. The operating contractor, NI Industries, Inc. (NI Industries), has operated the facility since early 1952. RBAAP was originally constructed by the Aluminum Company of America (ALCOA) as an aluminum reduction plant supplying the military. The facility was built under authority of the Defense Plant Corporation in 1942 and production of aluminum began in May 1943. The facility subsequently was closed in August 1944. From 1951 until the present, the RBAAP has produced steel cartridge cases with production reaching peaks during the Korean and Vietnam conflicts. The primary industrial processes used at the facility during this period have included electroplating, cleaning, and metal finishing.

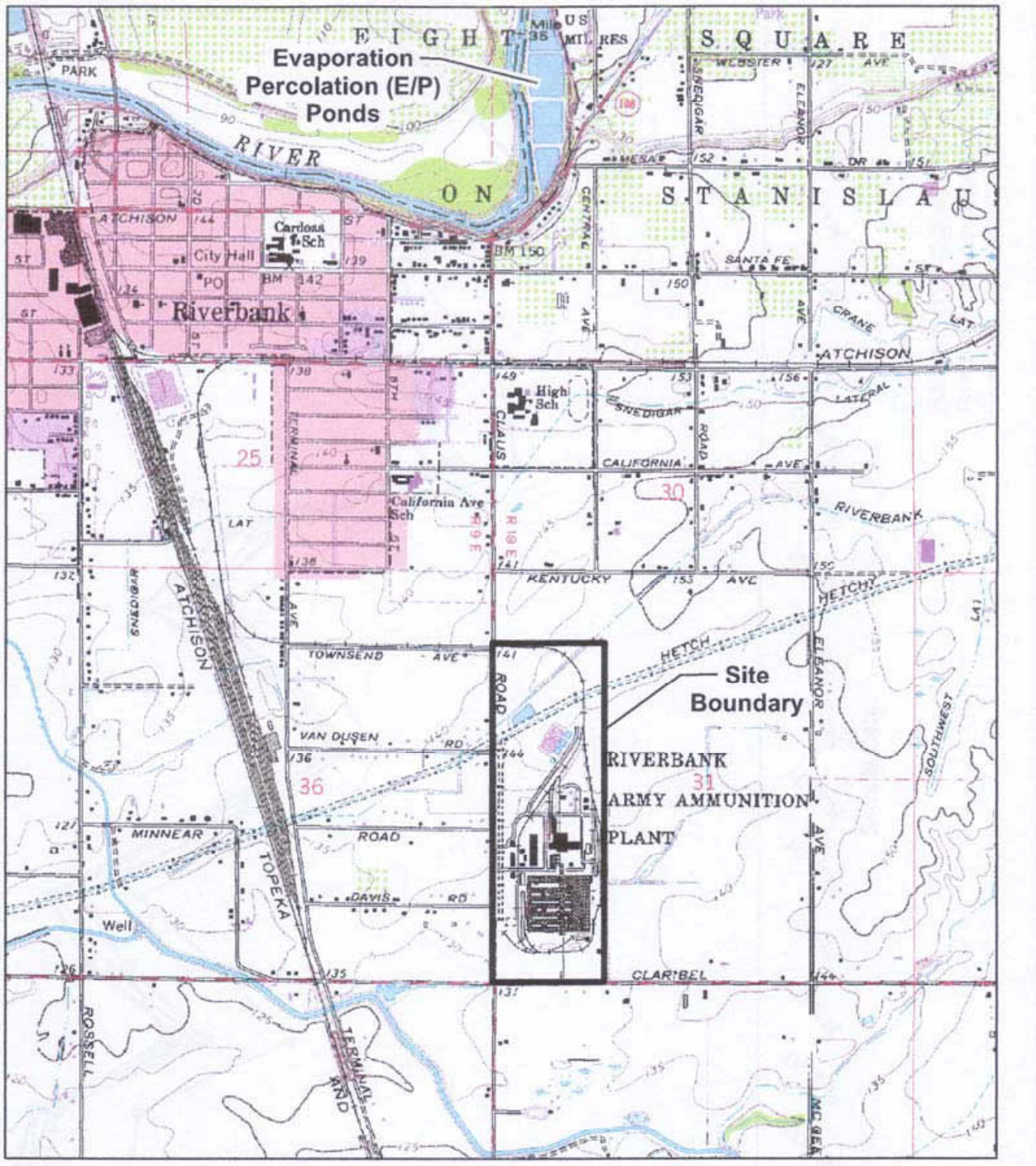
In May of 2003, the House of Representatives, Committee on Energy and Commerce requested that DOD provide a survey of perchlorate use of all DOD facilities. RBAAP has manufactured various ammunition requirements since its existence, none of the production operations have included any manufacture of explosive or included the loading of that same explosive. The past and present production operations have only included the manufacture of the metal parts for the ammunition case or projectile. In the case of the grenade produced at RBAAP, this only included the metal parts for the body of the grenade.

When the Army undertook the sampling effort to address any possible sites where perchlorate might be found, RBAAP was exempted from any sampling required due to the fact that no possible use or spill of perchlorate had ever taken place at this installation.

Prior to receiving notification from the House of Representatives, Committee regarding the survey of perchlorate use at RBAAP, the Army and more specifically the Army Environmental Center advised the ammunition sites to conduct sampling for perchlorate.

According to the former Commander's Representative for the RBAAP, an exemption from this requirement was requested due to the fact that RBAAP had never handled or produced explosives in the production process. Instead, this installation's production processes only included the production of the metal body of the various ammunition requirements. In addition, based on a review of the past operations at RBAAP environmental documentation did not include any possible spills of perchlorate materials.

Currently, RBAAP activities are limited to the operation of a cartridge case line, layaway of idle facilities, limited manufacturing and technology updates, and maintenance and protection of the overall facility. RBAAP has been recommended for closure by the Base Realignment and Closure (BRAC) Commission, and pending Congressional approval, it will be closed in 2006. There is currently no existing plan to change the general land use from its present industrial use. Various buildings at the facility have been leased out to private businesses that conduct a variety of light to heavy industrial activities, as detailed below. Based on the available infrastructure and other property improvements, it appears likely that future site use will continue to be light to heavy industrial.



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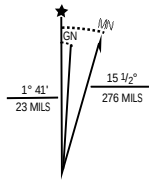

UTM GRID AND 1981 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET

Reference: U.S.G.S. 7.5-minute Riverbank Quadrangle, California.

Project Manager	Area Manager	ARCADIS	LOCATION OF RBAAP AND THE EVAPORATION/PERCOLATION PONDS RIVERBANK ARMY AMMUNITION PLANT RIVERBANK, CALIFORNIA	Project Number
	J. PETERS			RC000665.0001
Task Manager	Technical Review			Figure
N. MORGAN-BUTCHER	N. SHERIF			1
Drawing Date	Drawn By			
13 APR 05	M. CHIU			

ARCADIS G&M, Inc.
1050 Marina Way South
Richmond, CA 94804
Tel: 510-233-3200 Fax: 510-233-3204
www.arcadis-us.com

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Date\Time : Thu, 14 Apr 2005 – 4:00pm
Path\Name : W:\Projects-Active\RBAAP\5-yr review\Figure 1.ai

0 200M

0 200yd

Reference: USGS TerraServer Image, 10 km NE of Modesto, California, United States. 8 March 2002.

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Project Director: N. MORGAN-BUTCHER	Area Manager: J. PETERS
Task Manager: N. SHERIF	Technical Review: N. SHERIF
Drawing Date: 15 APR 05	Drawing By: M. CHIU

ARCADIS

ARCADIS G&M, Inc.
1050 Marina Way South
Richmond, CA 94804
Tel: 510-233-3200 Fax: 510-233-3204
www.arcadis-us.com

AERIAL PHOTOGRAPH
RIVERBANK ARMY AMMUNITION PLANT
RIVERBANK, CALIFORNIA

Project Number: RC000665.0001

Figure: 2

Date\Time : Mon, 18 Apr 2005 - 10:15am
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Tenant	Type of Business
Ceracon	Manufacturing of metal parts
LMC-West	Manufacturing of dust collection and nut harvesting equipment
C&N Machining, Inc.	Machine shop
Wholesale Services, Inc.	Wholesaler of propane
Leisure RV Storage	Recreational vehicle storage facility
Cingular Wireless	Telecommunications leasing of the water tower for antenna installation
Environmental & Lubrication Solutions, Inc.	Distributor of packaged lubrication products
Sierra Railroad	Shortline railroad
Riverbank Oil Transfer	Transfer of used waste oil
California Highway Technology	Manufacturing of steel reinforcement for highways and bridges
Berkeley Forge	Storage of industrial equipment

RBAAP is bordered on the north, west and south by sparse residential areas, with pastureland to the east. The densest housing community is adjacent to the northwest corner of the facility. In addition, several residences are directly west of the main plant, across Claus Road. Denser residential development may continue to spread toward RBAAP, but no land use changes appear to be imminent in the immediate vicinity.

The shallow groundwater bearing zones underlying the Site are not currently used as drinking water sources. These zones have been designated the A, A', B, and C, and are summarized as follows:

- A – an unsaturated upper sand zone with average depth from 29 to 60 feet below ground surface (bgs); bottom 10 feet predominately clay and silt
- A' – a partially to fully saturated, well-graded silty sand with average depth from 60 to 90 feet bgs and approximately 30 feet thick; bottom 10 feet predominately clay and thinly interbedded sand and silt

- B – saturated, semi-continuous sand units interbedded with thin silt and clay layers with average depth from 90 to 120 feet bgs and approximately 30 feet thick; bottom 10 feet predominately sand and silty sand with isolated areas of silt and clay
- C – saturated sand zone with an average depth from 120 to 150 feet bgs (approximately 30 feet thick)

The aquifer zones defined above are not hydraulically independent. The presence of discontinuous fine-grained sediment layers creates a complex flow pattern in the subsurface. The average groundwater flow direction beneath the Site is westerly. Vertical gradients between A'-, B-, and C-zones are generally very small.

Deeper water bearing zones are associated with drinking water resources. The shallowest of these zones, designated the D-zone, consists of saturated coarse silt and clay from 150 and 195 feet bgs (approximately 45 feet thick), and gravel and clayey gravel below approximately 195 feet bgs. Regional pumping for agricultural and domestic uses can create seasonally strong downward gradients from the C-zone to the D-zone. Water levels have dropped sharply each summer since 2001 (CH2M Hill, 2005). Despite winter increases, water levels have exhibited a net decline of approximately 6 feet over the last 5 years. Due to the decline in the water table elevation, the A-zone is now completely unsaturated for a large portion of the year, with only the lower portion becoming saturated during late fall and winter seasons.

History of Contamination

The Army’s Installation Restoration Program at RBAAP concluded that chromium, primarily in the hexavalent form, and free cyanide associated with past operations had contaminated groundwater both on and off the facility. The offsite contamination impacted or potentially impacted the domestic wells of 70 residences west of the facility. Sources of chromium contamination were identified as aboveground tanks that were part of the Industrial Waste Treatment Plant (IWTP), and to a lesser degree chromium contaminated brick debris located on the landfill. The IWTP has treated wastewaters generated from the electroplating, cleaning, and metal-finishing processes at the facility. These processes have involved use of zinc chromate solutions. The original IWTP storage and equalization tanks were made of redwood, and are believed to have periodically leaked.

The landfill comprises a 4.5-acre parcel that was used for surface and trench disposal and debris burning from 1942 to 1966. Monitoring wells installed downgradient of the landfill indicated that the landfill was a likely source of cyanide and chromium contamination in groundwater. The cyanide contamination has been linked to the disposal of potliners from the aluminum reduction process on the southern portion of the landfill. Chromium contamination in this area of the facility has been traced to construction rubble, which included chromium-contaminated bricks. In addition, the E/P ponds contained levels of zinc in excess of the California Total Threshold Limit Concentration (TTLC). The E/P Ponds had received various degrees of treated facility effluent since discharge to the ponds began in 1952, resulting in contamination of the pond sediments.

Initial Response

Beginning in 1980, the Army has conducted investigations of past plant operations at RBAAP under the Installation Restoration Program. Subsequent investigations led to RBAAP being placed on the NPL in February 1990 due to the chromium and cyanide concentrations found in groundwater. Prior to the ROD, three response (removal) actions were conducted at the Site. These removal actions are summarized as follows:

- **E/P Ponds Removal Action.** A removal action was required at the ponds to address zinc contamination in the soils within the ponds. Between September and December 1993, the Army excavated approximately 1,120 cubic yards of contaminated soil and disposed of it in an approved offsite landfill.
- **Permanent Potable Water Supply Response Action.** A response action was necessary to protect residents from potential exposure to groundwater contaminated with chromium and cyanide migrating downgradient of RBAAP to the west. Initially, the Army provided bottled water to residents potentially impacted by the contamination. To provide a permanent source of clean water, the Army extended the City of Riverbank's public water supply system into the residential areas west of Riverbank. In December 1992, residents were connected to the City's public water supply. In addition, the Army drilled deeper wells for a small number of residents that still wanted to use wells for irrigation purposes.

- **IGWTS Response Action.** The IGWTS response action was established as a non-time critical removal action to protect public health, welfare, and the environment and to mitigate further offsite migration of groundwater contamination. As part of the IGWTS response action, the Army converted a total of eight monitoring wells, four in the B-zone and four in the C-zone, to extraction wells. The treatment system, consisting of reduction/precipitation for chromium and cyanide removal followed by selective anion exchange for additional cyanide removal, was built in 1991, and full operation of the IGWTS began in October 1991.

Aside from these response actions, the landfill and IWTP were both the subject of housekeeping and maintenance activities. Most of the potliners and contaminated bricks were removed during rubble cleanup efforts in 1987. In addition, from 1973 to 1980, the IWTP was upgraded and the redwood tanks were replaced with concrete tanks. Several investigations have also been conducted at the facility under the Resource Conservation and Recovery Act (RCRA) program. On June 30, 1995, DTSC issued a RCRA Part B Hazardous Waste Facility permit for RBAAP. A subsequent Corrective Action Consent Agreement (DTSC, 2002) identified 25 Solid Waste Management Units (SWMUs) and 16 Areas of Concern (AOCs). Cleanup associated with residual soil contamination at SWMU 1 (IWTP) has been deferred until RCRA closure. DTSC has concurred that the remaining SWMUs and AOCs do not require further action under RCRA (CH2M Hill, 2002e, 2005b).

Basis for Taking Action

Aside from the initial response actions above, further remedial action was necessary to address groundwater in the A'-, B- and C-zone aquifers with chromium and cyanide concentrations exceeding state and/or federal drinking water standard maximum contaminant levels (MCLs). Potential exposures to groundwater through direct ingestion or showering were associated with significant human health risks. Although the ROD concluded that action was not warranted to address human health risk based on exposure to landfill soils, in accordance with a Dispute Resolution Agreement, a final landfill cover was required to ensure that residual chromium in the soils did not impact groundwater.

IV. Remedial Actions

Remedy Selection

The only ROD for the RBAAP facility was signed on March 23, 1994. This Site-wide ROD included two response actions, one for the groundwater and the other for the landfill. The ROD also documented the decision that no further action was required for the E/P ponds although groundwater monitoring would continue in accordance with applicable waste discharge permits (i.e., the WDRs). In addition, the ROD mentioned additional activities (termed "post-ROD actions") that may need to be addressed in the future. The potential post-ROD actions are discussed further below

The development of remedial action objectives for RBAAP was aimed at protecting human health and the environment through media-specific or operable unit-specific goals. The remedial action objectives were as follows:

- Groundwater – Restore the groundwater in all water bearing zones to remediation goals.
- Landfill – Remediate the landfill to protect human health and the environment, including water quality.

The groundwater remediation goals were the state MCL for chromium of 50 micrograms per liter (µg/L) and the state and federal MCL for cyanide of 200 µg/L. Based on these remedial action objectives, the following remedial actions were selected for the groundwater and the landfill:

Groundwater

The groundwater remedy included the following major components:

- Groundwater extraction from wells located onsite and offsite to provide full capture of the chromium and cyanide A'-, B-, and C-zone plumes, as defined by the remediation goals of 50 and 200 µg/L, respectively.

- On-site treatment by chemical reduction and precipitation, followed by ion exchange and treated groundwater discharge to the E/P Ponds.
- Long-term groundwater monitoring for chromium and cyanide to ensure that the remedy is effective.

The ROD did not specifically address action for A-zone groundwater because the A-zone was not saturated at the time. The A-zone is discussed below in the section on Post-ROD Actions.

Landfill

The landfill remedy included the following major components:

- Install a final cover in accordance with the substantive provisions of California Code of Regulations (CCR), Title 23, Chapter 15, Articles 5 and 8, Corrective Action and Closure Requirements and maintain the cover for 20 years.
- Install additional monitoring wells downgradient of the landfill.

Construction of the landfill remedial action was completed in October of 1996. This remedial action includes routine groundwater monitoring to check that the remedial action is effective and that the cleanup objectives are being maintained.

Post-ROD Actions

The ROD described two conditions that, although not part of the selected remedy, may need to be addressed based on events that occur after approval and implementation of the ROD. These conditions are (1) recharge of the A-zone, and (2) investigation of the IWTP source area upon closure. These potential actions are discussed below.

Recharge of the A-Zone

The ROD calls for continued monitoring of the A-zone to determine if it recharges, and if it does recharge, investigation of the extent of contamination. If groundwater concentrations were to exceed the MCL cleanup levels, the A-zone groundwater would then be remediated, as necessary.

IWTP Source Investigation Upon Closure

The IWTP was identified as a source of chromium contamination in the groundwater during the RI. Investigations conducted around the current IWTP tanks determined that the residual contamination in these soils did not represent a threat to groundwater. However, because the IWTP is an operating system, investigations were limited to the perimeter of the tanks. In accordance with RCRA SWMU closure requirements and the 2002 Corrective Action Consent Agreement, the Army will perform a more complete investigation of the IWTP area upon RCRA closure to ensure that potential impacts to the environment are mitigated. The IWTP area is a RCRA Part B-permitted facility and must be closed in accordance with RCRA requirements when operations cease at the facility. Additional investigation of the IWTP area may be required under state RCRA requirements, with remediation under the RCRA requirements, and a coordinated cleanup and abatement order issued by Cal-EPA/RWQCB, if warranted. No remedial action was required at the time the ROD was issued because the sampling results from the remedial investigation did not indicate concentrations of inorganics above background levels at the IWTP area. Although the RBAAP facility will be closed under BRAC, there is no current schedule for the implementation of BRAC or RCRA-related activities. As per the 1990 Federal Facilities Agreement, EPA will be included in RCRA actions at the site.

Remedy Implementation

The U.S. Army Corps of Engineers (COE) contracted with CH2M Hill to complete the remedial design of the selected remedy, both for the landfill and the groundwater extraction and treatment system. The RBAAP remedial design was started in 1994 with the preparation of the Closure and Post-Closure Maintenance Plan. This document presented the remedial design for landfill closure. According to the Closure and Post-Closure Maintenance Plan, access to the RBAAP site is restricted to employees and authorized vehicles at all times. Although the landfill itself is not fenced, the entire RBAAP property is fenced, gated at all points of access, and all visitors are required to check in at the main gate. The RBAAP is monitored 24-hours a day, 7 days a week. Warning signs every ~150 ft are in place at the landfill. In FY06, the Army will proceed with upgrading the signage at the landfill site.

The EPA approved the remedial design on February 13, 1995. The Closure and Post-Closure Maintenance Plan was subsequently modified and finalized in May 1996, after landfill construction was complete (CH2M Hill, 1996).

The remedial design for the groundwater extraction and treatment system began in 1994 and was completed in June 1995, as presented in the Groundwater Extraction and Treatment System 100 Percent Design Document (CH2M Hill, 1995). Extraction system design and operating criteria are described in the Final Extraction System Design and Monitoring Plan (CH2M Hill, 1997a). Additional supplements to the remedial design documentation were included in a technical memorandum titled, “Supplement to Design Documentation for the Groundwater Extraction and Monitoring Network, IGWTS, GWTS, and IWTP” (CH2M Hill, 1997b). EPA, in consultation with the State of California, approved these documents, collectively considered the 100 percent design documentation for the remedial design, on September 29, 1997.

Construction of the two remedial actions proceeded on independent tracks. The landfill remedial action began in June 1995, and initial work was completed in October 1995.

System Operations

NI Industries (NI) is the operating contractor for the RBAAP facility. In this role, NI performs security and access control for the facility. Until 2004, the Army had contracted with NI to perform operations and maintenance (O&M) activities for each of the remedial actions constructed at RBAAP. NI Industries operated the IGWTS and the onsite extraction well system since operations started in 1991, and continued in this role through the system expansion, including the addition of the GWTS and offsite extraction well system in 1996. They also performed the routine landfill O&M activities through 2004.

AGSC was contracted by the Army to replace NI Industries as the O&M contractor for the RBAAP in 2004. As a part of this role, AGSC performs O&M for the GWTS, including onsite and offsite extraction wells, and the landfill.

System O&M and monitoring requirements are described in the following documents, which were approved by EPA, in consultation with the State of California:

- IGWTS and GWTS O&M Manuals (WTS, 1991, and CH2M Hill, 1997c).
- Final Closure and Post-Closure Maintenance Plan (CH2M Hill, 1996).

- Final Extraction System Design and Monitoring Plan with System Operating Procedures (CH2M Hill, 1997a).

The O&M activities are being conducted in general compliance with these approved plans. However, recent system upgrades and modifications have been made, and the following draft updates to the earlier plans reflect current operations:

- Project Management Plan (AGSC, 2004a).
- Draft GWTS O&M Plan Update (AGSC, 2005).

The current O&M activities reflect modifications to the system since 2004 when AGSC resumed O&M responsibilities.

System operational and monitoring requirements include the following:

Landfill

- Groundwater monitoring downgradient to evaluate effectiveness of the cover and migration of contaminants.
- Surface water runoff monitoring.
- Final cover monitoring, including monitoring and maintenance of vegetative cover growth, surface erosion, and settlement and grading.
- Surface water drainage monitoring and maintenance.

Landfill maintenance has generally been limited to routine mowing and weed control, and occasional revegetation, repairs of minor erosion, and drainage system repairs. Landfill O&M activities are to be reported on a quarterly frequency.

Groundwater Extraction and Treatment

- Daily monitoring of treatment plant and extraction system operations.
- Ongoing maintenance of the groundwater extraction and treatment systems in accordance with the 2005 O&M Manual update. System maintenance comprises three main components: routine preventative maintenance, minor equipment maintenance and repair, and major equipment repair/replacement.

- Quarterly sampling of groundwater monitoring wells, and continuous groundwater elevation measurement of certain wells (other wells are measured monthly).
- Monthly sampling of GWTP influent.
- Monthly sampling of the GWTS and IGWTS ion exchange column effluent and the final effluent discharged to the E/P ponds.

The GWTP is staffed full-time during the day, Monday through Friday, and occasionally on Saturday and Sunday. In addition, an autodialer emergency alarm system that offers onsite and remote monitoring capability for operation of the GWTP was installed in 2004. This system is connected to a telephone line and responds by dialing up to four separate telephone numbers to provide notice of potential system failure.

Routine daily O&M tasks include, but are not limited to, the following:

1. Monitor extraction well and influent pump flow rates, and adjust as necessary.
2. Monitor pressures across the multimedia filters and ion exchange columns.
3. Conduct ion exchange regeneration and backwashes as needed, and operate the regenerant evaporator.
4. Prepare and submit work orders as needed for the repair of GWTP equipment.
5. Operate the backwash system for the multimedia filters as needed.
6. Perform routine housekeeping for maintenance of the facility.
7. Record pertinent operational data, including totalizer readings and flow rates.

Groundwater extraction and treatment system maintenance has primarily been limited to routine system maintenance and repairs. The Army undertook an aggressive system optimization process intended to reduce operational costs while maintaining required flow rates following construction completion in September 1997. This aggressive system is still being implemented to maintain capture at the required flow rates. Figure 3 shows the actual cumulative gallons extracted and treated at RBAAP for the period from January 2001 through November 2004 versus the flow rate required for containment during that same

timeframe. The figure demonstrates that the target extraction rates, as determined by groundwater modeling, have been achieved throughout the last four years of operations.

From 2000 through 2003, operational costs including the GWTS, landfill maintenance and leases ranged from approximately $1.0 to $1.4 million per year. Annual O&M costs for 2004 were not available due to initiation of multi-year performance-based contract for RBAAP O&M. Although the treatment plant optimization efforts were intended to reduce costs, operational costs have risen from approximately $1 million in 2000 to $1.4 million in 2003. Although there was a slight increase in operation costs over the past several years, these costs are still within the expected range proposed during system installation. Table 2 illustrates the annual operating costs since 2000.

Table 2: Annual System O&M Costs

Time Period	Approximate Total O&M Costs
Fiscal Year 2000	$1,015,000
Fiscal Year 2001	$1,116,000
Fiscal Year 2002	$1,286,000
Fiscal Year 2003	$1,368,000
Fiscal Year 2004	Not Available([1])

(1) Actual annual costs not available due to initiation of multi-year performance-based contract. The estimated O&M cost for 2004, based on the average annual cost of the contract, is approximately $500,000.

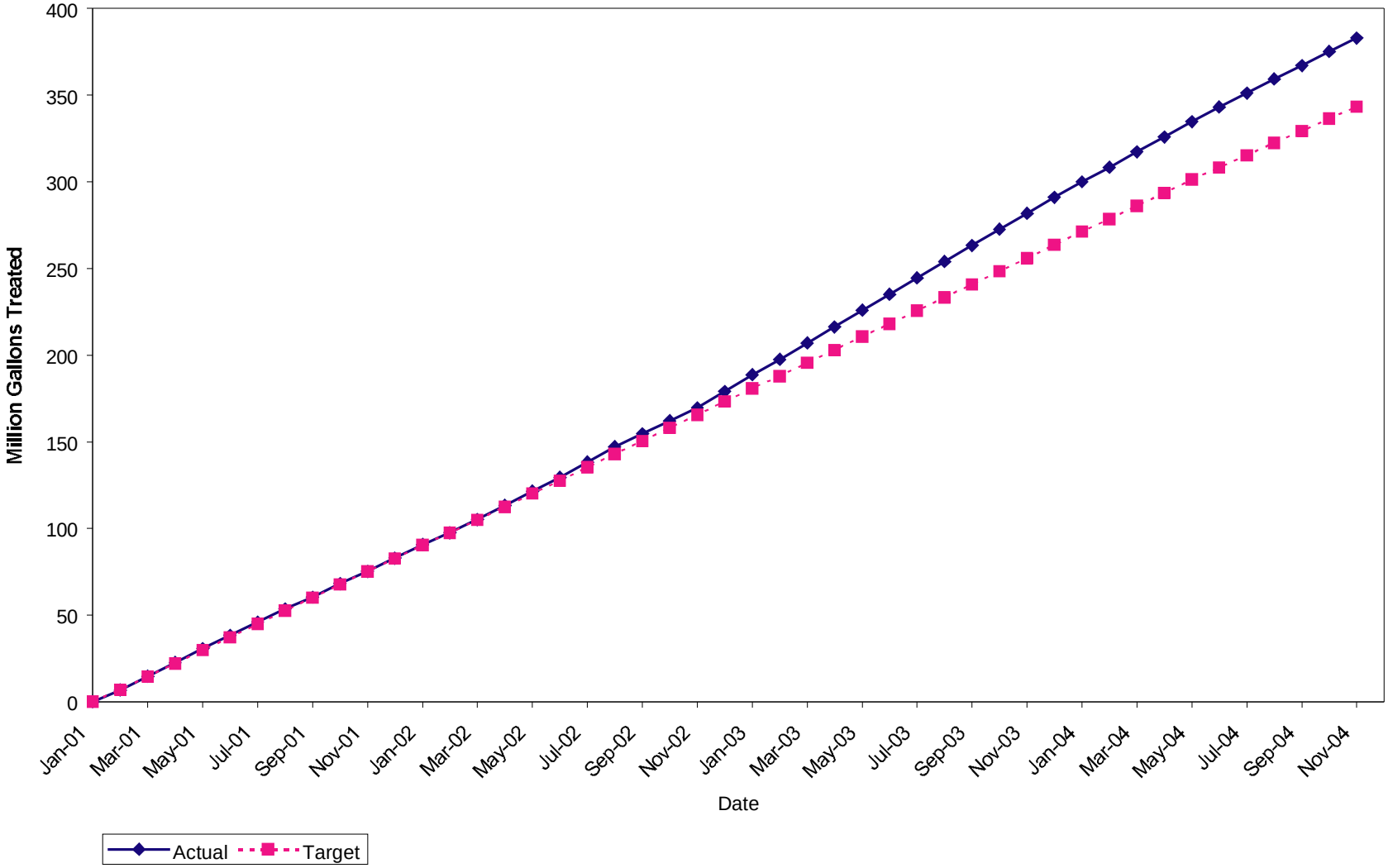
Post-ROD Actions

As described above, the ROD listed two potential issues that may need to be addressed even though they are not specific components of the selected remedy. These include the A-zone and the IWTP area.

Since the previous five-year review, RBAAP has continued monitoring water levels and water quality in the A-zone. Water level data from the A- and A'-zones continue to show seasonal water level fluctuations, where water levels drop several feet during the summer months and recover somewhat during the winter months. Since 2000, groundwater levels have not been able to fully recover in the winter months due to the relatively large decline during the summer (Figure 4). The net decline of water levels has left the majority of the

A-zone wells dry during most of the year. Sufficient A-zone groundwater monitoring points are available to monitor the extent of any A-zone contamination, if water levels recharge. As is discussed below, A-zone contamination would ultimately be contained by pumping in the A'-zone, primarily by extraction from EW113A'.

Investigations and any cleanup of the IWTP have been deferred until RCRA closure. The IWTP area that will be investigated at closure includes both the IWTP itself, and the associated industrial and cyanide wastewater collection systems that historically transported water from the production areas at RBAAP to the IWTP. Preliminary investigations of these areas have not identified significant soil source areas (CH2M Hill, 2005b).



Reference: CH2M Hill, 4th Quarter 2004 Groundwater Monitoring Report.

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Project Director: N. MORGAN-BUTCHER	Area Manager: J. PETERS
Task Manager: N. SHERIF	Technical Review: N. SHERIF
Drawing Date: 18 APR 05	Drawn By: M. CHIU

ARCADIS
ARCADIS G&M, Inc.
1050 Marina Way South
Richmond, CA 94804
Tel: 510-233-3200 Fax: 510-233-3204
www.arcadis-us.com

RIVERBANK GWTP CUMULATIVE GALLONS TREATED
(2001-2004)
RIVERBANK ARMY AMMUNITION PLANT
RIVERBANK, CALIFORNIA

Project Number: RC000665.0001

Figure: 3

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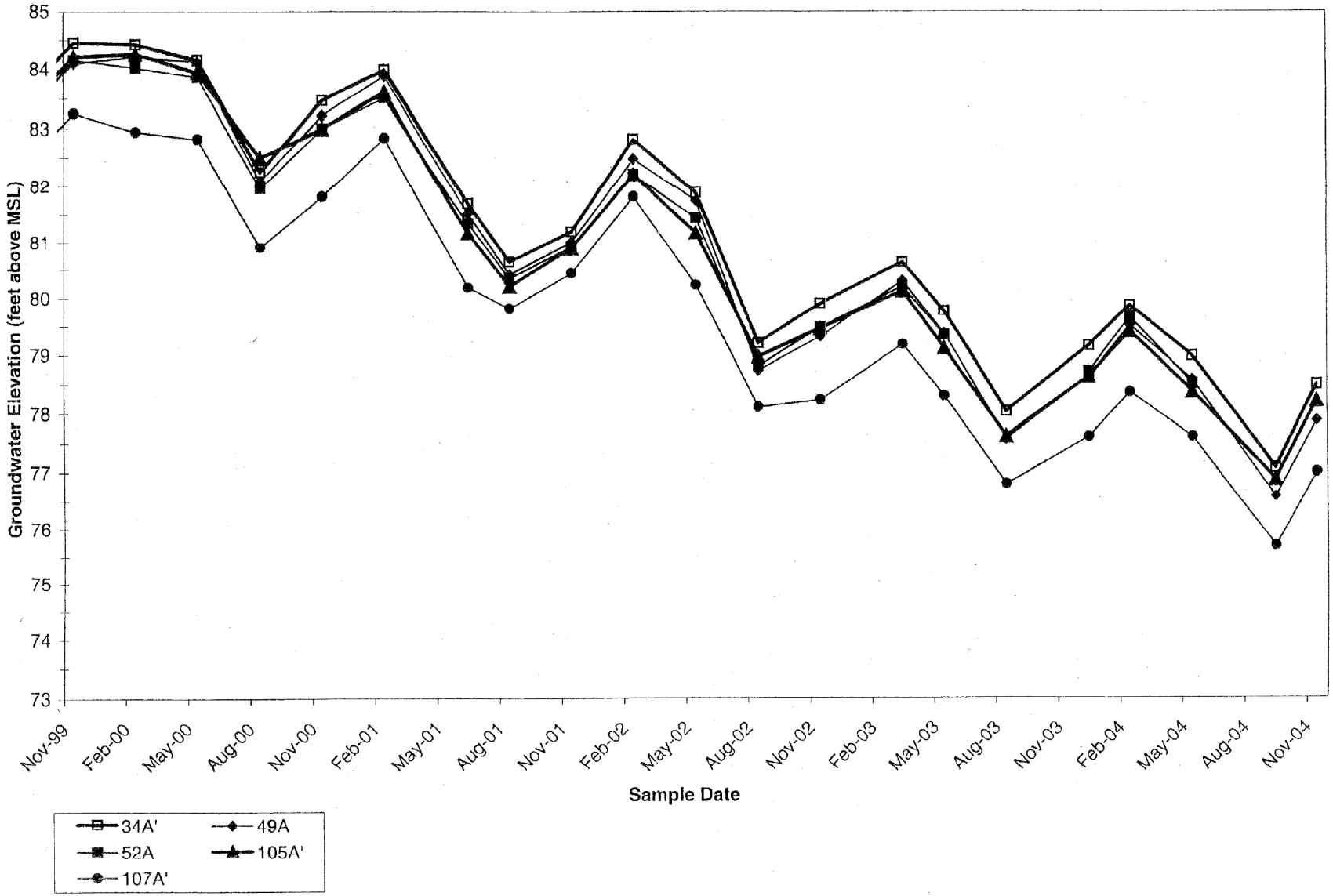

Reference: CH2M Hill, 4th Quarter 2004 Groundwater Monitoring Report.

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Project Director: N. MORGAN-BUTCHER	Area Manager: J. PETERS
Task Manager: N. SHERIF	Technical Review: N. SHERIF
Drawing Date: 18 APR 05	Drawn By: M. CHIU

ARCADIS
ARCADIS G&M, Inc.
1050 Marina Way South
Richmond, CA 94804
Tel: 510-233-3200 Fax: 510-233-3204
www.arcadis-us.com

RBAAP HYDROGRAPH - A/A'-ZONE
RIVERBANK ARMY AMMUNITION PLANT
RIVERBANK, CALIFORNIA

Project Number: RC000665.0001

Figure: 4

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V. Progress Since the Last Five-Year Review

The first Five-Year Review Report concluded that the landfill and groundwater remedies for RBAAP were protective of human health and the environment, and identified only minor issues that should be addressed to maintain the long-term effectiveness of the remedies (U.S. Army Environmental Center, 2001). These issues included:

- A-zone source areas were not being actively addressed, and an evaluation of potential supplemental A-zone remedial actions needed to be completed.
- The existing extraction system did not contain contaminant migration from a small area of A'-zone chromium contamination present near the landfill. A contingency plan for extraction system expansion needed to be developed if migration was detected.
- The O&M Manual and As-Built Drawings needed to be updated to account for all of the changes made during system optimization.

As noted previously, the remedies generally appear to have been operated and maintained in accordance with the approved procedures during the period since the previous review. Concentrations in groundwater have typically declined, and the overall plume size has been reduced. The status of the minor issues noted above is as follows:

- Treatability studies have been conducted on possible technologies to address the A-zone source areas (CH2M Hill, 2003d). An in depth review and decision on additional implementation of these technologies are ongoing.
- Concentrations of chromium at a single well adjacent to the landfill (well MW65A') have continued to fluctuate near the cleanup level of 50 mg/L (CH2M Hill, 2005a). Migration of chromium from this area has not been observed. As a result, no contingency plan is required.
- An updated O&M manual that reflects current operations was recently completed (AGCS, 2005).

These issues and other findings of the 2005 review are detailed in the following section.

VI. Five-Year Review Findings

The second RBAAP five-year review was led by Neill Morgan-Butcher of ARCADIS as a subcontractor under AGSC's contract No. W911S0-04-P-0008 with the Army Environmental Center. ARCADIS is under contract to the AGSC to provide regulatory and technical support at the RBAAP facility. The following team members assisted in the review:

- Paul Zianno, U.S. Army Contracting Officer Representative for RBAAP
- James Gansel, senior consultant for SOTA Environmental, and former Commander's Representative for RBAAP
- David Towell, project manager for long-term consultant CH2M Hill
- Randy Rogers, Glen Mitchell, and Erik Appel, AGSC project management for RBAAP
- John Tabor, senior plant operator for AGSC, formerly with NI Industries, Inc.

The second five-year review consisted of the following activities: interviews with Army staff and contractors at RBAAP; a review of relevant site documents (Attachment 1); a site inspection (Attachment 2); and a review of applicable or relevant and appropriate requirements (ARARs, Attachment 3) and exposure pathways. In addition, interviews were conducted with several members of the Riverbank community to gain understanding of local concerns relative to RBAAP. Once the draft report is available for public review, a public meeting will be announced and held to allow interested members of the public to ask questions and provide comments on the RBAAP remediation program and other related issues. The final report will be placed in the information repository. Notice of its completion will also be announced to the public. A brief summary of this report will be made available to interested community members.

Interviews

As part of the site inspection, interviews were conducted with James Gansel, the former Commander's Representative for RBAAP and currently a senior consultant for SOTA Environmental, and John Tabor, the senior GWTP operator with AGSC, who currently operates the remedial system at the facility. David Towell, a project manager with CH2M Hill, was independently interviewed due to his extensive work on the Site dating from the remedial design to the ongoing groundwater monitoring program. In addition, managers for AGSC were interviewed to verify information obtained onsite.

The Army has continued its aggressive program to lease out areas and buildings at RBAAP for use by external commercial and industrial occupants. Neither the onsite tenants nor the nearby residents have maintained a significant interest in the environmental restoration program at RBAAP. Limited interviews with community members have been conducted in association with this five-year review. Because RBAAP has recently been recommended for closure by the BRAC 2005 Commission, community interest focused on how discontinued military use of the facility would affect the cleanup efforts and land use. Because community interest in the Site remains low, it was determined that more extensive interviews were not necessary as part of the five-year review process. In addition, operation and maintenance activities have been routine for the most part with little that has the potential to affect either on- or off-facility populations.

The following summarizes key highlights of the interviews conducted during this five-year review. Mr. Gansel did not note any major problems with the O&M of the Site remedies. However, the GWTP and extraction wells reportedly experienced a shut-down for three months in late 2002, due to problems with a nitrate removal unit. A fixed-bed reactor process was used at the time to meet the facility WDRs by removing nitrate present in the extracted groundwater. Following correction of the GWTP problems created by the nitrate removal unit, the groundwater treatment system was restarted without nitrate removal and has apparently not encountered similar problems again. Because the nitrate in the groundwater is apparently related to high concentrations regionally, the RWQCB revised the WDRs to reflect these elevated background levels. Mr. Gansel emphasized that overall protectiveness has

been maintained, and that recent system upgrades have significantly improved system reliability.

In the interview with Mr. Tabor, no significant problems with system O&M were identified, and he similarly underscored the value of the system improvements implemented by AGSC, especially within the GWTP. Mr. Tabor did note, however, that some of the extraction well pumps and plumbing might have to be replaced in the near future due to aging. These issues generally fell within the context of routine O&M, and did not indicate a pervasive problem. Mr. Tabor confirmed that he had been performing routine monthly visual inspections of the landfill as required, but they were not documented in writing. Visual inspection procedures have since been revised, and the inspections are now being documented.

Other interviews conducted with AGSC management supported the opinions and observations noted above. Extraction well MW104B may have reliability issues during periods of very high ambient temperatures that should be resolved. However, the fourth quarter 2004 groundwater monitoring report stated that pumping at this well may be discontinued because it is no longer required to maintain plume capture.

As noted above, several interviews were also conducted with members of the community (see Attachment B for interview details). Those individuals interviewed voiced general satisfaction with the remedial program. Concern was raised regarding the need to assure continuity of the remediation program, if RBAAP closes, as expected. Because the Site remedies have been in place for an extended period of time, people were not aware of the status of the cleanup and would like to see some additional information.

Site Inspection

AGSC and ARCADIS staff took part in a Site inspection on April 7, 2005. During these activities, remedial systems were inspected and treatment plant operations were observed. The inspection evaluated the landfill cap, groundwater treatment system, surface water drainage system, facility fencing, and groundwater extraction system. A summary of the site inspection findings is presented below. (Please refer to Attachment 2 for the site inspection checklist that details the inspection findings. Attachment 4 contains a number of photos

documenting site conditions observed during the site inspection.)

Conditions during the inspection were generally favorable with mild temperatures and some slight to moderate precipitation.

The vegetation on the landfill had not been mowed recently making it somewhat difficult to observe the condition of the landfill cap. The landfill cap appeared to be in good condition.

Vegetation covered essentially the entire landfill cap with no distressed areas noted. Star thistle remains a problematic invasive species, displacing the seeded vegetative cover grasses in some areas. AGSC is working to mitigate this problem with the application of an herbicide. It was unclear as to when the most recent application of herbicide had occurred, but AGSC is anticipating the use of herbicide every spring, or as needed, to mitigate the problem.

No significant landfill cap damage was observed. Small rodent burrows were evident and scattered across those areas of the cap inspected. A rodent abatement program is already in place at RBAAP to address the problem. In April 2003, a Fumatoxin was used to control ground squirrel burrows around the landfill area. In addition, bait stations are also being used year round for ground squirrel control. During the inspection, no indications were evident of the landfill cover damage caused in 1997 by a contractor doing work on the adjoining railroad tracks. Landfill cap repairs were made, as noted in a 1997 memorandum attached to the First Five-Year Review Report.

Minor erosion was observed along some of the landfill side slopes. Minor erosion and ponding areas were also apparent in limited stretches of the perimeter ditch along the northern and eastern edges of the landfill. Vegetation in the ditches at the north end of the landfill could limit the effectiveness of the surface drainage and should be removed as part of the routine mowing. These conditions did not appear to impair the integrity of the landfill cover or drainage system and AGSC currently is in the process of repairing the minor erosion and ponded areas of the perimeter ditch as well as removing any vegetation that may impede drainage. Only one of the survey monuments was found during the landfill inspection due to the thick vegetative cover, but it was in good condition. No other issues related to the cover system or appurtenant structures, including drainage channels, access roads, or warning signs were noted.

No issues were identified with respect to the RBAAP facility fencing in the landfill vicinity, or other areas of the facility inspected. All parts of the RBAAP facility are secured and closely monitored to ensure that unauthorized access does not occur. With the exception of the minor rodent holes, no intrusive activities were noted on the cover system. AGSC is in the process of eradicating the minor rodent holes to prevent any damage. If the scheduled routine maintenance is continued, it does not appear that this minor damage has the potential to expose landfill wastes or landfill cover liners.

The GWTP, consisting of the GWTS and the IGWTS, was found to be operating and functioning properly. No operational problems were observed. The current operating mode, which uses ion exchange only, results in very straightforward operational procedures. The primary operator activity is to regenerate the resin in the ion exchange columns when it is spent. Currently, each ion exchange column is regenerated on a weekly basis. The O&M manual has been updated to reflect recent system upgrades and changes in operation of the treatment system; however, approval of the O&M manual has not been obtained from the EPA. The As-Built Drawings were not updated to reflect the change in operations at the time of the inspection, but have since been completed. The updated O&M Manual does contain a schematic representation of the current system, but AGSC will incorporate the schematic into the O&M Manual before it is issued as a final document.

All groundwater extraction well vaults were intact with no signs of damage. Extensive ground squirrel borrows were evident in the vicinity of the EW113 extraction wells, and appeared to require abatement to protect the wells and appurtenances. AGSC is in the process of implementing an aggressive rodent control program in this area. The groundwater extraction pumps were extracting water from the A’- and B–zones, with a total combined extraction rate of approximately 180 gpm.

CH2M Hill, the contractor performing groundwater monitoring at the RBAAP site, did not note any problems with well heads, well locks, or access during the fourth quarter 2004

sampling event. Based on a review of the sampling documentation, the samples were collected in accordance with the approved Sampling and Analysis Plan (CH2M Hill, 1997a).

The laboratory results for recent groundwater monitoring events are discussed in the data review section below.

The IWTP area and its associated wastewater influent pipeline systems remain covered by concrete, asphalt and large production buildings. There are no current mechanisms for additional transport of contaminants from these potential source areas down to the groundwater aquifer. If the Army decides to close RBAAP, additional investigation of conditions in these areas will be required under the RCRA program.

Security records for the landfill and GWTP are maintained on both the daily operations report and the weekly operations report by the AGSC treatment plant operator. When the treatment plant operator is not in attendance at the GWTP, the facility is secured and locked. Weekly inspections of the landfill and landfill cap are conducted by the GWTP operator and documented on inspection checklists. There have been no security breaches at the GWTP or the landfill over the past five years. No significant cap damage has been observed or documented during the landfill inspections. Rodent infestations at the landfill have been reduced or eliminated through the implementation of a professional rodent control management program. NI Industries maintains a record of any and all events that occur on each work shift. Incident Reports are generated to report any incident that is considered outside of normal operations and serious incidents are reported to the Commander's Representative and other enforcement agencies, as necessary. There have been no documented security breaches at the RBAAP facility in the past five years.

Changes in ARARs or Exposure Pathways

There are three types of ARARs – chemical-specific, location-specific, and action-specific. Of the ARARs listed in the ROD (see Attachment 3), the primary requirements that could change and potentially result in the need to alter the remediation goals are the chemical-specific state and federal drinking water criteria and the action-specific landfill cover and post-closure requirements. These ARARs are based on regulatory requirements, as opposed to strictly site-related conditions. Despite the recommended closure of RBAAP by the BRAC 2005 Commission, the expected land use and associated potential exposure pathways, and the site remedies, are essentially unchanged. In accordance with the ROD, deed restrictions will be required if RBAAP closes to prevent changes in land use.

Since the previous Five-Year Review, only one change has been made to these ARARs. The state drinking water standard MCL for cyanide, which was 200 mg/L, was amended to 150 mg/L in 2002. This change was not based on new toxicity data. Instead, the state MCL of 150 mg/L used the same toxicity and risk equations as the federal MCL of 200 mg/L. The federal MCL is merely rounded up from 150 to 200 mg/L. Because the underlying risk information has not changed, the current remedy is still protective of human health and the environment. Therefore, the cleanup level will remain "frozen" to the value stated in the ROD (i.e., 200 mg/L), in accordance with EPA policy. The drinking water standard MCL for chromium of 50 mg/L, as listed in the ROD, has not changed.

The ARARs in the ROD reference the substantive requirements of the State of California's CCR Title 23, Division 3, Chapter 15, Articles 5 and 8 for landfill cover and post-closure maintenance requirements. These action-specific ARARs that specify landfill closure actions requirements have not changed since the signing of the ROD.

Site conditions and associated exposure pathway assumptions remain consistent with those assumed in the baseline risk assessment. Installation of the landfill cover has further restricted the potential for receptors to contact contaminated soil. Land use in the offsite areas of groundwater contamination has not changed, remaining rural residential; however, there is an increase in residential development in the general area. Currently, no drinking

water wells are operating within the areas of contamination present in the A-,A'-, B-, or C-zones. Land use at RBAAP continues to be limited to commercial/industrialactivities by outside businesses and ongoing facility operations by the Army and its contractor. The facility is only accessible through a checkpoint that is manned 24 hours a day.

Although there has not been a change after the ROD has been issued, EPA has initiated a reassessment of the health risks associated with cyanide. This reassessment is underway; the results of this reassessment will need to be updated in subsequent 5-year reviews after the reassessment is completed.

Data Review

Documents reviewed as part of this five-year review are listed in Attachment 1. Available semi-annual landfill maintenance reports have not noted any substantial issues with ponding, cracking or other potential landfill cap problems. However, landfill maintenance reports for early 2004 could not be located for review. In addition, landfill maintenance reports for late 2004 were initially unavailable although they have since been provided by AGSC. AGSC did not perform required landfill drainage storm water monitoring in the fourth quarter of 2004 or the first quarter of 2005, but since have formalized storm water monitoring procedures and documentation and will conduct this monitoring as required. The landfill settlement survey was performed as required in August 2003, and sloping met the required minimum 2 percent grade.

Security records for the landfill and GWTP are maintained on both the daily operations report and the weekly operations report by the AGSC treatment plant operator. When the treatment plant operator is not in attendance at the GWTP, the facility is secured and locked. Weekly inspections of the landfill and landfill cap are conducted by the GWTP operator and documented on inspection checklists. There have been no security breaches at the GWTP or the landfill over the past five years. No significant cap damage has been observed or documented during the landfill inspections. Rodent infestations at the landfill have been reduced or eliminated through the implementation of a professional rodent control management program. NI Industries maintains a record of any and all events that occur on

each work shift. Incident Reports are generated to report any incident that is considered outside of normal operations and serious incidents are reported to the Commander's Representative and other enforcement agencies, as necessary. There have been no documented security breaches at the RBAAP facility in the past five years.

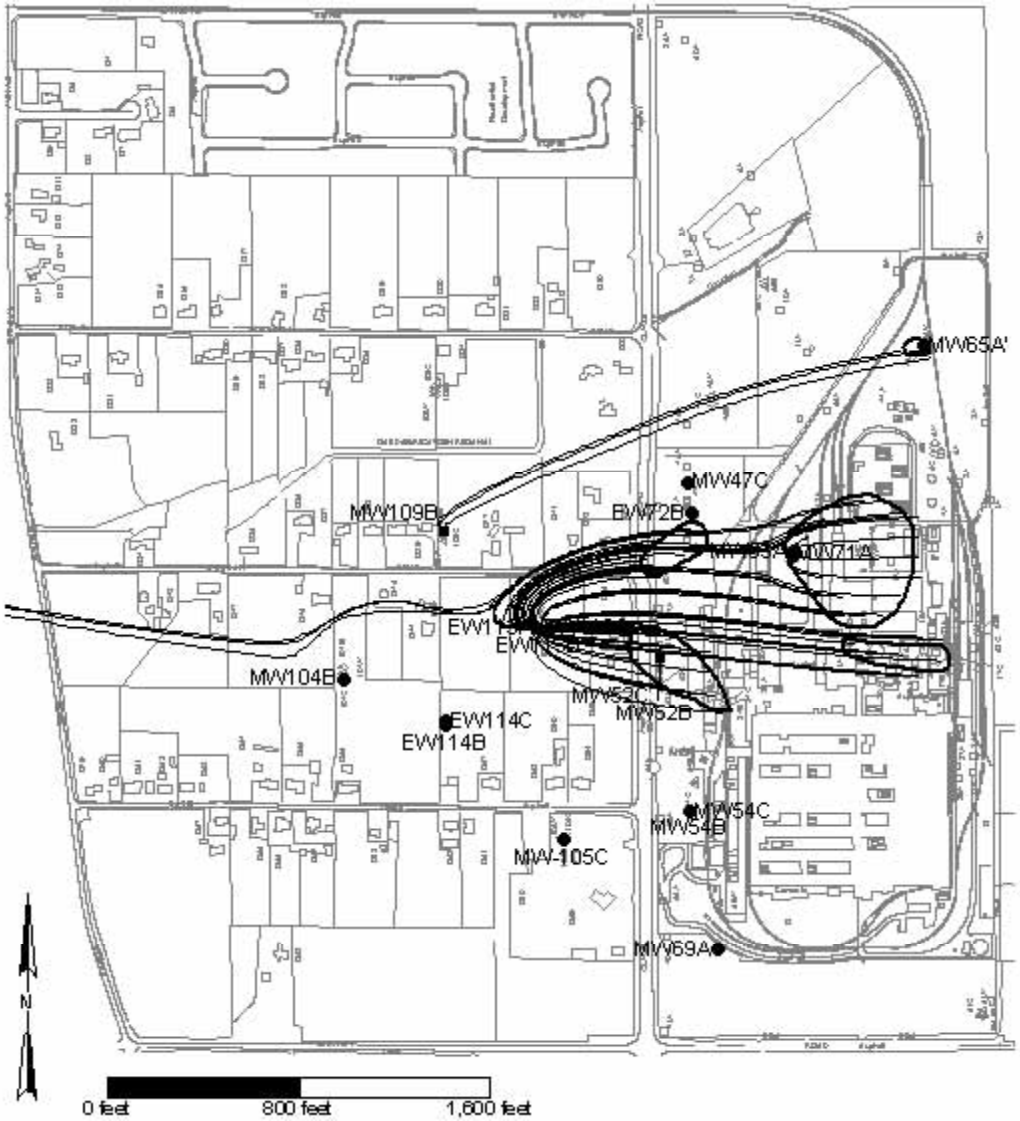
A review of monthly groundwater treatment system O&M reports and quarterly groundwater monitoring reports through December 2004 indicate that over 400 million gallons of water have been extracted and treated over the last 4 years (August 2000 through November 2004). The beginning of this time period corresponds to last date reported in the previous five-year report. Figure 3 shows the cumulative volume of water extracted from January 2001 through November 2004.

Figure 3 also shows the cumulative target extraction volume over time. The recommended target extraction rates have been modified several times in response to changing contaminant conditions and ongoing attempts to optimize and minimize the amount of water being extracted, while still providing complete containment of the contamination in the A-, A'-, B-, and C-zones. Table 3 presents the target extraction rates over time from September 1997 through December 2004. Each recommended change in the target extraction rate has been supported by simulations of groundwater flow that demonstrate the ability of the pumping scenario to contain the areas of contamination. These simulation results and associated recommendations are presented in quarterly groundwater monitoring reports. In general, the contaminated areas are much smaller now then they were in 1997 when the system began operation, and significantly smaller than in 2001 when the first five-year review was performed. In many cases, remaining wells exceeding cleanup levels are fluctuating near these concentrations. This reduced extent of contamination requires less extraction to maintain capture.

Table 3: Target Extraction Rates – September 1997 to December 2004

Time Period		Target Extraction Rate (gallons per minute)
September-97	January-98	282
January-98	February-99	248
February-99	July-99	180
July-99	December-99	140
December-99	February-00	155
February-00	April-00	175
April-00	December-03	172
December-03	December-04	160

Modeling simulations have been conducted to confirm that the current 160 gpm target extraction rate is adequate to capture the groundwater contamination at RBAAP. The simulation results from the fourth quarter 2004 Quarterly Groundwater Monitoring Report (CH2M Hill, 2005) reflect the current actual groundwater extraction rate of 180 gpm, and are presented as Figures 5 and 6, and Figures 7 and 8 for the A- and A'-zones and the B-zone, respectively. These figures show groundwater flowlines emanating from the boundaries of the contaminated areas and the up-gradient edge of the RBAAP facility. Figures for the C-zone were not included because no contamination has been detected above MCLs in the C-zone since the third quarter of 2003.



Well	Pumping Rate (gpm)
EW113A	12.9
EW113B	44.2
EW113C	0.0
EW114B	18.0
EW114C	0.0
MW104B	23.0
MW109B	31.9
MW71A	0.0
MW72B	23.2
MW47C	0.0
MW52B	0.0
MW52C	0.0
MW54B	19.6
MW54C	0.0
MW63A	7.2
MW69A	0.0
Total	180

Reference: CH2M Hill, 4th Quarter 2004 Groundwater Monitoring Report.

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Project Director	Area Manager
N. MORGAN-BUTCHER	J. PETERS
Task Manager	**Technical Review**
N. SHERIF	N. SHERIF
Drawing Date	**Drawn By**
18 APR 05	M. CHIU

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ARCADIS G&M, Inc.
1050 Marina Way South
Richmond, CA 94804
Tel: 510-233-3200 Fax: 510-233-3204
www.arcadis-us.com

FLOWLINES STARTING AT THE EDGE OF THE A-ZONE TARGET AREAS
180 GPM SCENARIO
4TH QUARTER 2004
RIVERBANK ARMY AMMUNITION PLANT
RIVERBANK, CALIFORNIA

Project Number
RC000665.0001

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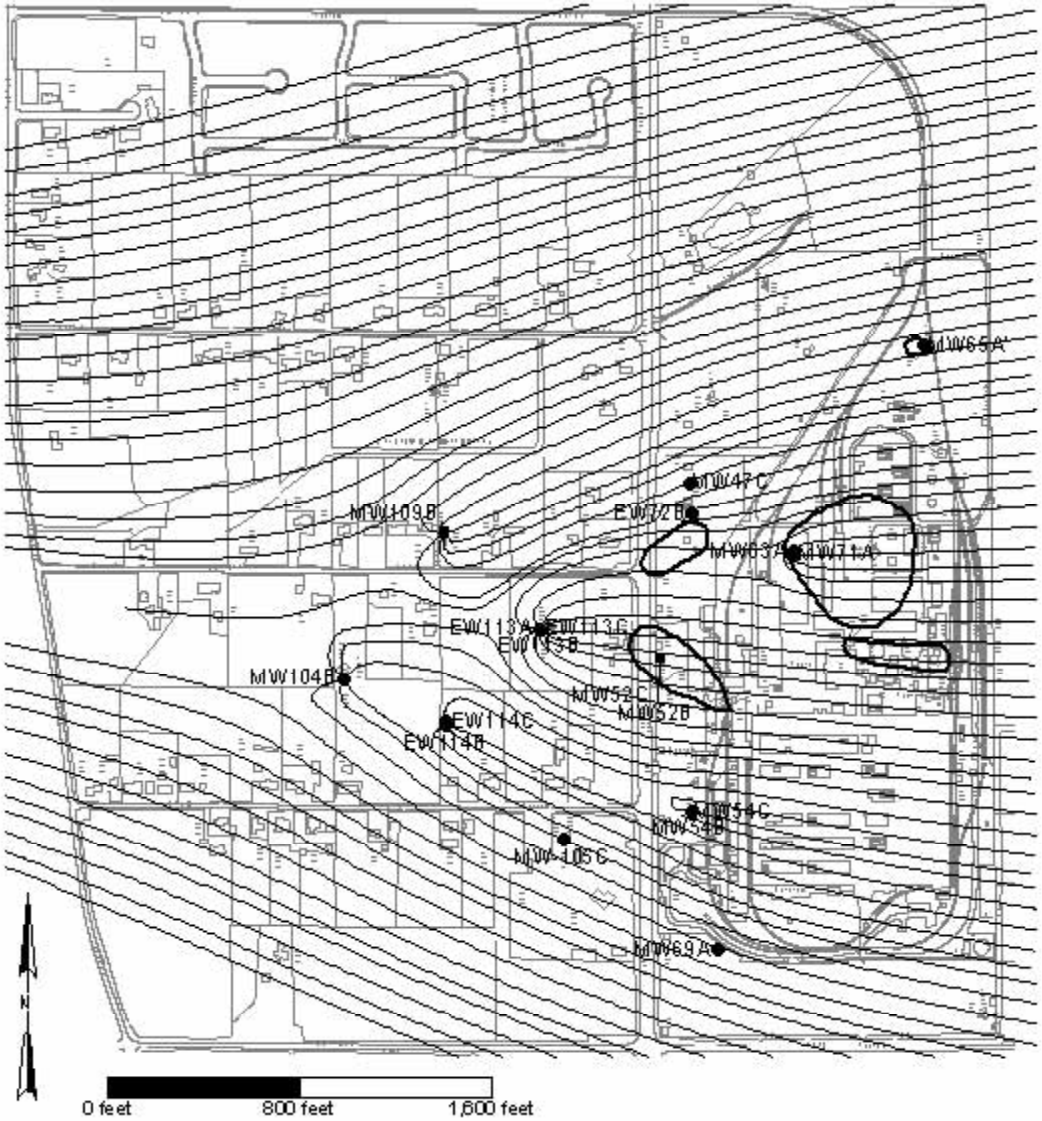

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MW69A	0.0
Total	180

Reference: CH2M Hill, 4th Quarter 2004 Groundwater Monitoring Report.

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N. MORGAN-BUTCHER	J. PETERS
Task Manager	**Technical Review**
N. SHERIF	N. SHERIF
Drawing Date	**Drawn By**
18 APR 05	M. CHIU

ARCADIS
ARCADIS G&M, Inc.
1050 Marina Way South
Richmond, CA 94804
Tel: 510-233-3200 Fax: 510-233-3204
www.arcadis-us.com

FLOWLINES STARTING IN THE A-ZONE AT THE UPGRADIENT EDGE OF THE SITE, 180 GPM SCENARIO
4TH QUARTER 2004
RIVERBANK ARMY AMMUNITION PLANT
RIVERBANK, CALIFORNIA

Project Number
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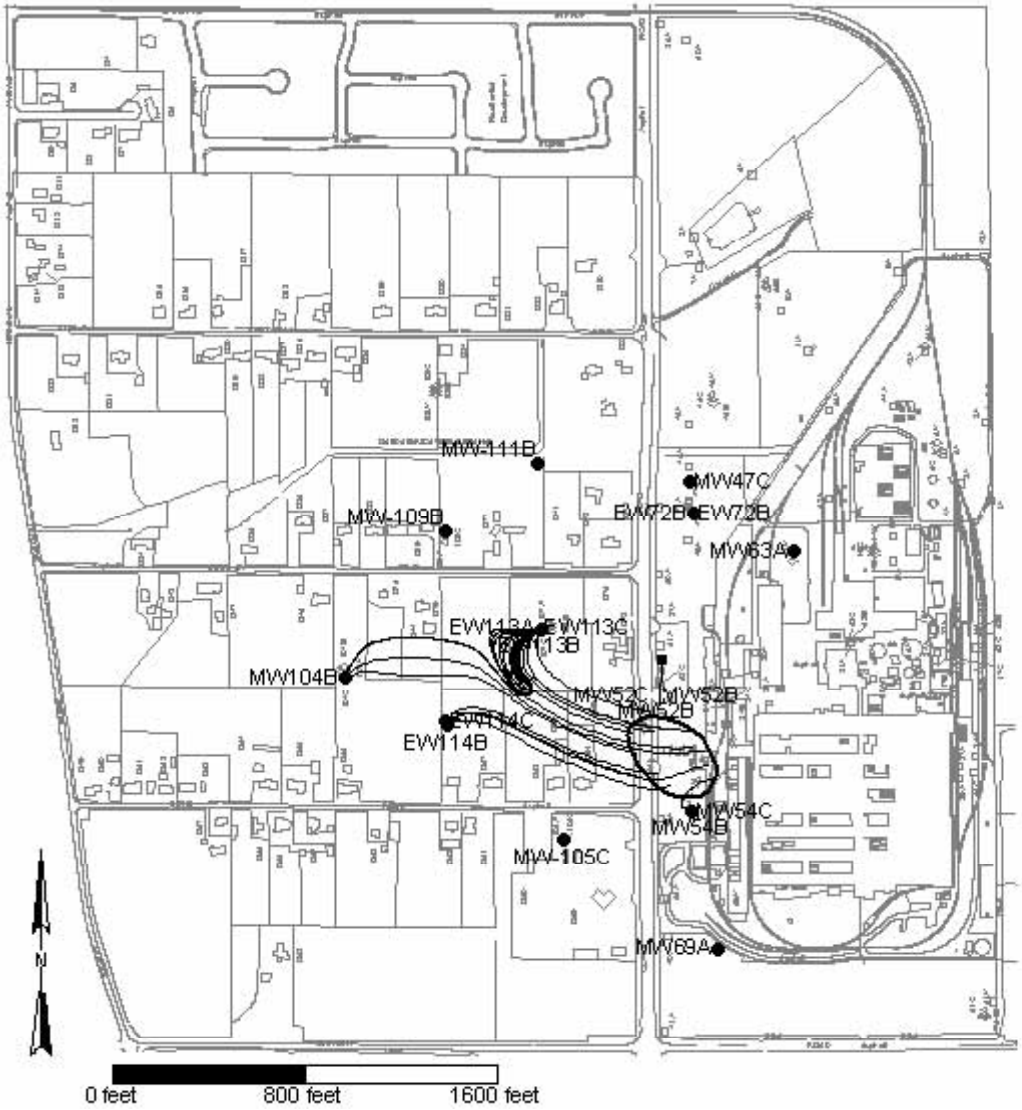

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MW54C	0.0
MW63A	7.2
MW69A	0.0
Total	180

Reference: CH2M Hill, 4th Quarter 2004 Groundwater Monitoring Report.

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Project Director	Area Manager
N. MORGAN-BUTCHER	J. PETERS
Task Manager	**Technical Review**
N. SHERIF	N. SHERIF
Drawing Date	**Drawn By**
18 APR 05	M. CHIU

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1050 Marina Way South
Richmond, CA 94804
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www.arcadis-us.com

FLOWLINES STARTING IN THE EDGE OF THE B-ZONE TARGET AREAS
180 GPM SCENARIO
4TH QUARTER 2004
RIVERBANK ARMY AMMUNITION PLANT
RIVERBANK, CALIFORNIA

Project Number: RC000665.0001

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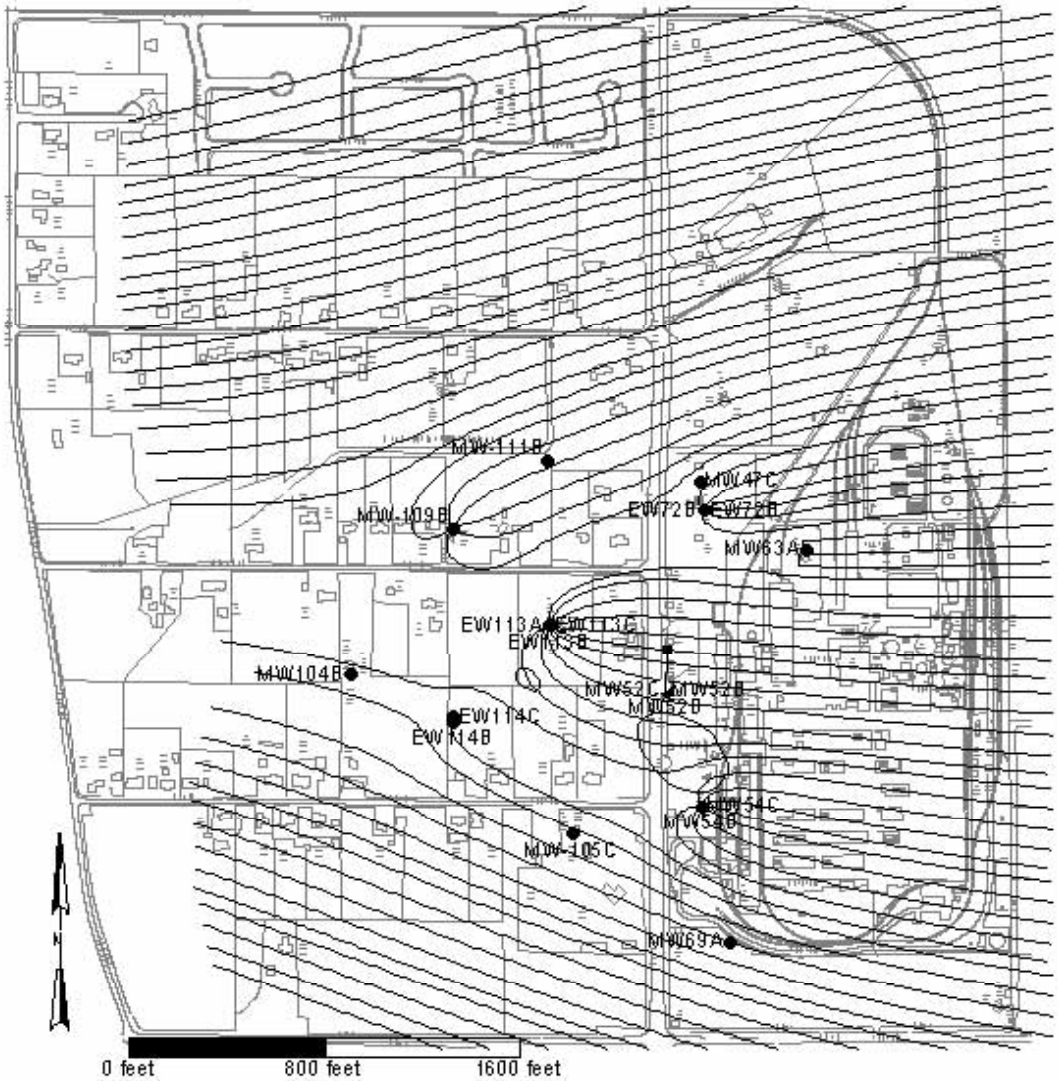

Well	Pumping Rate (gpm)
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EW113C	0.0
EW114B	18.0
EW114C	0.0
MW104B	23.0
MW109B	31.9
MW71A	0.0
MW72B	23.2
MW47C	0.0
MW52B	0.0
MW52C	0.0
MW54B	19.6
MW54C	0.0
MW63A	7.2
MW69A	0.0
Total	180

Reference: CH2M Hill, 4th Quarter 2004 Groundwater Monitoring Report.

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Project Director	Area Manager
N. MORGAN-BUTCHER	J. PETERS
Task Manager	**Technical Review**
N. SHERIF	N. SHERIF
Drawing Date	**Drawn By**
18 APR 05	M. CHIU

ARCADIS
ARCADIS G&M, Inc.
1050 Marina Way South
Richmond, CA 94804
Tel: 510-233-3200 Fax: 510-233-3204
www.arcadis-us.com

FLOWLINES STARTING IN THE B-ZONE AT THE UPGRADIENT EDGE OF THE SITE, 180 GPM SCENARIO
4TH QUARTER 2004
RIVERBANK ARMY AMMUNITION PLANT
RIVERBANK, CALIFORNIA

Project Number
RC000665.0001

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Groundwater elevations are depressed in the A- and A'-zones in the areas near wells MW104A', MW109A' and EW113A' as a result of extraction from MW104B, MW109B, EW113A', and EW113B in the A'- and B-zones. Chromium and cyanide contamination zones present in the A- and A'-zones will be captured at extraction wells MW63A' and MW109B, and the EW113 extraction well cluster, as illustrated in Figures 5 and 6. In addition, the flow patterns indicate that chromium contamination at MW65A' will likely be captured in the MW109B extraction well. Monitoring well MW109B was converted to an extraction well in June 2004 to contain cyanide contamination offsite. Extraction well MW109B is being used because it provides containment at a lower extraction rate than is required using MW104B. This amendment was proposed in the 2001 five-year report. Groundwater elevation contours from December 2004 in the B-zone indicate that chromium contamination will be captured at the EW113 and EW114 extraction well clusters, and cyanide contamination will be captured at extraction well MW109B.

Figures 5 through 8 indicate that the majority of the target contamination areas are fully captured using the average extraction rates from the fourth quarter 2004. However, the distribution of pumping needs to be adjusted on an ongoing basis for the groundwater in the delineated target areas to be fully captured. In the A- and A'-zones, the figures indicate that a small portion of the groundwater from the cyanide and MW49A chromium source areas could potentially flow between well MW109B and the EW113 series wells. While the figures do show flow between extraction wells MW109B and EW113, it is the net flow over multiple quarters that is important and capture is being maintained over these longer time periods. Downgradient wells monitor this area and would detect groundwater not captured before it would cross the facility boundary.

Based on the fourth quarter 2004 sampling data, the current areas of contamination in each zone at RBAAP are shown in Plates 1, 2, and 3 for the A- and A'-zones, the B-zone, and the C-zone, respectively. The maximum chromium and cyanide concentrations in groundwater from first through fourth quarter 2004, along with historical data are summarized in Table 4 below. Landfill compliance monitoring wells (wells 5A', 5B, 14A', 65A', 66B, 66C, 73A', and 74A') have been non-detect, with the exception of well 65A', which has had concentrations of chromium that fluctuated near the MCL of 50 µg/L.

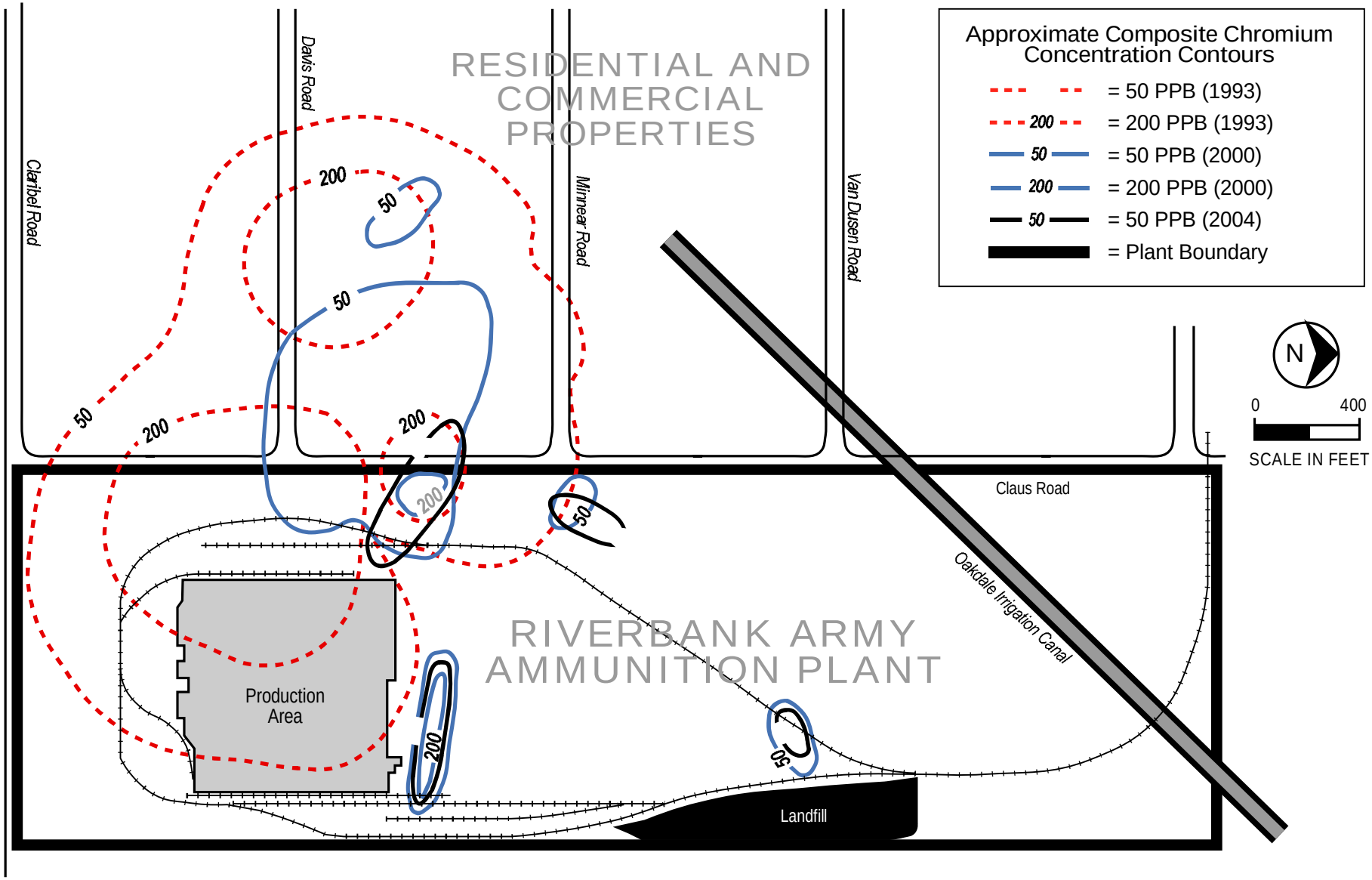
The data show that contaminant concentrations in the A'-, B-, and C-zones have decreased sharply since the time the ROD was signed in 1994, and continued reductions have been observed since the previous five-year review in 2001. Not only have the contaminant

concentrations decreased dramatically, the areas of contamination are also much smaller. Chromium and cyanide concentrations have not been detected above the MCLs in the C-zone during 2004. However, chromium and cyanide concentrations in the A-, A'-, and B-zones still exceed the cleanup levels. Figure 9 illustrates the reduction in the size of the chromium-contaminated areas using concentrations from 1993, 2000, and 2004. The chromium contamination contours shown in this figure represent a composite of the A-, A'-, B-, and C-zones.

Table 4: Comparison of Historic and Current Groundwater Concentrations

Contaminant	Zone	1986 to 1993 Peak Concentrations (µg / L)	1st and 2nd Quarter 2000 Peak Concentrations (µg / L)	1st through 4th Quarter 2004 Peak Concentrations (µg / L)	Cleanup Level (µg / L)
Onsite					
Chromium	A	1,300	1,680	354	50
	A'	312	83.6	106	50
	B	515	229	155	50
	C	42	ND (<10)	27.2	50
Cyanide	A	22,600	5,580	ND	200
	A'	1,660	231	432	200
	B	1,075	69	42.5	200
	C	229	ND (<20)	ND	200
Offsite					
Chromium	A'	140	45.6	43	50
	B	395	228	56.7	50
	C	110	63.9	39.9	50
Cyanide	A'	93.3	72	67	200
	B	139	231	186	200
	C	283	21	25.3	200

ND = non-detect.



Reference: CH2M Hill, First Five-Year Review Report.

Project Director: N. MORGAN-BUTCHER	Area Manager: J. PETERS	ARCADIS	GROUNDWATER CLEANUP (1993-2004) RIVERBANK ARMY AMMUNITION PLANT RIVERBANK, CALIFORNIA	Project Number: RC000665.0001
Task Manager: N. SHERIF	Technical Review: N. SHERIF			Figure: 9
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In addition to the decreasing concentrations, water levels have declined significantly. At least some of the decreases in concentrations in the A-zone are likely as a result of the dewatering of this zone. Water level fluctuations continue to occur in the A- and A'-zones; however, since 2000, groundwater levels have not been able to fully recover causing a continual net decline in water levels. Regional groundwater withdraws are apparently responsible for the declining water levels, and it is expected that this situation will continue indefinitely, based on continued high demand for water within the region. Concentrations in the A'-zone are somewhat above the respective MCLs for both chromium and cyanide.

At the time of the first five year review in 2001, water levels had risen somewhat over the two previous years and some resaturation of the A-zone was observed. As a result, the first Five-Year Review Report recommended evaluation of potential remedial actions for A-zone contamination. The ROD includes provisions for the recharge of the A-zone that require the Army to investigate and, if necessary, remediate the groundwater in the A-zone in accordance with the remediation goals (i.e., MCLs). The Army subsequently evaluated options to enhance remediation of the A-zone, including the following: (1) injection of sodium dithionite for hexavalent chromium reduction, and (2) injection of ozone gas for destruction (chemical oxidation) of cyanide. Although the evaluation of ozone has not been completed, injection of sodium dithionite has apparently been effective in reducing hexavalent chromium. **Based on current declining groundwater trends and the post-ROD action requirements, continued evaluation of potential supplemental actions in the A-zone appears to unnecessary.**

Recent GWTP influent and effluent data (from July 2004 through December 2004) are summarized in Table 5. The data show that the treatment system is typically removing contaminants to below detection limits. The available monthly operations reports for the last 3 years document that the treatment plant effluent is consistently non-detect (ND) for chromium and cyanide, with the exception of November 2004 when chromium was detected at a concentration 4.3 mg/L.

A review of the water level contours presented in Plates 1, 2, and 3 demonstrate the inward gradients created by the operation of the groundwater extraction system. The capture zones generated by the RBAAP extraction wells appear to extend well beyond the areas of chromium and cyanide contamination. These water level contours, which were developed

based on field water level measurements taken from the monitoring well network, support the conclusions of the model simulations. The contours confirm that operation of the extraction system under the current scenario will capture the contaminated areas at RBAAP.

Table 5: Treatment System Influent and Effluent Concentrations – September 2004 to December 2004

Contaminant	Date	Influent Concentrations (mg/L)		Effluent Concentrations (mg/L)
		Onsite	Offsite	
Chromium	Sep-04	56	19	ND (<10)
	Oct-04	62	24	ND (<10)
	Nov-04	57	24	4.3
	Dec-04	54	16	ND (<1.0)
Cyanide	Sep-04	40	50	ND (<5.0)
	Oct-04	ND (<10)	ND (<10)	ND (<10)
	Nov-04	ND (<5.0)	ND (<10)	ND (<5.0)
	Dec-04	ND (<5.0)	ND (<10)	ND (<5.0)

ND = non-detect.

In summary, the goals of the remedial action at RBAAP are being met by the following: (1) the intact landfill cover, which prevents exposure to contaminated materials and inhibits infiltration of contaminants to the groundwater; and (2) operation of the groundwater extraction system, which captures and removes contaminants from the groundwater. Monitoring results show decreased concentrations of contaminants at extraction and monitoring wells, except in the shallow A-zone where monitoring data are not currently available due to declining water levels. This indicates that contaminant loading to all but the shallowest groundwater zones has substantially decreased, and most monitoring well concentrations are near or below cleanup levels. Further migration of residual contaminated groundwater is controlled through the establishment of an inward gradient in groundwater flow. Monitoring results indicate that the groundwater treatment system is meeting required effluent discharge limits.

VII. Technical Assessment

The following conclusions support the determination that the remedy at RBAAP is protective of human health and the environment.

Question A: Is the Remedy Functioning as Intended by the Decision Documents?

- **Health and Safety Plan/Contingency Plan:** AGSC, the onsite contractor performing O&M of the remedial action, has a Site Safety and Health Officer that oversees work activities and implements safety procedures according to the Site Safety and Health Plan and applicable Occupational Safety and Health Administration regulations. AGSC has appropriate health and safety and emergency response protocols to control risks. The Safety and Health Plan was updated in 2004.

- **Implementation of Institutional, Informational, Engineering Controls and Other Measures:**

  The institutional control at the site, as specified in the ROD, consists of a RCRA Consent Agreement requiring the "Post-ROD" future activity of investigating and mitigating (if needed) the soils beneath the IWTP source area. Although not specifically required by the ROD, site security actions, including warning signage, security fencing, and limited access to the entire facility, have been implemented at the landfill cap and GWTP areas on the site. Of the security actions, the signage can be considered an "institutional control," working in conjunction with other controls (fencing, security guards).

  The site access controls are in place and have been successful in preventing unauthorized access to the landfill cap and GWTP areas. This has prevented any damage to the remedial systems that could be caused by unauthorized entry. The owner envisions implementing deed restrictions at the landfill, to ensure continued integrity of the landfill cover, since the RBAAP is closed under the BRAC 2005 recommendations.

The IWTP source area and its associated wastewater influent pipeline systems remain capped by concrete, asphalt, and buildings. If the IWTP is closed pursuant to RCRA, additional investigation of conditions in these areas will be required under the RCRA program Consent Agreement to evaluate the need for supplemental remedial actions.

The landfill and the IWTP areas continue to be owned and controlled by the U.S. government. There are no current plans to transfer these properties; however, the site has been listed in the BRAC list, and ownership of the site might change. The land use at RBAAP continues to be commercial and industrial use by the Army, its contractor NI Industries, and various private companies that lease space at the facility. There are no plans underway by the local jurisdictions to change the land use at the RBAAP.

No institutional controls are in place or were selected in the ROD to prevent exposure to the contaminated groundwater while the groundwater remediation process is underway. Institutional controls and the implementation of institutional controls will be identified, evaluated and documented in the forthcoming Property Management Plan.

- **Remedial Action Performance:** The landfill cover system has been effective in isolating the contaminants present in the landfill. There is some very minor erosion occurring on the landfill slopes, and minor animal burrows were found on the cover; however, neither of these conditions currently appear to affect the performance or

integrity of the cover system. Continued maintenance of the cover, including filling of burrows and erosion repair, and rodent abatement is required and has been implemented by AGSC. The groundwater extraction and treatment system is fully operational. The system has established containment of the contaminated areas and is meeting discharge requirements. The remedial actions continue to be effective, and the groundwater extraction and treatment system is operating and functioning as designed. Depending on the outcome of ongoing technology evaluation activities, additional remedial actions may be appropriate in the IWTP area to limit the potential groundwater quality impacts associated with A-zone groundwater recharge.

- **System Operations/O&M:** The current system operating procedures, as implemented, are effective and consistent with site requirements. The only significant operational difficulty with the treatment plant in the last five years was the shutdown in late 2002 due to problems with the nitrate removal unit. The treatment system was subsequently modified and has not experienced any additional major upsets.
- **Cost of System Operations/O&M:** As described above in Section IV, annual operating costs have increased slightly in recent years, but remained consistent within planned costs. The average annual costs are anticipated to decrease slightly through 2009 due to the implementation of a multi-year performance-based contract for RBAAP O&M. These savings are at least in part a result of with increased system optimization. Actual annual costs for 2004 were not available because the multi-year O&M contract does not distinguish costs on an annual basis.
- **Opportunities for Optimization:** The Army has implemented extensive optimization at RBAAP during the last year. Major changes in treatment system and effluent discharge operations have been implemented to streamline operations and reduce costs. In addition, the groundwater extraction scenarios are reviewed quarterly to assess opportunities for further optimization. Concurrent with the system optimization efforts, the monitoring program has been evaluated on a quarterly basis to identify appropriate increases or reductions in monitoring frequency at individual wells. It is expected that the monitoring program optimization will continue.

- **Early Indicators of Potential Remedy Failure:** No early indicators of potential remedy failure were noted during the review. Maintenance requirements have met expectations, and the extraction system is capturing the contaminated groundwater migrating downgradient of the source areas.

Question B: Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives Used at the Time of Remedy Selection Still Valid?

- **Changes in Standards and To Be Considered:** The federal drinking water standard MCL for chromium identified as the groundwater remediation goal in the ROD has not changed since the ROD was signed. Subsequent to the ROD, the California State drinking water standard MCL for cyanide has been lowered from 200 to 150 mg/L. Because the underlying risk information has not changed, the current remedy is still protective of human health and the environment. Therefore, the cleanup level will remain "frozen" to the value stated in the ROD (i.e., 200 mg/L), in accordance with EPA policy.
- **Changes in Exposure Pathways:** No changes in conditions at the RBAAP facility that affect exposure pathways were identified as part of this five-year review. Although portions of the facility have been leased for use by private companies, there are no current or planned changes in land use, and no new contaminant sources or routes of exposure. There is no indication that hydrogeologic conditions are not adequately characterized. Although there has been variability in the location and magnitude of groundwater contamination, the changes observed have been in accordance with the understanding of the conceptual model of the groundwater conditions at the RBAAP site. In addition, the concentration and magnitude of contamination has decreased significantly during this review period.
- **Changes in Toxicity, Other Contaminant Characteristics, and Risk Assessment Methodologies:** The primary pathways evaluated in the risk assessment were related to exposure to contaminants in soil at the landfill and exposure to contaminated groundwater. The landfill cover eliminates potential exposure to soil contaminants, and no wells are producing water from the contaminated areas. Because there are no

complete exposure pathways, no effort was put into re-assessing toxicity, contaminant characteristics, or risk assessment methodologies during this five-year review.

- **Expected Progress Toward Meeting RAOs:** The groundwater remedy is progressing well and has achieved cleanup levels at many monitoring locations. The ROD used an estimate of 10 years operation for the groundwater treatment system, while the combined IGWTS/GWTS has been operating approximately 9 years. Decreasing concentrations have reduced the recovery rates and efficiency of the system, such that continued reductions in concentrations will generally be slow. The landfill remedy is performing as expected.

Question C: Has Any Other Information Come to Light that Could Call Into Question the Protectiveness of the Remedy?

New information has come to light as follows: No ICs are in place to protect against the future use of contaminated groundwater while the groundwater is undergoing remediation. In addition, no ICs are in place that would protect against future use of the landfill for inappropriate uses or to restrict the site to industrial use. As mentioned earlier in this section, however, the owner has indicated that it envisions implementing deed restrictions on the landfill areas specified in the 1994 ROD if the RBAAP is closed, per 2005 BRAC recommendations. The Army will analyze options for groundwater institutional controls and will document the ICs for both the Landfill and for groundwater in the forthcoming Property Management Plan.

Technical Assessment Summary

According to the data reviewed, the site inspection, and the interviews, the remedies are functioning as intended by the ROD. There have been no changes in the physical conditions at the RBAAP facility that would affect the protectiveness of the remedy. There

have been no changes in the toxicity factors for the contaminants of concern or the risk assessment methodology that affects the protectiveness of the remedy. However, some form of institutional control is needed to ensure no unacceptable exposure to contaminated groundwater occurs during the groundwater remediation process. Also, deed restrictions at the landfill cap area are needed in order for the remedy to remain protective in the long term, institutional controls must be implemented for the Landfill as identified in the 1994 ROD as a deed restriction and institutional controls will be identified and implemented if appropriate for groundwater. The Army will analyze options for groundwater institutional controls and will document the ICs for both the Landfill and for groundwater in the forthcoming Property Management Plan.

VIII. Issues

Several issues were noted during the second five-year review and are identified in Table 6. None of these are sufficient to warrant a conclusion that the remedy is not protective. Some of the issues could affect the long-term performance of the remedy.

Table 6: Identified Issues

Issue	Currently Affects Protectiveness	Affects Future Protectiveness
There are no institutional controls in place for the landfill area to prevent inappropriate uses in the future that could impact the integrity of the cap.	No	Yes
There are no institutional controls in place to ensure that no inappropriate use of contaminated groundwater occurs while the groundwater remediation is occurring. However all potentially affected residences have been provided with a public water supply for domestic use as part of the Permanent Potable Water Supply Response Action and which limits groundwater use to irrigation only.	No	Yes
EPA approval of the O&M Manual Update has not been obtained, as required.	No	No
Landfill O&M, specifically including the twice annual surface water monitoring, was not performed during the 2004 to 2005 season. Landfill reports were also not always being prepared and submitted on a semi-annual basis, as required	No	No
Rodent burrows at the EW113 extraction well cluster may lead to undermining of these structures.	No	No
Community members would like more information regarding the implications of the proposed closure and the status of the remedial actions.	No	No
The Army's onsite information repository did not have all required documents readily available. Documents not located included quarterly groundwater monitoring reports, quarterly landfill reports, and monthly GWTS reports.	No	No

IX. Recommendations and Follow-up Actions

The recommendations and follow-up actions necessary to address the issues identified are outlined in Table 7 below. The Army discontinued evaluations to assess the need for and potential types of remedial actions for the A-zone source area at RBAAP.

Table 7: Recommendations and Follow-up Actions

Issues	Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness?	
					Current	Future
Potential RBAAP closure	If RBAAP closure proceeds, implement deed restrictions.	Army	EPA/State	TBD	No	Yes
O&M Plan Update approval by EPA	Submit O&M plan update to EPA for review and approval.	Army	EPA/State	12/1/2006	No	No
Landfill O&M	Review the formalized landfill O&M procedures implemented by AGSC to ensure compliance	AGSC	Army	12/1/2006	No	No
EW1 13 Area Rodent Burrows	Restore the area around the EW 113 wells and implement burrow monitoring and abatement, as necessary.	Army	EPA/State	3/1/2006 Completed	No	No
Community Outreach	Prepare a factsheet updating community on status of site remediation	Army	EPA/State	12/15/2006	No	No
Information Repository	The information repository currently is being updated so that documents are readily available.	AGSC	Army	4/1/2006	No	No

TBD = To be determined

X. Protectiveness Statements

Protection of human health and the environment through the landfill and groundwater remedial actions at RBAAP are discussed below. Appropriate health and safety and emergency response protocol are in place and being properly implemented to control risks. The landfill remedial action is currently protective of human health and the environment. The groundwater remedial action is operating as designed and is currently protective of human health and the environment. However, in order for the remedy to remain protective in the long term, institutional controls must be implemented as appropriate. Institutional controls and the implementation of institutional controls will be identified, evaluated and documented in the forthcoming Property Management Plan.

Land Use Controls / Institutional Controls

The Army has implemented, maintained and enforced land use controls [LUCs] / Institutional Controls [ICs] consistent with the selected remedial actions in the 1994 Record of Decision for the Riverbank Army Ammunition Plant. To address the comments on the Draft second 5-year review related to LUC [IC] issues and as previously planned, the Army will develop a document to serve as a Property Management Plan to address all relevant and necessary LUCs associated with the RBAAP remedial actions as described in the ROD and/or with the existing RCRA Permit. The Army will further research possible existing county or city ordnances regarding well regulations/restrictions which may act as an IC for groundwater. However, it should be noted that all residences within the extent of contaminated groundwater were provided with public water.
If there are no existing city or county ordnances in place, the need for ICs to restrict future groundwater use seem potentially unwarranted and would be difficult to implement short of purchasing water rights.

The Plan will identify land use controls with specific implementation actions to be used to implement, maintain and enforce the LUCs by the Army, by any

subsequent property owners and users that are transferees of the property BRAC 05, and, if necessary, the state and local jurisdictions. The Plan will describe several LUC objectives, the LUC, and the location where the LUC is or will be applied. The implementation actions may include, but will not be limited to, CERCLA 12 1(c) five-year remedy reviews with periodic monitoring and reports, notification to regulators prior to modification or termination of LUCs, generation of a map showing the areas where LUCs are implemented, and identification of POCs at the facility. In addition, the Plan will integrate the Army standardized Finding of Environmental Suitability notification procedure in advance of leasing or transferring the property under BRAC 05. The Plan will be revised to include the concept of a Property Management Plan with additional details and recommendations for appropriate sites.

It is anticipated that the Property Management Plan will be provided to the regulatory agencies for review in November 2006 and will be finalized and implemented in February 2007.

At this time the Army is only aware of contamination having been in the Landfill and the Groundwater. Previous studies were conducted at the IWTP and the Production Areas of the plant which did not confirm the presence of known waste in-place. The Landfill and the Groundwater waste amounts and locations have been included in the FYR. The IWTP and the Production Areas were previously included in a RCRA Corrective Action Plan. Based on the previous sampling and studies completed on these areas, waste piles were not confirmed. In addition, since these areas are included in the RCRA Part “B” Permit, the State of California required that they be identified in a RCRA Correction Action Plan. The Property Management Plan requires that both areas be completely addressed at the time of RCRA Closure.

Regardless of the current BRAC Action, plans are to allow the current RCRA Part “B” Permit to remain in-place. All other AOCs and SWMUs have been investigated and addressed as documented in the Feb 2005 Final RFI Report for RBAAP.

The Final FYR will include the completed RCRA Corrective Action Agreement as a part of the document text. In addition, the Army will identify any existing or required LUCs in the FYR. The forthcoming Property Management Plan will provide specifics on IC implementation actions. Based on the current status of the site, the areas that would be identified on-site would include the following:

- **Landfill Site: LUCs/Engineering Controls, Institutional Controls:**

  Currently in place: Access controlled by facility fencing. Signage is present but will require upgrading.
  Future LUCs: Restrictive covenant addressing landfill specific requirements will be placed on the property at the time of transfer.

- **Production Areas and associated IWTP and underground waste conveyance lines.**

  Currently in place: It would appear that Institutional Control is addressed under the RCRA Part B Permit 97-NC-012 which specifically identifies AOC 12- (Industrial Wastewater Collection System) and SWMU-12 (Industrial Wastewater Treatment Plant). At the time of transfer of the property the party (i.e., transferee or Army) held responsible for addressing future permit closure requirements will be identified and this requirement will be incorporated into the transfer documents.

- **On-Site Groundwater**

  Currently in place: No LUCs / ICs currently in place. The forthcoming Property Site Management Plan will identify LUC requirements and implementation actions. At the time of transfer of the property, the appropriate restriction on groundwater use will be identified and incorporated as a restrictive covenant in the deed.

According to the 1994-ROD ICs were not specified as a component of the groundwater remedy although the Permanent Potable Water Supply (PPWS) response action provided residents with a public water supply for domestic use and limited use of groundwater for irrigation only. The Army will determine if there are any official restrictions through the city or county and further assess the need for some form of IC in the forthcoming Property Management Plan. The groundwater cleanup goal has not been attained in all locations (both on-site and off-site), and thus some form of IC is needed.

Although the future use of the site could change to residential, the Army or future landowner would be required to obtain closure under the current RCRA permit to meet the proposed future land use requirements. As mentioned above, The Army will identify areas containing waste exceeding UU/UE and any existing LUCs in the FYR, and the forthcoming Property Management Plan will provide specifics on IC implementation actions. The Army is currently looking into the existence of any city or county zoning or well restriction ordinances that may be applicable as ICs for off-post groundwater.

Landfill

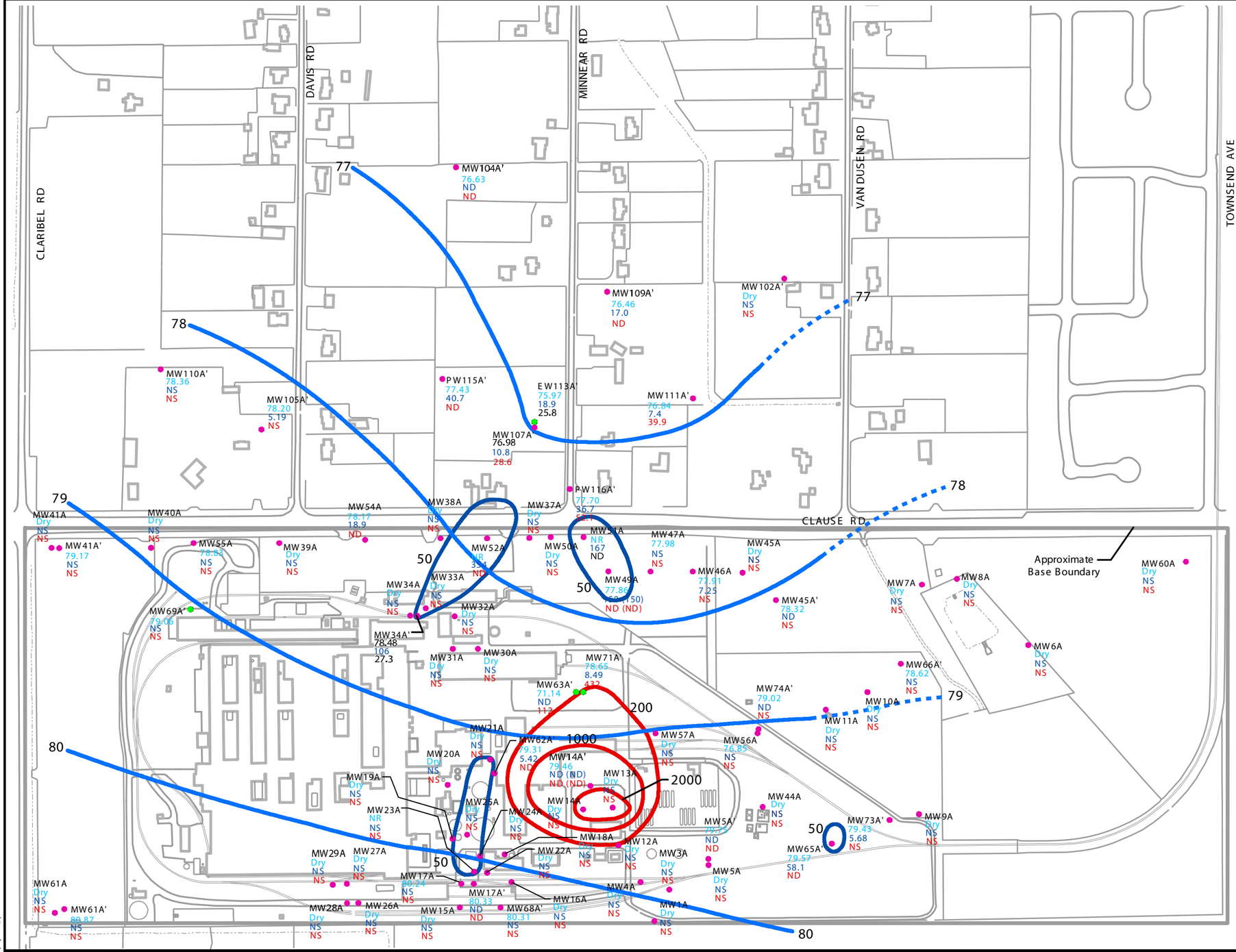
The landfill cap is effective in containing contaminants by preventing infiltration of rainwater and eliminating direct contact with contaminated soils. O&M of the landfill cap and drainage have generally been performed as required, and compliance well groundwater monitoring results have been stable, and typically below cleanup levels. Institutional controls at the landfill remain in place and are effective. RBAAP is fully fenced and access is controlled through a manned gate and security patrols. Warning signs are in place at the landfill. The landfill remedy is currently protective of human health and the environment. However, in order to ensure continued protectiveness, deed restrictions that prevent inappropriate use of the landfill area are needed. The Army will document LUCs in the forthcoming Property Management Plan, which will address the requirement to implement appropriate deed restrictions prior to property transfer.

Groundwater

Immediate threats to human health and the environment have been addressed, and the groundwater extraction and treatment system is operating and functioning as designed. Containment of the contaminated areas has been achieved through establishment of inward gradients that limit migration of the groundwater plumes. Contaminant concentrations in groundwater throughout the site are falling and the size of the contaminated areas is being reduced as expected. The groundwater remedial action is currently protective of human health and the environment. However, in order to ensure continued protectiveness the Army will analyze options for groundwater institutional controls and will select and implement appropriate ICs.

XI. Next Review

This is a statutory site that requires ongoing five-year reviews. The next review will be completed within five years of EPA's approval of this five-year review report.



LEGEND

- MONITORING WELL
- EXTRACTION WELL
- 80 GROUNDWATER ELEVATION CONTOUR
- 83.1 GROUNDWATER ELEVATION
- NR NO MEASUREMENT RECORDED
- 50 CHROMIUM ISOCONCENTRATION LINE
- 76.1 CHROMIUM CONCENTRATION (ug/L)
- NS NOT SAMPLED
- ND NOT DETECTED
- 200 CYANIDE ISOCONCENTRATION LINE
- 76.1 CYANIDE CONCENTRATION (ug/L)
- NS NOT SAMPLED
- ND NOT DETECTED

NOTES

1. Groundwater contours represent the elevation of the water surface above mean sea level.
2. Only monitoring wells that are screened in the A and A' aquifer zones are shown on this map.
3. In some instances where the A-zone wells were not sampled this quarter, the contours are based on results from prior quarters.

0 180 360 Feet

Reference: CH2M Hill, 4th Quarter 2004 Groundwater Monitoting Report

Project Director: N. MORGAN-BUTCHER	Area Manager: J. PETERS
Task Manager: N. SHERIF	Technical Review: N. SHERIF
Drawing Date: 14 APR 05	Drawing By: M. CHIU

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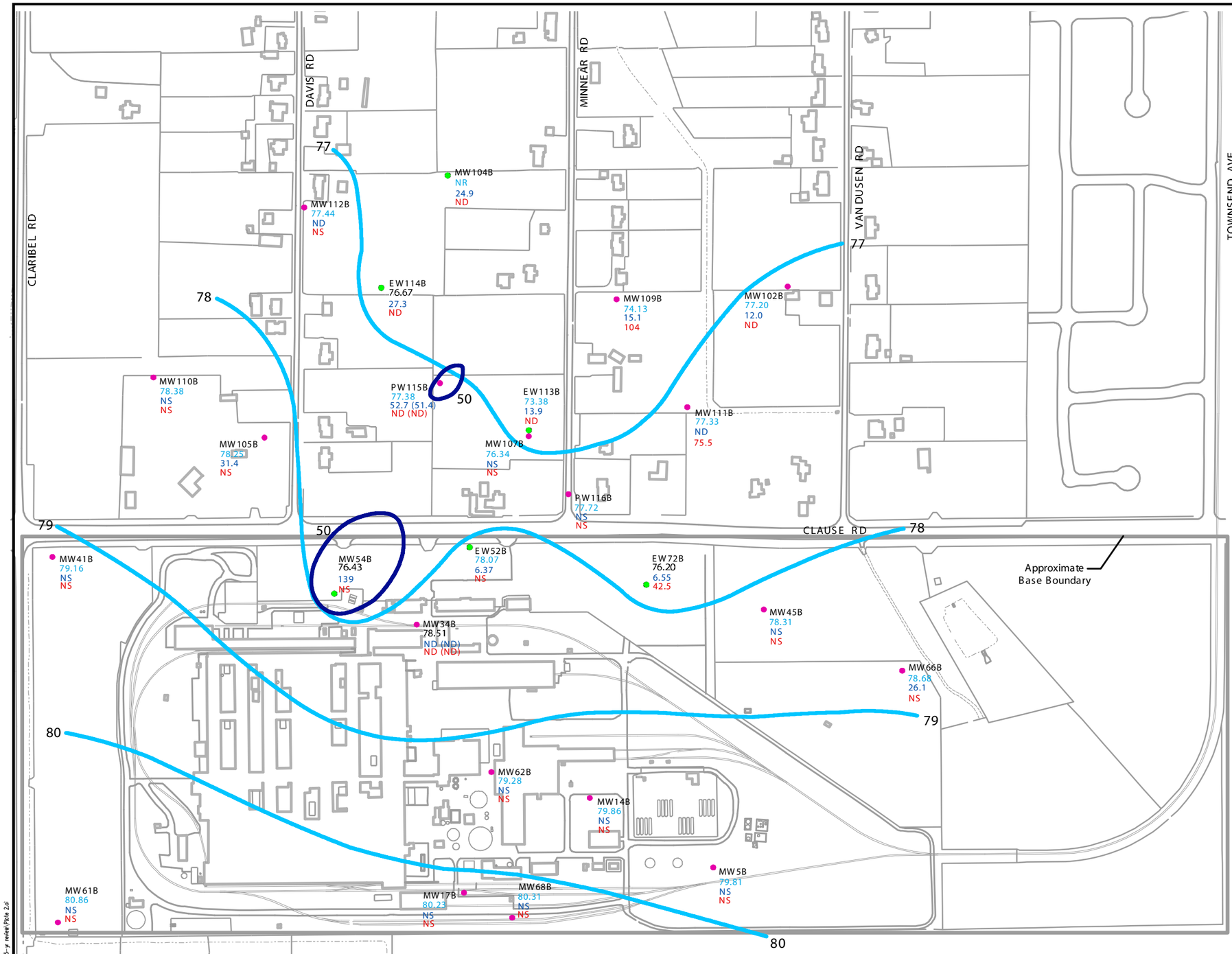
ARCADIS G&M, Inc.
1050 Marina Way South
Richmond, CA 94804
Tel: 510-233-3200 Fax: 510-233-3204
www.arcadis-us.com

RBAAP A/A' AQUIFER ZONE
GROUNDWATER ELEVATION CONTOURS WITH FOURTH QUARTER 2004 CHROMIUM AND CYANIDE ISOPLETHS
RIVERBANK ARMY AMMUNITION PLANT
RIVERBANK, CALIFORNIA

Project Number: RC000665.0001

Plate: 1



LEGEND

- MONITORING WELL
- EXTRACTION WELL
- 80 GROUNDWATER ELEVATION CONTOUR (Dashed Where Approximate)
- 83.1 GROUNDWATER ELEVATION
- NR NO MEASUREMENT RECORDED
- 50 CHROMIUM ISOCONCENTRATION LINE
- 76.1 CHROMIUM CONCENTRATION (ug/L)
- NS NOT SAMPLED
- ND NOT DETECTED
- 200 CYANIDE ISOCONCENTRATION LINE
- 76.1 CYANIDE CONCENTRATION (ug/L)
- NS NOT SAMPLED
- ND NOT DETECTED

NOTES

1. Groundwater contours represent the elevation of the water surface above mean sea level.
2. Only monitoring wells that are screened in the B aquifer zone are shown on this map.

0 180 360 Feet

Reference: CH2M Hill, 4th Quarter 2004 Groundwater Monitoring Report.

Project Director: N. MORGAN-BUTCHER	Area Manager: J. PETERS
Task Manager: N. SHERIF	Technical Review: N. SHERIF
Drawing Date: 14 APR 05	Drawing By: M. CHIU

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1050 Marina Way South
Richmond, CA 94804
Tel: 510-233-3200 Fax: 510-233-3204
www.arcadis-us.com

RBAAP B AQUIFER ZONE
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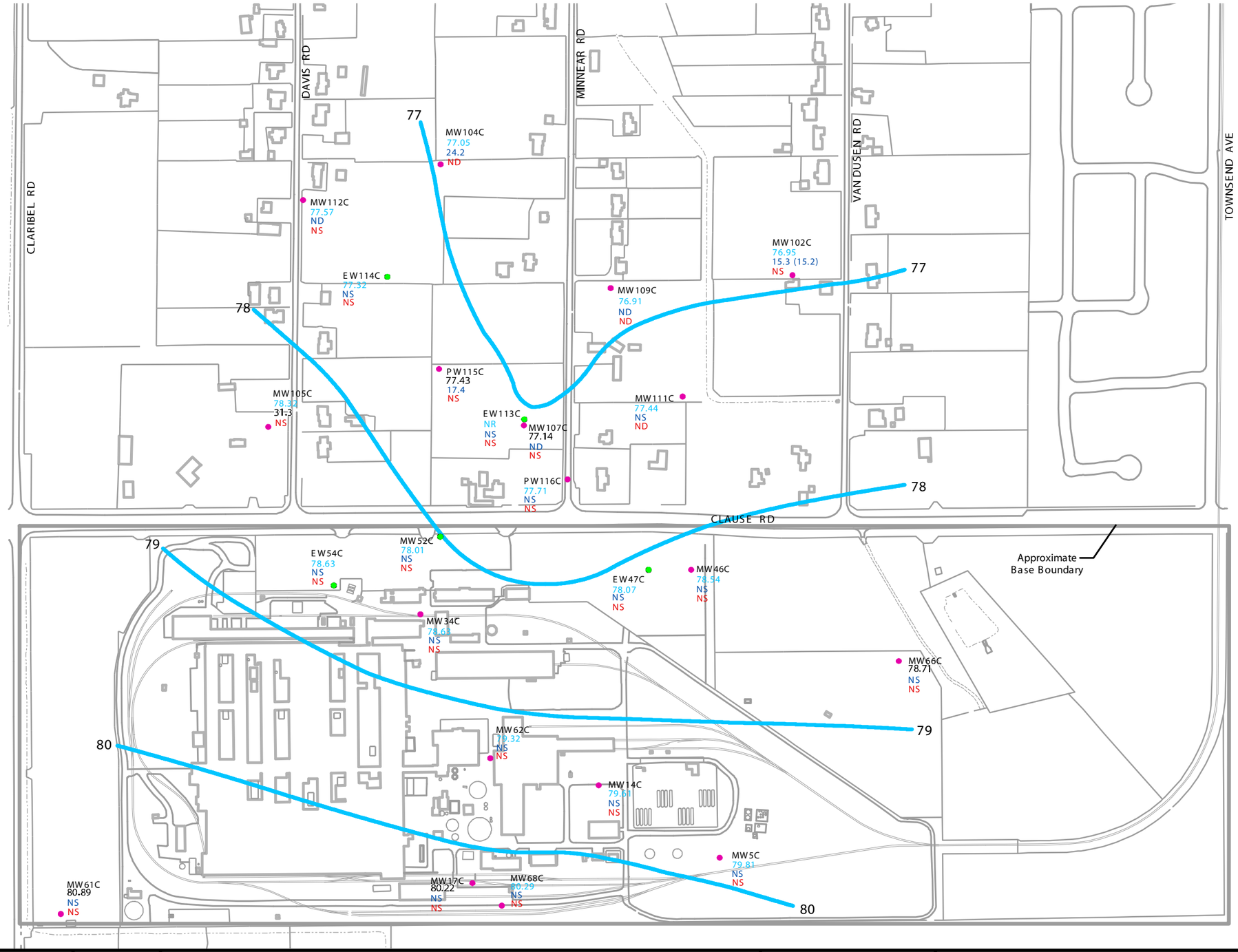
RIVERBANK ARMY AMMUNITION PLANT
RIVERBANK, CALIFORNIA

Project Number: RC000665.0001

Plate: 2



LEGEND

●	MONITORING WELL
●	EXTRACTION WELL
80	GROUNDWATER ELEVATION CONTOUR
83.1	GROUNDWATER ELEVATION
NR	NO MEASUREMENT RECORDED
50	CHROMIUM ISOCONCENTRATION LINE
76.1	CHROMIUM CONCENTRATION (ug/L)
NS	NOT SAMPLED
ND	NOT DETECTED
200	CYANIDE ISOCONCENTRATION LINE
76.1	CYANIDE CONCENTRATION (ug/L)
NS	NOT SAMPLED
ND	NOT DETECTED

NOTES

1. Groundwater contours represent the elevation of the water surface above mean sea level.
2. Only monitoring wells that are screened in the C aquifer zone are shown on this map.

0 180 360 Feet

Reference: CH2M Hill, 4th Quarter 2004 Groundwater Monitoring Report.

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Task Manager: N. SHERIF	Technical Review: N. SHERIF
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ARCADIS G&M, Inc.
1050 Marina Way South
Richmond, CA 94804
Tel: 510-233-3200 Fax: 510-233-3204
www.arcadis-us.com

RBAAP C AQUIFER ZONE
GROUNDWATER ELEVATION CONTOURS WITH FOURTH QUARTER 2004 CHROMIUM AND CYANIDE ISOPLETHS
RIVERBANK ARMY AMMUNITION PLANT
RIVERBANK, CALIFORNIA

Project Number: RC000665.0001

Plate: 3

TABLE 3-2:

Fourth Quarter 2005 Groundwater Analytical Data

Riverbank Army Ammunition Plant

Location	Zone	4th Quarter 2005 Sample Date	4th Quarter 2005 Dissolved Chromium (µg/L)	4th Quarter 2005 Total Cyanide (µg/L)	3rd Quarter 2005 Dissolved Chromium (µg/L)	3rd Quarter 2005 Total Cyanide (µg/L)	2nd Quarter 2005 Dissolved Chromium (µg/L)	2nd Quarter 2005 Total Cyanide (µg/L)	1st Quarter 2005 Dissolved Chromium (µg/L)	1st Quarter 2005 Total Cyanide (µg/L)	4th Quarter 2004 Dissolved Chromium (µg/L)	4th Quarter 2004 Total Cyanide (µg/L)
5	A'	11/20/05	5.0 U	5.0 U	NS	NS	5.0 U	5.0 U	NS	NS	5.0 U	20 U
5	B	NS	NS	NS	NS	NS	5.0 U	5.0 U	NS	NS	NS	NS
9	A	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
12	A	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
13	A	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
14	A	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
14	A'	11/21/05	5.0 U	12.4	NS	NS	5.0 U	5.0 U	NS	NS	5.0 U (5 U)	20 U (20 U)
15	A	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
16	A	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
17	A	NS	NS	NS	NS	NS	5.0 U	NS	**94.1**	20 U	NS	NS
17	A'	11/16/05	5.0 U	5.0 U	NS	NS	5.0 U	NS	NS	NS	5.0 U	20 U
18	A	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
19	A	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
20	A	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
21	A	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
34	A'	11/20/05	**90.4**	NS	**58.1**	13.9	38.7 (37.9)	10.7 (7.3)	**103**	24.3	**106**	27.3
34	B	NS	NS	NS	NS	NS	5.0 U	5.0 U	NS	NS	5.0 U (5 U)	20 U (20 U)
41	A'	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
45	A'	11/20/05	5.0 U	NS	NS	NS	5.0 U	5.0 U	NS	NS	5.0 U	NS
45	B	NS	NS	NS	NS	NS	5.0 U	5.4	NS	NS	NS	NS
46	A	11/22/05	21	NS	NS	NS	6.18 (6.6)	10.0 (11.3)	NS	NS	7.25	NS
47	C	NS	NS	NS	NS	NS	5.0 U	5.0 U	NS	NS	NS	NS
49	A	11/22/05	**152**	5.0	**150**	8.8	**152**	5.0 U	**143**	20 U	**150 (150)**	20 U (20 U)
50	A	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
51	A	11/22/05	**122 (116)**	5.0 U	**134**	5.0 U	**94.3**	5.0 U	15.1	20 U	**167**	20 U
52	A	11/22/05	**336**	5.0 U	**316**	5.0 U	**235 (234)**	5.0 U (5.0 U)	**189**	20 U	**354**	20 U
52	B	NS	NS	NS	NS	NS	7.17	5.0 U	NS	NS	6.37	NS
52	C	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
54	A	11/22/05	23	5.0 U	NS	NS	13.9	5.0 U	NS	NS	18.9	20 U
54	B	11/20/05	**131**	NS	**133**	NS	**145**	5.9	**155**	NS	**139**	NS
54	C	NS	NS	NS	NS	NS	27.9	20.0 U	NS	NS	NS	NS
62	A'	11/21/05	5.0 U	5.0 U	5.0 U	NS	5.0 U	10.0	5 U (5 U)	20 U (20 U)	5.42	20 U
63	A'	11/20/05	5.0 U	138	NS	116	5.0 U	104	NS	111	5.0 U	112
65	A'	11/20/05	45.6	5.8	**56.2**	NS	**62**	5.6	42	NS	**58.1**	20 U
66	B	11/21/05	28.4	NS	NS	NS	11.7	5.0 U	NS	NS	26.1	NS
66	C	NS	NS	NS	NS	NS	5.0 U	5.0 U	NS	NS	NS	NS
67	D	NS	NS	NS	NS	NS	7.56	5.0 U	NS	NS	NS	NS
69	A'	NS	NS	NS	NS	NS	14.7	5.8	NS	NS	NS	NS
71	A'	11/20/05	5.0 U	116	NS	**296**	8.06	**241**	NS	**549**	8.49	**432**
72	B	11/20/05	5.0 U	38.9	NS	NS	6.3	38.7	NS	NS	6.55	42.5
73	A'	11/21/05	13.8 (11.3)	NS	NS	NS	5.0 U	5.0 U	NS	NS	5.68	NS

TABLE 3-2:
Fourth Quarter 2005 Groundwater Analytical Data
Riverbank Army Ammunition Plant

Location	Zone	4th Quarter 2005 Sample Date	4th Quarter 2005 Dissolved Chromium (µg/L)	4th Quarter 2005 Total Cyanide (µg/L)	3rd Quarter 2005 Dissolved Chromium (µg/L)	3rd Quarter 2005 Total Cyanide (µg/L)	2nd Quarter 2005 Dissolved Chromium (µg/L)	2nd Quarter 2005 Total Cyanide (µg/L)	1st Quarter 2005 Dissolved Chromium (µg/L)	1st Quarter 2005 Total Cyanide (µg/L)	4th Quarter 2004 Dissolved Chromium (µg/L)	4th Quarter 2004 Total Cyanide (µg/L)
74	A'	11/21/05	**94.2**	NS	5.0 U	NS	5.0 U	5.6	5 U	NS	5.0 U	NS
102	B	NS	NS	NS	NS	NS	8.76	5.0 U	NS	NS	12.0	20 U
102	C	NS	NS	NS	NS	NS	17.1	5.0 U	NS	NS	15.3 (15.2)	NS
104	A'	11/17/05	5.0 U	5.0 U	5.0 U	NS	5.0 U	5.0 U	5 U	NS	5.0 U	20 U
104	B	11/17/05	26.7	6.7	27.1	9.8 U	31.7 (31.2)	12.7 (12.4)	30.6	20 U	24.9	20 U
104	C	11/17/05	22.1	5.0 U	25.8	5.0 U	26.4	5.0 U	23.1 (22.2)	20 U (20 U)	24.2	20 U
104	D	11/17/05	14.5	5.0 U	5.0 U	5.0 U	5.19	5.0 U	9.67	20 U	7.58	20 U
105	A'	11/17/05	5.0 U	NS	5.0 U	NS	5.25	14.9	5.73	NS	5.19	NS
105	B	11/17/05	21.1	NS	5.0 U	NS	9.36	5.0 U	49.7 (48.1)	NS	31.4	NS
105	C	11/17/05	30.4	NS	39.8	NS	22.9	5.8	21.7	NS	31.3	NS
107	A'	NS	NS	NS	7.31	NS	8.11	17.1	NS	NS	10.8	28.6
107	B	NS	NS	NS	NS	NS	5.0 U	6.3	NS	NS	NS	NS
107	C	11/17/05	7.02	NS	NS	NS	5.0 U	5.0 U	NS	NS	5.0 U	NS
109	A'	11/17/05	9.59	5.0 U	7.01	NS	9.74	5.2	11.7	NS	17.0	20 U
109	B	NS	NS	NS	15	64.9	14.3	74.9	15	86.4	15.1	104
109	C	11/17/05	5.0 U (5.0 U)	8.8 (5.0 U)	ND	5.0 U	5.68	5.0 U	5 U	38.4	5.0 U	20 U
109	D	11/18/05	13	5.0 U	NS	NS	7.45	5.0 U	NS	NS	6.67	20 U
110	A'	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
110	B	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
111	A'	11/17/05	**89.6**	50.8	NS	NS	6.81	31.2	NS	NS	7.4	39.9
111	B	11/17/05	5.86	47.7	NS	40	5.0 U	51.5	NS	58	5.0 U	75.5
111	C	11/17/05	NS	5.0 U	NS	NS	5.0 U	5.0 U	NS	NS	NS	20 U
112	B	11/18/05	5.0 U	NS	NS	NS	5.0 U	5.0 U	NS	NS	5.0 U	NS
112	C	11/18/05	5.0 U	NS	NS	NS	5.0 U	5.0 U	NS	NS	5.0 U	NS
113	A'	11/17/05	18.5	20.7	16.7	23	17.7	23.5	19.4	27	18.9	25.8
113	B	11/17/05	13.8	17.4	12.9	18.7	13.1	19.1	13.7	20 U	13.9	20 U
113	C	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
114	B	11/18/05	13.9	5.0 U	27.5	NS	30	6	27.5	NS	27.3	20 U
114	C	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
115	A'	11/17/05	36.7	5.0 U	15.9	NS	17.4	5.0 U	**58.6**	NS	40.7	20 U
115	B	11/17/05	**87.6**	6.9	33.7	NS	**74.2**	10.4	44.1	NS	**52.7 (51.4)**	20 U (20 U)
115	C	11/17/05	**108**	6.0	17.2	NS	14 (13.6)	5.0 U (5.0 U)	13.8	NS	17.4	NS
116	A'	11/18/05	29.2	49.0	21.4	44.6	12.7	57.3	15.9	66.2	36.7	52.1
D-45	D	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
D-76	D	11/18/05	8.00	5.0 U	NS	NS	9.02	5.0 U	NS	NS	9.2 (9.69)	NS
D-77	D	NS	NS	NS	NS	NS	9.26 (9.28)	5.0 U (5.0 U)	NS	NS	8.55	NS
D-79	D	11/18/05	6.48	5.0 U (5 U)	NS	NS	7.53	5.0 U	NS	NS	6.94	NS
D-90	D	11/18/05	8.48	5.0 U	NS	NS	8.17	5.0 U	NS	NS	8.19	NS
D-91	D	11/18/05	7.63 (7.69)	5.0 U (5.0U)	NS	NS	8.63	5.0 U	NS	NS	7.94	NS

Bold value in shaded cell indicates result greater than the MCL Wells that have not been sampled for more than 5 years are not shown.
J = estimated value U = non detect ( ) = Duplicate result NS = Not sampled

Attachment 1

List of Documents Reviewed

Attachment 1

List of Documents Reviewed

Ahtna Government Services Corporation, 2004a. Project Management Plan, Operations and Maintenance of Groundwater Treatment Plant, Riverbank Army Ammunition Plant, CA. July.

_____, 2004b. Riverbank Army Ammunition Plant Groundwater Treatment Facility Monthly Operations and Water Discharge Summary. July to December.

_____, 2004c. Riverbank Army Ammunition Plant Groundwater Treatment System Monthly Operations and Discharge Summary. June through December.

_____, 2005. Groundwater Treatment System Operation and Maintenance Update, Riverbank Army Ammunition Plant, Riverbank, California. May.

California Department of Toxic Substances Control, 2002. Corrective Action Consent Agreement. Riverbank Army Ammunition Plant. June.

CH2M Hill, 1995. Riverbank Army Ammunition Plant Groundwater Extraction and Treatment System 100 Percent Design Document. June.

_____, 1996. Final Closure and Post-Closure Maintenance Plan - Riverbank Army Ammunition Plant Landfill. May.

_____, 1997a. Riverbank Army Ammunition Plant Final Extraction System Design and Monitoring Plan with System Operating Procedures. September 24.

_____, 1997b. Supplement to Design Documentation for the Groundwater Extraction and Monitoring Network, IGWTS, GWTS, and IWTP. September 23.

_____, 1997c. O&M Manual, Riverbank Army Ammunition Plant, Groundwater Treatment System (GWTS). September.

_____, 2001a. Quarterly Groundwater Monitoring Report, RBAAP Groundwater Monitoring Program, 2001 – First Quarter. Prepared for Riverbank Army Ammunition Plant. April.

_____, 2001b. Quarterly Groundwater Monitoring Report, RBAAP Groundwater Monitoring Program, 2001 – Second Quarter. Prepared for Riverbank Army Ammunition Plant. July.

_____, 2001c. Quarterly Groundwater Monitoring Report, RBAAP Groundwater Monitoring Program, 2001 – Third Quarter. Prepared for Riverbank Army Ammunition Plant. October.

_____, 2001d. Technical Memorandum, Final Addendum to the Five-Year Review Report for the Riverbank Army Ammunition Plant. September 21.

_____, 2002a. Quarterly Groundwater Monitoring Report, RBAAP Groundwater Monitoring Program, 2001 – Fourth Quarter. Prepared for Riverbank Army Ammunition Plant. January.

_____, 2002b. Quarterly Groundwater Monitoring Report, RBAAP Groundwater Monitoring Program, 2002 – First Quarter. Prepared for Riverbank Army Ammunition Plant. April.

_____, 2002c. Quarterly Groundwater Monitoring Report, RBAAP Groundwater Monitoring Program, 2002 – Second Quarter. Prepared for Riverbank Army Ammunition Plant. August.

_____, 2002d. Quarterly Groundwater Monitoring Report, RBAAP Groundwater Monitoring Program, 2002 – Third Quarter. Prepared for Riverbank Army Ammunition Plant. October.

_____, 2002e. RCRA Facility Investigation Current Conditions Report, Riverbank Army Ammunition Plant, Riverbank, California. October.

_____, 2003a. Quarterly Groundwater Monitoring Report, RBAAP Groundwater Monitoring Program, 2003 – First Quarter. Prepared for Riverbank Army Ammunition Plant. April.

_____, 2003b. Quarterly Groundwater Monitoring Report, RBAAP Groundwater Monitoring Program, 2003 – Second Quarter. Prepared for Riverbank Army Ammunition Plant. August.

_____, 2003c. Quarterly Groundwater Monitoring Report, RBAAP Groundwater Monitoring Program, 2003 – Third Quarter. Prepared for Riverbank Army Ammunition Plant. October.

_____, 2003d. Final In-Situ Chromium Reduction Treatability Study Work Plan. Prepared for Riverbank, Army Ammunition Plant, Riverbank, California. November.

_____, 2005a. Quarterly Groundwater Monitoring Report, RBAAP Groundwater Monitoring Program, 2004 – Fourth Quarter. Prepared for Riverbank Army Ammunition Plant. January.

_____, 2005b. RCRA Facility Investigation Phase 1 Report. Prepared for Riverbank Army Ammunition Plant. February.

Harding Lawson Associates [HLA], 1998. Groundwater Treatment System Assessment Report, August 1996 through November 1997. Prepared for Riverbank Army Ammunition Plant. September.

_____, 1998b. Quarterly Groundwater Monitoring Report, RBAAP Groundwater Program, 1998 – Third Quarter. Prepared for Riverbank Army Ammunition Plant. October.

NI Industries, Inc., 2001-2004. Quarterly Landfill Monitoring Report. Prepared for Riverbank Army Ammunition Plant.

_____, 2001-2004. Monthly Groundwater Treatment Plant Monthly Operations Report. Prepared for Riverbank Army Ammunition Plant. December 2002, February through August 2003.

U.S. Army Environmental Center, 1994. Record of Decision, Riverbank Army Ammunition Plant. March.

_____, 2001. First Five-Year Review Report for Riverbank Army Ammunition Plant, City of Riverbank, Stanislaus County, California. February.

Roy F. Weston, Inc. [Weston], 1991. Riverbank Army Ammunition Plant Remedial Investigation Report. West Chester, Pennsylvania. Prepared for Commander, U.S. Army Toxic and Hazardous Materials Agency, Aberdeen Proving Ground, Maryland 21010-5401.

_____, 1994. Quarterly Groundwater Monitoring Report, RBAAP Groundwater Program, 1993 — Fourth Quarter. Prepared for Riverbank Army Ammunition Plant. February.

WTS, 1991. Riverbank Army Ammunition Plant Interim Groundwater Treatment System (IGWTS) Operation and Maintenance Manual. January.

Attachment 2

Site Inspection Checklist

Attachment 2

Site Inspection Checklist

I. SITE INFORMATION	
Site name: Riverbank Army Ammunition Plant	Date of inspection: April 7, 2005
Location and Region: Riverbank, CA – Region 9	EPA ID: CA7210020759
Agency, office, or company leading the five-year review: U.S. Army	Weather/temperature: Overcast, few showers, approximately 60° Fahrenheit

Remedy Includes: (Check all that apply)

- T Landfill cover/containment
- T Access controls
- T Institutional controls
- T Groundwater pump and treatment
- £ Surface water collection and treatment
- £ Other_____
- £ Monitored natural attenuation
- T Groundwater containment
- £ Vertical barrier walls

Attachments: £ Inspection team roster attached £ Site map attached

II. INTERVIEWS (Check all that apply)

1. O&M site manager Randy Rogers/Erik Appel (Name) Project Manager (Title) April 15, 2005 (Date)
   Interviewed £ at site £ at office T by phone Phone no. _____
   Problems, suggestions; £ Report attached _____
   No problems noted with either the landfill or the GWTS.

2. O&M staff John Tabor (Name) Plant Operator (Title) April 7, 2005 (Date)
   Interviewed S at site £ at office £ by phone Phone no. _____
   Problems, suggestions; £ Report attached _____
   No current problems that affect system performance were noted.

3. Local regulatory authorities and response agencies (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency Riverbank Chamber of Comm.
Contact Kim Velasquez ____ CEO ____ 07/18/05 (209) 869-4541
Name Title Date Phone no.
Problems; suggestions; £ Report attached With RBAAP on BRAC list, concerned about loss of community asset; Army should proactively provide information on reuse and cleanup.

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; £ Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; £ Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; £ Report attached _____

4. Other interviews (optional) £ Report attached.

Mrs. Tackett (Davis Ave. neighbor) was interviewed on 7/18/05. She was unhappy over interactions with Army Real Estate person, but was OK with environmental program. Might like to have more information about status.

Mr. Clemens (Claus Rd. neighbor) was interviewed on 7/18/05. He reported no issues.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**

T O&M manual	T Readily available	T Up to date	£ N/A
T As-built drawings	T Readily available	£ Up to date	£ N/A
£ Maintenance logs	£ Readily available	£ Up to date	£ N/A

Remarks As-built drawings have not been updated to reflect system modification in the last five years.

2. **Site-Specific Health and Safety Plan** T Readily available T Up to date • N/A
   T Contingency plan/emergency response plan T Readily available T Up to date • N/A
   Remarks Recently updated.

3. **O&M and OSHA Training Records** T Readily available T Up to date £ N/A
   Remarks

4. **Permits and Service Agreements**

£ Air discharge permit	£ Readily available	£ Up to date	T N/A
T Effluent discharge	T Readily available	T Up to date	£ N/A
T Waste disposal, POTW	T Readily available	T Up to date	£ N/A
£ Other permits	£ Readily available	£ Up to date	£ N/A

   Remarks NPDES changed to WDR in 2001

5. **Gas Generation Records** • Readily available • Up to date T N/A
   Remarks

6. **Settlement Monument Records** • Readily available • Up to date • N/A
   Remarks Documents were not available in the library.

7. **Groundwater Monitoring Records** T Readily available T Up to date • N/A
   Remarks All readily available with the exception of 2004 reports

8. **Leachate Extraction Records** • Readily available • Up to date T N/A
   Remarks

9. **Discharge Compliance Records**

£ Air	£ Readily available	£ Up to date	T N/A
T Water (effluent)	T Readily available	T Up to date	£ N/A

   Remarks

10. **Daily Access/Security Logs** T Readily available T Up to date • N/A
    Remarks access gate, secured 24 hours a day

IV. O&M COSTS

1. O&M Organization

£ State in-house £ Contractor for State
£ PRP in-house £ Contractor for PRP
£ Federal Facility in-house T Contractor for Federal Facility
£ Other_____

2. O&M Cost Records

T Readily available T Up to date
T Funding mechanism/agreement in place
Original O&M cost estimate__$1.9 million/year_ • Breakdown attached

Total annual cost by year for review period if available: Summarized in 5-year review text

From_____ To_____ _____ • Breakdown attached
Date Date Total cost
From_____ To_____ _____ • Breakdown attached
Date Date Total cost
From_____ To_____ _____ • Breakdown attached
Date Date Total cost
From_____ To_____ _____ • Breakdown attached
Date Date Total cost
From_____ To_____ _____ • Breakdown attached
Date Date Total cost

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons: _None_____

V. ACCESS AND INSTITUTIONAL CONTROLS T Applicable • N/A

A. Fencing

1. Fencing damaged • Location shown on site map T Gates secured • N/A

Remarks____entire facility is fenced_____

B. Other Access Restrictions

1. Signs and other security measures • Location shown on site map • N/A

Remarks____Access controlled by security patrols, landfill has warning signs every ~150' on a barbed wire topped fence_____

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented • Yes T No • N/A
Site conditions imply ICs not being fully enforced • Yes T No • N/A

Type of monitoring (e.g., self-reporting, drive by) Drive by security patrols
Frequency Multiple times per day
Responsible party/agency NI Industries, Inc. security department
Contact _____ _____ _____ _____
Name Title Date Phone no.

Reporting is up-to-date T Yes £ No £ N/A
Reports are verified by the lead agency T Yes £ No £ N/A

Specific requirements in deed or decision documents have been met £ Yes T No £ N/A
Violations have been reported £ Yes £ No T N/A
Other problems or suggestions: • Report attached
Deed restrictions have not been implemented. As required in the ROD, deed restrictions will be required for the landfill if the Army closes the RBAAP facility.

2. **Adequacy** T ICs are adequate • ICs are inadequate • N/A
Remarks

D. General

1. **Vandalism/trespassing** • Location shown on site map T No vandalism evident
Remarks

2. **Land use changes on site** • N/A
Remarks None – Space has been leased to private companies, but land use has not changed during the last five years.

3. **Land use changes off site** • N/A
Remarks None

VI. GENERAL SITE CONDITIONS

A. Roads T Applicable • N/A

1. Roads damaged • Location shown on site map T Roads adequate • N/A
   Remarks_____

B. Other Site Conditions

Remarks _____

VII. LANDFILL COVERS T Applicable • N/A

A. Landfill Surface

1. Settlement (Low spots) • Location shown on site map T Settlement not evident
   Areal extent_____ Depth_____
   Remarks_____

2. Cracks • Location shown on site map T Cracking not evident
   Lengths_____ Widths_____ Depths_____
   Remarks_____

3. Erosion • Location shown on site map • Erosion not evident
   Areal extent_____ Depth 1 to 2 inches
   Remarks Minor erosion evident along side slope, however, the liner does not seem to be affected.

4. Holes • Location shown on site map • Holes not evident
   Areal extent_____ Depth Unknown
   Remarks___evidence of some squirrel burrows

5. Vegetative Cover T Grass T Cover properly established T No signs of stress
   • Trees/Shrubs (indicate size and locations on a diagram)
   Remarks Invasion of weeds was evident within the vegetative cover.

6. Alternative Cover (armored rock, concrete, etc.) T N/A
   Remarks_____

7. Bulges • Location shown on site map T Bulges not evident
Areal extent_____ Height_____
Remarks_____
_____

8. Wet Areas/Water Damage T Wet areas / water damage not evident
£ Wet areas £ Location shown on site map Areal extent_____
T Ponding £ Location shown on site map Areal extent_____
£ Seeps £ Location shown on site map Areal extent_____
£ Soft subgrade £ Location shown on site map Areal extent_____
Remarks There were a few areas around the landfill that had very minor ponding or slopes for ponding._____

9. Slope Instability • Slides • Location shown on site map T No evidence of slope instability
Areal extent_____
Remarks_____
_____

B. Benches • Applicable T N / A
(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. Flows Bypass Bench • Location shown on site map • N / A or okay
Remarks_____
_____

2. Bench Breached • Location shown on site map • N / A or okay
Remarks_____
_____

3. Bench Overtopped • Location shown on site map • N / A or okay
Remarks_____
_____

C. Letdown Channels • Applicable T N / A
(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. Settlement • Location shown on site map • No evidence of settlement
Areal extent_____ Depth_____
Remarks_____
_____

2. Material Degradation • Location shown on site map • No evidence of degradation
Material type_____ Areal extent_____
Remarks_____
_____

3. Erosion • Location shown on site map • No evidence of erosion
Areal extent_____ Depth_____
Remarks_____
_____

4. Undercutting • Location shown on site map • No evidence of undercutting
Areal extent_____ Depth_____
Remarks_____
_____

5. Obstructions Type_____ • No obstructions
• Location shown on site map Areal extent_____ Size_____
Remarks_____
_____

6. Excessive Vegetative Growth Type_____
• No evidence of excessive growth
• Vegetation in channels does not obstruct flow
• Location shown on site map Areal extent_____
Remarks_____
_____

D. Cover Penetrations T Applicable • N/A

1. Gas Vents • Active • Passive
• Properly secured/locked • Functioning • Routinely sampled • Good condition
• Evidence of leakage at penetration • Needs Maintenance
T N/A
Remarks_____
_____

2. Gas Monitoring Probes
• Properly secured/locked • Functioning • Routinely sampled • Good condition
• Evidence of leakage at penetration • Needs Maintenance T N/A
Remarks_____
_____

3. Monitoring Wells (within surface area of landfill)
• Properly secured/locked • Functioning • Routinely sampled • Good condition
• Evidence of leakage at penetration • Needs Maintenance T N/A
Remarks_____
_____

4. Leachate Extraction Wells
• Properly secured/locked • Functioning • Routinely sampled • Good condition
• Evidence of leakage at penetration • Needs Maintenance T N/A
Remarks_____
_____

5. Settlement Monuments T Located T Routinely surveyed • N/A
Remarks Only one monument was found. Excessive vegetation prevented location of the other two monuments.

E. Gas Collection and Treatment	• Applicable T N/A
1.	Gas Treatment Facilities • Flaring • Thermal destruction • Collection for reuse • Good condition • Needs Maintenance Remarks_____
2.	Gas Collection Wells, Manifolds and Piping • Good condition • Needs Maintenance Remarks_____
3.	Gas Monitoring Facilities (e.g., gas monitoring of adjacent homes or buildings) • Good condition • Needs Maintenance T N/A Remarks_____
F. Cover Drainage Layer	T Applicable • N/A
1.	Outlet Pipes Inspected T Functioning • N/A Remarks_____
2.	Outlet Rock Inspected T Functioning • N/A Remarks_____
G. Detention/Sedimentation Ponds	• Applicable T N/A
1.	Siltation Areal extent_____Depth_____ • N/A • Siltation not evident Remarks_____
2.	Erosion Areal extent_____Depth_____ • Erosion not evident Remarks_____
3.	Outlet Works • Functioning • N/A Remarks_____
4.	Dam • Functioning • N/A Remarks_____

H. Retaining Walls	• Applicable T N/A
1. Deformations	• Location shown on site map • Deformation not evident Horizontal displacement_____ Vertical displacement_____ Rotational displacement_____ Remarks_____
2. Degradation	• Location shown on site map • Degradation not evident Remarks_____
I. Perimeter Ditches/Off-Site Discharge	T Applicable • N/A
1. Siltation	• Location shown on site map T Siltation not evident Areal extent_____ Depth_____ Remarks_____
2. Vegetative Growth	• Location shown on site map • N/A T Vegetation does not impede flow Areal extent_____ Type_____ Remarks Minor vegetative growth needs to be removed as part of routine maintenance.___
3. Erosion	• Location shown on site map • Erosion not evident* Areal extent_____ Depth_____ Remarks Very minor erosion of perimeter ditches apparent, not enough to affect ditch performance. No action necessary_____
4. Discharge Structure	T Functioning • N/A Remarks_____
VIII. VERTICAL BARRIER WALLS	• Applicable T N/A
1. Settlement	• Location shown on site map • Settlement not evident Areal extent_____ Depth_____ Remarks_____
2. Performance Monitoring	Type of monitoring _____ • Performance not monitored Frequency_____ • Evidence of breaching Head differential_____ Remarks_____

IX. GROUNDWATER/SURFACE WATER REMEDIES T Applicable £ N/A
A. Groundwater Extraction Wells, Pumps, and Pipelines T Applicable £ N/A
1. Pumps, Wellhead Plumbing, and Electrical T Good condition £ All required wells properly operating £ Needs Maintenance £ N/A Remarks All wells will be grounded. Well 54B was filled with water due to recent rain; MW113 series had excessive animal burrows. AGSC is in the process of taking action on removing the water from 54B, and will evaluate if the animal burrows are causing structural damage to the 113 series.
2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances T Good condition £ Needs Maintenance Remarks_____
3. Spare Parts and Equipment T Readily available T Good condition £ Requires upgrade £ Needs to be provided Remarks_____
B. Surface Water Collection Structures, Pumps, and Pipelines £ Applicable T N/A
1. Collection Structures, Pumps, and Electrical £ Good condition £ Needs Maintenance Remarks_____
2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances £ Good condition £ Needs Maintenance Remarks_____
3. Spare Parts and Equipment £ Readily available £ Good condition £ Requires upgrade £ Needs to be provided Remarks_____

C. Treatment System	T Applicable • N/A
1.	Treatment Train (Check components that apply) £ Metals removal £ Oil/water separation £ Bioremediation £ Air stripping £ Carbon adsorbers £ Filters_____ £ Additive (e.g., chelation agent, flocculent)_____ T Others ion exchange beds, holding tanks and associated piping T Good condition £ Needs Maintenance £ Sampling ports properly marked and functional T Sampling/maintenance log displayed and up to date T Equipment properly identified T Quantity of groundwater treated annually approximately 100 million gallons • Quantity of surface water treated annually_____ Remarks_____
2.	Electrical Enclosures and Panels (properly rated and functional) • N/A T Good condition • Needs Maintenance Remarks_____
3.	Tanks, Vaults, Storage Vessels • N/A T Good condition • Proper secondary containment • Needs Maintenance Remarks_____
4.	Discharge Structure and Appurtenances • N/A T Good condition • Needs Maintenance Remarks_____
5.	Treatment Building(s) • N/A T Good condition (esp. roof and doorways) • Needs repair T Chemicals and equipment properly stored Remarks_____
6.	Monitoring Wells (pump and treatment remedy) T Properly secured/locked T Functioning T Routinely sampled T Good condition T All required wells located £ Needs Maintenance £ N/A Remarks_____
D. Monitoring Data	
1.	Monitoring Data T Is routinely submitted on time T Is of acceptable quality
2.	Monitoring data suggests: T Groundwater plume is effectively contained T Contaminant concentrations are declining

E. Monitored Natural Attenuation

1. Monitoring Wells (natural attenuation remedy)
• Properly secured/locked • Functioning • Routinely sampled • Good condition
• All required wells located • Needs Maintenance T N/A
Remarks_____

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

The landfill cover and groundwater extraction and treatment system all appear to be in very good condition and operating as intended.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

Landfill O & M needs to be performed and reported as specified in the Closure and Post Closure Plan.

C.	Early Indicators of Potential Remedy Problems
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. None.
D.	Opportunities for Optimization
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. None.

Attachment 3

Applicable or Relevant and Appropriate Requirements (ARARs)

ATTACHMENT 3

Applicable or Relevant and Appropriate Requirements (ARARs)

Actions	Requirements	Prerequisites	Citation for Federal Requirements	Citation for California Requirements
Construction of Groundwater Extraction and Monitoring Wells	The construction of all extraction and monitor wells must comply with California Well Standards construction requirements.	Construction of extraction and monitoring wells.	NA	California Well Standards, Bulletin Nos. 74-81 and 74-90 – Applicable
Groundwater Extraction	The groundwater will be extracted and treated until the aquifer meets federal and state MCLs and state Water Quality Objectives (WQOs) for protection of the beneficial use classifications for municipal, domestic, industrial, and agricultural water supply: • Chromium – 50 µg/L (CA MCL; CA WQO). • Cyanide – 200 µg/L (Safe Drinking Water Act (SDWA) MCL).	None	57 FR 31776 (17 July 1992, effective 17 January 1994), to be codified at SDWA 40 CFR, Part 141 – Relevant and appropriate 40 CFR 300.430(c)(2)(i)(B) – Applicable	Title 22, CCR Chapter 15, §§64401 et seq. – Applicable California RWQCB Title 23, CCR Chapter 23 §3000 (California Inland Surface Waters Plan - Basin Plan 5B) State Board Resolution 88-63 State Board Resolution 68-26 - Applicable Pursuant to ROD, substantive provisions of Article 5 contained in the sections of Chapter 15 listed below are to be followed - Title 23, CCR, Division 3, Chapter 15, §§2550.1, 2550.5 - 2550.10, and 2550.12.

Actions	Requirements	Prerequisites	Citation for Federal Requirements	Citation for California Requirements
Groundwater Treatment at the IGWTS and IWTP with Direct Discharge of Treatment System Effluent to the OID Canal	Must take action to protect affected fish or wildlife resources of the Stanislaus River – Applicable.	Point source discharge to waters of the United States – protection of downstream water – Stanislaus River	Fish and Wildlife Coordination Act (16 USC 661 et seq.); 40 CFR 6.302(g) – Applicable	Title 23, CCR Chapter 9, Article 3 (Substantive requirements with respect to discharge of chromium and cyanide to be followed by agreement as stated in the ROD.)
	National Pollutant Discharge Elimination System (NPDES) Permitting Program (with respect to chromium and cyanide).		40 CFR 122.44(a) (CWA) – Applicable	
	Use of best available technology economically achievable (BATEA) is required to control toxic and nonconventional pollutants. Use of best conventional pollutant control technology is required to control conventional pollutants. Technology-based limitations may be determined on a case-by-case basis.			
	The discharge must comply with applicable federal Water Quality Criteria (WQC) and California WQOs for the protection of human health and aquatic organisms specified for the use classifications for the Stanislaus River. E/P Ponds: • Chromium (VI) less than 50 µg/L (monthly average) • Cyanide - 5.2 µg/L (monthly average) OID Canal: • Chromium (VI) - 11 pg/L (CA WQO for the protection of aquatic life - 4-day average concentration not to be exceeded more than once every 3 years ; 1-hour average 16 µg/L).		CWA Sections 303(c)(2)(B) and 304(a) – Relevant and appropriate	State Board Resolution 68-16
	The discharge must be consistent with the requirements of a Water Quality Management Plan approved by EPA under the Clean Water Act (CWA) §208(b).		40 CFR 122.44(d) – Applicable	
	Discharge limitations must be established for all toxic pollutants that are or may be discharged at levels greater than that which can be achieved by technology-based standards.		40 CFR 122.44(e) – Applicable	
	Develop and implement a best management practice (BMP) program and incorporate in the NPDES permit to prevent the release of toxic constituents to surface waters.		40 CFR 125.100 – Applicable	
	Criteria and standards for NPDES permit.		40 CFR 125 – Applicable	

Actions	Requirements	Prerequisites	Citation for Federal Requirements	Citation for California Requirements
Groundwater Treatment at the IGWTS and IWTP with Direct Discharge of Treatment System Effluent to the OID Canal (continued)	The BMP program must: • Establish specific procedures for the control of toxic and hazardous pollutant spills. • Include a prediction of direction, rate of flow, and total quantity of toxic pollutants where experience indicates a reasonable potential for equipment failure. • Ensure proper management of solid and hazardous waste in accordance with regulations promulgated under RCRA.	Discharge to waters of the United States	40 CFR 125.104 – Applicable	
	To ensure compliance, the discharge must be monitored for: • The volume of effluent. • The mass of each pollutant. • Frequency of discharge and other measurements, as appropriate.		40 CFR 122.44(i) – Applicable	
	Approved test methods must be followed for monitored waste constituents. Detailed requirements for analytical procedures and quality control (QC) are provided.		40 CFR 136.1 to 136.3(e) – Applicable	
	Comply with additional permit conditions such as: • Proper operations and maintenance (O&M) of treatment systems • Duty to mitigate any adverse effects of any discharge	Offsite dischargers	40 CFR 122.41(d,e) – Applicable	
Groundwater Treatment at the IGWTS and IWTP with Discharge to the E/P Ponds	The discharge must comply with applicable federal Water Quality Criteria (WQC) and California WQOs for the protection of human health and aquatic organisms specified for the use classifications for the Stanislaus River: E/P ponds: • Chromium (VI) less than 50 µg/L (monthly average) • Cyanide – 5.2 µg/L (monthly average) OID Canal: • Chromium (VI) – 11 pg/L (CA WQO for the protection of aquatic life - 4-day average concentration not to be exceeded more than once every 3 years ; 1-hour average 16 µg/L). • Cyanide – 5.2 µg/L (CA WQO for the protection of aquatic life – daily average; 1-hour average 22 µg/L)		CWA Sections 303(c)(2)(B) and 304(a) – Relevant and appropriate	State Board Resolution 68-16

Actions	Requirements	Prerequisites	Citation for Federal Requirements	Citation for California Requirements
Groundwater Treatment at the IGWTS and IWTP with Discharge to the E/P Ponds (continued)	Must take action to conserve threatened species; must not destroy or adversely modify the critical habitat of the valley elderberry longhorn beetle (*Desmocerus califomicus dimorphus*); consultation with the Department of Interior (DOI).	Critical habitat upon which a federally threatened species depends	Endangered Species Act of 1973 (16 USC 1531 et seq.); 50 CFR 402; Fish and Wildlife Coordination Act (16 USC 661 et seq.); and.33 CFR 320.330 – Applicable	
Disposal of Treatment Residuals	Hazardous waste that is transported offsite for disposal must be received by a hazardous waste facility that has an appropriate and valid Hazardous Waste Facility Permit or that is otherwise authorized by the State Department of Health Services. Waste must be packaged and transported according to RCRA, U.S. Department of Transportation (DOT), and California Highway Patrol requirements.	Off-site disposal of hazardous waste Transportation of hazardous waste across public highway	40 CFR 262; 49 CFR 175, 178, and 179 – Applicable if the treatment residues are hazardous waste and they are disposed of offsite.	Title 22, CCR Division 4.5, Chapter 13, §66263,23(b) – Applicable if the treatment residues are hazardous waste and they are disposed of offsite. Title 22, CCR Division 4.5, Chapter 13, §66263.23(b) – Applicable if the treatment residues are hazardous waste and they are disposed of offsite.
Fugitive Dust Emissions During Excavation and Grading	Application of water, chemicals, or vegetation to control dust emissions. Prevent or expeditiously remove any visible accumulation of mud or dirt from public paved roads, including shoulders, adjacent to the site of the landfill.	Fugitive emissions from construction, demolition, excavation, land clearing, grading, land leveling, cut and fill operations, travel on the site, and travel on access roads to and from the site Landfill disposal site		Rule 8020; Rule 8040; and Rule 8060 – Applicable
Final Cover	Placement of a cover over waste. Pursuant to the Dispute Resolution Agreement reached during negotiations on 11 February 1993, the final cover of the landfill must include: • A foundation soil layer of sufficient stability provided by grading and compacting existing landfill soils.	Closure of any landfill		Substantive provisions of Articles 5 and 8 of Chapter 15 are to be followed as set out in the Dispute Resolution Agreement.

Actions	Requirements	Prerequisites	Citation for Federal Requirements	Citation for California Requirements
Final Cover (continued)	• A 1-ft-thick clay layer consisting primarily of clays from a clean source on the installation. The clay source will be supplemented, as necessary, by off-site clays to produce a clay layer with a design permeability of 1 x 10^6 cm/sec. • Geotechnical data collected from a source at the installation to determine the appropriate ratio of on-site to off-site clays to achieve a design permeability of 1 x 10^6 cm/sec. • A minimum of 1 ft of clean topsoil placed over the clay layer to provide an adequate rooting depth for vegetative cover and protection of the clay layer. • The final cover designed with the objective of minimizing maintenance. • The final cover graded to provide a minimum of 2% slope to minimize ponding of precipitation and provide adequate drainage. • The final cover constructed in accordance with an approved Construction Quality Assurance Plan (CQAP).			
Post-Closure Maintenance	Restrict post-closure use of property as necessary to prevent damage to the cover.	Find closure of a hazardous waste landfill with some hazardous materials or residues left in-place		Substantive provisions of Articles 5 and 8 of Chapter 15 are to be followed as set out in the Dispute Resolution Agreement.
	Post-closure maintenance shall extend as long as wastes pose a threat to water.	Post-closure maintenance requirements for landfills in California		Substantive provisions of Articles 5 and 8 of Chapter 15 are to be followed as set out in the Dispute Resolution Agreement.

Actions	Requirements	Prerequisites	Citation for Federal Requirements	Citation for California Requirements
Post-Closure Maintenance (continued)	Pursuant to the Dispute Resolution Agreement reached during negotiations on February 11, 1993, the following actions during post-closure maintenance must be taken: • The final cover will be maintained to ensure its integrity and effectiveness for a period of 20 years. • **A 5-year review process** under the RBAAP FFA will be used to evaluate whether continued maintenance of the cover is necessary to protect human health and the environment, including water quality **after the 20-year maintenance period** (see ROD). • One or two additional monitoring wells will be installed at the point of compliance to protect beneficial uses of the groundwater.			
Well Construction for Contained Groundwater Monitoring	The construction of all monitoring wells must comply with the California Well Standards construction requirements.	Construction of monitoring wells		California Well Standards, Bulletins 74-81 and 74-90 – Applicable

Attachment 4

Photographs Documenting Site Conditions

Photo 1
Groundwater Treatment Plant

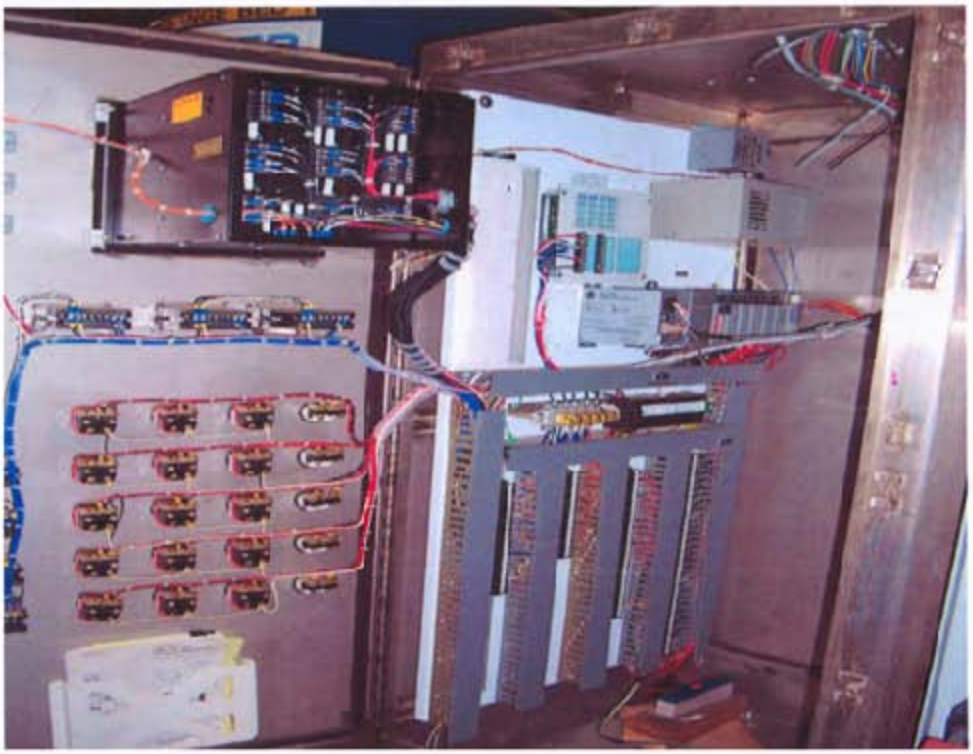

Photo 2
GWTS Control System Panel

Photo 3
GWTS Ion Exchange System

Photo 4
Ion Exchange Regeneration Tanks

Photo 5
Offsite Monitoring Wells - 107 Series Wells

Photo 6
Offsite Extraction Well MW109B

Photo 7
Offsite Extraction Wells and Control System - 109 Series Wells

Photo 8
Offsite Extraction Wells and Control System, and Animal Burrows - 113 Series Wells

Photo 9
Central Landfill Area with View to North

Photo 10
Landfill Drainage, Eastern Side Looking South

Photo 11
Landfill Drainage, Northern Side of Landfill

Photo 12
Landfill Drain and Animal Burrows

ATTACHMENT 5

PUBLIC NOTICE

Modesto Bee

5-19-06

PUBLIC NOTICES

Department of the Army, Riverbank Army Ammunition Plant

The second Five-year Review Report for the Riverbank Army Ammunition Plant in Riverbank, California is being developed and will be released for public review on August 1, 2006. The U.S. Army has conducted the five-year review of the environmental remedial actions implemented at the Riverbank Army Ammunition Plant (RBAAP).

Since 1980, the Army has been conducting investigations of past plant operations at RBAAP under the Installation Restoration Program. Investigations led to RBAAP being placed on the National Priorities List (NPL) in February 1990 due to chromium and cyanide contamination found in the groundwater. In 1994, the Army's Installation Restoration Program at RBAAP concluded that a groundwater extraction and treatment system was the preferred approach to treat the chromium (primarily in hexavalent form) and cyanide contamination associated with past operations that had contaminated groundwater both on and off the RBAAP facility. The systems for addressing contamination in the groundwater have been operational for the last 10 years.

The Five-year Review Report process includes the opportunity for public review. The Five-year Review report will be available for public review for a period of 30 days beginning on August 1, 2006. The report will be available for review at:

Stanislaus County Library
Riverbank Branch
3442 Sante Fé Street
Riverbank, CA 95367
(209) 869-7008

The Environmental Protection Agency and the Department of Toxic Substances Control provide oversight for the cleanup activities. The Army Corp of Engineers provides management and technical expertise to the cleanup activities at RBAAP:

Paul Zianno, Contracting Officer Technical Representative
United States Army Corps of Engineers
(USACE) (916) 557-6993

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The Modesto Bee

PUBLIC NOTICES

Home

DEPARTMENT OF THE ARMY, RIVERBANK ARMY AMMUNITION

Department of the Army, Riverbank Army Ammunition Plant The second Five-year Review Report for the Riverbank Army Ammunition Plant in Riverbank, California is being developed and will be released for public review on August 1, 2006. The U.S. Army has conducted the five-year review of the environmental remedial actions implemented at the Riverbank Army Ammunition Plant (RBAAP). Since 1980, the Army has been conducting investigations of past plant operations at RBAAP under the Installation Restoration Program. Investigations led to RBAAP being placed on the National Priorities List (NPL) in February 1990 due to chromium and cyanide contamination found in the groundwater. In 1994, the Army's Installation Restoration Program at RBAAP concluded that a groundwater extraction and treatment system was the preferred approach to treat the chromium (primarily in hexavalent form) and cyanide contamination associated with past operations that had contaminated groundwater both on and off the RBAAP facility. The systems for addressing contamination in the groundwater have been operational for the last 10 years. The Five-year Review Report process includes the opportunity for public review. The Five-year Review report will be available for public review for a period of 30 days beginning on August 1, 2006. The report will be available for review at: Stanislaus County Library Riverbank Branch 3442 Sante Fe Street Riverbank, CA 95367 (209) 869-7008 The Environmental Protection Agency and the Department of Toxic Substances Control provide oversight for the cleanup activities. The Army Corp of Engineers provides management and technical expertise to the cleanup activities at RBAAP: Paul Zianno, Contracting Officer Technical Representative United States Army Corps of Engineers (USACE)(916) 557-6993

Appeared in: ***Modesto Bee*** on Friday, 05/19/2006

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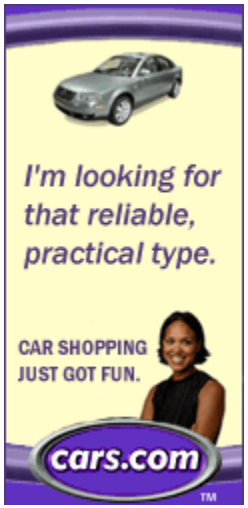

ATTACHMENT 6

EVALUATION OF THE ECOLOGICAL RISK

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 9
75 Hawthorne Street
San Francisco CA 94105-3901

Memorandum

DATE: 28 November 2005

FROM: Ned Black, Ph.D.
Regional CERCLA Ecologist/Microbiologist, SFD-8-4

TO: Xuan-Mai Tran, Remedial Project Manager, SFD-8-3
Cynthia Wetmore, Regional CERCLA Engineer, SFD-8-4

SUBJECT: Evaluation of ecological risk for the Five Year Review of Riverbank Army Ammunition Plant

The original evaluation of ecological risk at this site remains valid. Therefore, the remedy under five year review for this site is adequately protective of the environment.

The details of this evaluation are as follows.

Site name: Riverbank Army Ammunition Plant
EPA ID# CA7210020759 **Location:** 10mi northeast of Modesto, California
ROD date: 17 March 1994
5-year review date: 24 September 2006
Was there an ERA?
Yes. (summary in section 2 of ROD- rpt not found)
Were any ecological receptors evaluated?
Earthworms and plants.
Were sensitive habitats (per the NCP) evaluated?
Yes. There are evaporation/percolation (E/P) ponds in a riparian habitat and EPA asked the Army not to develop the surrounding area further. The same area may contain seasonal wetlands as well.
What contaminants are present at the surface?
cyanide, chromium, zinc, fluoride, thallium
Were complete exposure pathways considered?
No. Concentrations in soils were only compared to TRVs.
Is a Section 7 (ESA) consultation letter or documentation of informal Section 7 consultation on file?
No.
Can the statement that the remedy is "protective of the environment" be supported?
Yes.

List of eco-relevant documents (Itx #s):

9-30-1992	draft final feasibility study rpt	3135-00002
3-16-1994	Record of Decision (ROD)	3135-00032

List of other documents looked at (Itx #s):

4-30-1987	final rpt: remedial investigation of RBAAP	3135-00006
8-15-1996	5-year review rpt, RBAAP	3135-00096
2-20-2001	5-year review rpt	(Doc ID) 126805

Comments:

Riverbank Army Ammunitions Plant is an operating manufacturer of grenades and formerly produced aluminum sheeting and various ammunitions. The site is 173 acres and includes various plant facilities, a landfill, and evaporation/percolation (E/P) ponds. The surrounding area is primarily rural and the north section is bordered by the Stanislaus River.

As a result of the aluminum manufacturing process, the landfill was filled with pot liner containing cyanide. Cyanide leached into the groundwater aquifer. The remaining soil did not have high levels of contaminants- but the fragments of pot liner were removed anyway. The landfill was covered with a RCRA equivalent cap and seeded with native grasses to prevent rain from soaking into the landfill and leaching more contaminants into the groundwater as well as limit direct contact with soils.

The E/P ponds located on the banks of the Stanislaus River had high levels of zinc. They were excavated with care, as Phase I Ecological Risk Assessment identified the area as healthy riparian habitat supporting various aquatic and terrestrial organisms. A list can be found in the FS.

Chromium, primarily in the hexavalent form, and cyanide are the primary groundwater contaminants. Groundwater is pumped and treated to non-detect levels (<10µg/L) and the effluent is discharged to either the sanitary system drainage or the E/P ponds. As of the last review, the Army was looking into ways to approach the recharging A zone aquifer, which was not being treated as it was dry. A zone soils are contaminated, but at 30 feet bgs they are not expected to be disturbed and do not represent a future exposure pathway.

One possible concern is the use of a few open off-site wells for irrigation. Flora watered with contaminated water may represent a complete exposure pathway. Other wells, used for residential use, have been closed or are used for monitoring. Also, it had been assumed that current plant operations would continue, so no future use risks were considered. However, Riverbank Army Ammunitions Plant has been approved for closure by the 2005 BRAC committee.

ATTACHMENT 7

RESPONSE TO COMMENTS
(RTC)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105

December 20, 2005

Mr. Paul Zianno
Department of the Army USACE – Sacramento District
1325 J Street, CESPK-PM-M
Sacramento, CA 95814-2922

Re: Review of the Draft Second Five-Year Review Report for Riverbank Army Ammunition Plant, City of Riverbank, California, November 2005

Dear Mr. Zianno:

The U.S. Environmental Protection Agency (EPA) Region 9 has received the Draft Second Five-Year Review Report for Riverbank Army Ammunition Plant, City of Riverbank, California, dated November 2005. We have reviewed the aforementioned document and our comments are enclosed.

If there are any questions, please contact me at (415) 972-3002.

Sincerely,

Xuan-Mai Tran
Remedial Project Manager
Federal Facilities and Site Cleanup Branch

cc: (See Distribution List)

Enclosure

RIVERBANK AMRY AMMUNITION PLANT DISTRIBUTION LIST

Jim Pinasco
Department of Toxic Substances Control
8800 Cal Center Drive
Sacramento, CA 95826-3200

Brian Taylor
State of California, Regional Water Quality Control Board
Central Valley Region
11020 Sun Center Drive, #200
Rancho Cordova, CA 95670-6114

Linda Gumas
Riverbank Army Ammunition Plant
P.O. Box 670
Riverbank, CA 95367-0670

Mike Kipp
Department of the Army, SFIM-AEC-CDS
5179 Hoadley Road
Aberdeen Proving Ground, MD 21010-5401

Jim Gansel
SOTA Environmental Technology
2116 Churchill Avenue
Modesto, CA 95350-2700

Christine Dougherty
Ahtna Government Services Corporation
3680 Industrial Boulevard, Suite 600H
West Sacramento, CA 95691-6504

Neil Morgan-Butcher
ARCADIS G&M Inc.
155 Montgomery Street, Suite 1510
San Francisco, CA 94104-4120

Review of Draft Second Five-Year Review Report for
Riverbank Army Ammunition Plant
City of Riverbank, California
November 2005

GENERAL COMMENTS

1. The Riverbank Army Ammunition Plant (RBAAP) is now officially on the Base Realignment and Closure (BRAC) list. Please update all the text in the Draft Second Five-Year Review Report (the Report) to reflect the current status for the RBAAP as a BRAC site.

2. A signature page for all agencies' signatures (e.g., the Army, EPA, Department of Toxic Substances Control, and Regional Water Quality Control Board) needs to be included in the Report. It should follow the site-wide protectiveness statement. A sample of the signature page will be forwarded to the Army via email.

3. It is not clearly documented in the Report whether the administrative components (e.g., notification of potentially interested parties of initiation of review process, etc.) and community involvement (e.g., community involvement prior and post review, community involvement activities such as notices, fact sheets, etc.) were carried out during and after the review. Please provide this information within the Report.

4. The Report needs to be more specific about what type of institutional controls (ICs) have been implemented at the site. Without knowing more specifics, we can not evaluate if the ICs are effective. Are there any land use covenants in place, and have there been any amendments to the Base Master Plan (BMP)? If a land use covenant has been prepared and recorded, it should be attached as an appendix to the Report. If amendments to the BMP have been made to incorporate the ICs, a reference to the BMP should be made.

5. The Report should indicate if a land use covenant implementation plan has been prepared for the site.

6. The ROD identifies ICs as part of the remedy for the landfill, but is silent on whether ICs are appropriate for the rest of the site. Site conditions at the rest of the site need to be evaluated to make sure whether they are protective without ICs. The Report states that the site is used for industrial use, but without a land use covenant or other appropriate form of ICs, that use could change to residential. If any area was clean enough for continued industrial use but not clean enough for residential use, then ICs would be needed to ensure no inappropriate future use occurs (i.e., it must remain industrial use). Also, are there currently any well drilling prohibitions, restrictions on use of existing wells, or restrictions on groundwater usage? Some types of ICs are needed to prevent inappropriate use of currently contaminated groundwater.

7. According to the ROD summary provided in the Report, it does not appear that the ROD called for any of the ICs or other control measures discussed in the Report. If ICs are required for the remedy to be protective and if they are not in place, the Army should evaluate whether an Explanation of Significant Differences or a ROD Amendment will be needed to document any ICs that were not identified in the ROD.

8. ICs are needed at the landfill whether or not the base closes. Please provide information on the ICs for the landfill.

9. The Army should evaluate if ICs are needed to prevent anyone from using the contaminated groundwater while the groundwater remediation is ongoing. Such ICs could consist of existing "governmental ICs," which are ICs that rely on existing well permitting systems in place at the city or county level. The Army needs to include the recommendations in the specific comments to analyze the possible ICs for the groundwater and select an appropriate one. The effort to identify the appropriate ICs could consist of looking up the existing regulations already on the books at the local level, and talking to the local jurisdiction to see if they are aware of the contamination. The result could be that the local jurisdiction needs to pass a new policy that recognizes the contamination and assures no well permits would be given in that area.

10. The Report should state who is responsible for ongoing monitoring and enforcement of the ICs.

11. The warning signage can be considered to be an "informational institutional control," but the fencing is an engineering control (not institutional), and a security guard is more of an O&M activity. Please clarify the types of ICs in the Report.

12. The RCRA Consent Agreement for the IWTP area can be considered an "enforcement institutional control." Please clarify the type of IC in the Report.

13. If land-use zoning is to be considered an IC, as implied by this Report, it will have to be described and discussed further in the Report.

14. The position the Army takes in the Report on the status of the A zone is not clear and appears somewhat contradictory. The Report says both that the Army is awaiting results from the technology review and that supplemental actions in the A zone are unnecessary. The current plans for addressing the A zone and the current status of the technology evaluation should be clarified.

15. There is increased residential development in the area of the site and there are "currently" no drinking water wells operating within the area of contamination. Is there a possibility that drinking water wells could be sited in the area of contamination in the future? What is being done, or can be done, to ensure that no wells are sited in the area of contamination in the future.

16. In May of 2003, the House of Representatives, Committee on Energy and Commerce requested that DOD provide a survey of perchlorate use of all DOD facilities. Since the RBAAP is a military site that manufactured ammunition, including grenades, there is reason to be concerned that perchlorate may have been used/disposed at the site. EPA understands that perchlorate sampling was conducted at the site as part of the remedial investigation. Since that time, however, the sampling methodology and reference dose have changed, calling into question the reliability of the original sampling. Please describe and/or provide documentation of any perchlorate sampling or monitoring that the Army has conducted at the site since the ROD was signed in 1994.

17. The ROD indicates that the landfill cap will be maintained to ensure its integrity for a period of 20 years. Please provide information on the long term maintenance that will be needed after this 20 years period is over.

SPECIFIC COMMENTS

1. Executive Summary (page ES-1): The report states that ICs at the landfill remain in place and are effective. It is not clear what form the ICs take. Please provide specific descriptions of the ICs. In the recommendation section of the Report, it states that deed restrictions will need to be implemented if the site is closed. Does this refer to deed restrictions for the landfill or deed restrictions for the rest of the site? The ICs need to be specifically described so the protectiveness statement can be evaluated.

2. Executive Summary, Landfill section (page ES-1): Please edit the second through last sentences as follows, *"Institutional controls and access controls at the landfill remain in place and are effective. The access controls at the RBAAP facility ~~is~~ consist of ~~fully fenced~~ fencing, ~~and access is controlled through~~ a manned gate and security patrols. The institutional control consists of warning signs ~~are in place~~ at the landfill. The landfill remedy is currently protective of human health and the environment, but deed restrictions are required in order for the remedy to remain protective in the long term."*

3. Executive Summary, Groundwater section (page ES-1): Please edit the last sentence as follows, *"The groundwater remedial action is currently protective of human health and the environment, but some form of institutional control is needed to prevent inappropriate use of the contaminated groundwater while the groundwater remediation is occurring."*

4. Five-Year Review Summary Form, Issues section (page ES-3): Please replace the first bullet to read as follows, *"There are no institutional controls in place for the landfill area to prevent inappropriate uses in the future that could impact the integrity of the cap."*

   Please add a bullet stating the following, *"There are no institutional controls in place to ensure that no inappropriate use of contaminated groundwater occurs while the groundwater remediation is occurring."*

5. Five-Year Review Summary Form, Recommendations and Follow-up Actions section (page ES-3): Please replace the first bullet to read as follows, *"Implement deed restrictions at the landfill area."*

   Please add a bullet stating the following, *"Analyze options for groundwater institutional controls; select and implement ICs to restrict residential use of the site if appropriate."*

6. Five-Year Review Summary Form, Protectiveness Statement (page ES-4): Please edit as follows, *"The landfill remedial action is currently protective, based on . . . The groundwater remedial action is operating as designed and is currently protective. However, in order for the remedy to remain protective in the long term, institutional controls must be implemented as follows: Deed restrictions that prevent inappropriate use of the landfill area are needed and some form of institutional control is needed to prevent inappropriate uses of the groundwater while the remediation is occurring."* Please delete the last sentence, *"Because both of the . . ."* Please delete the Long-Term Protectiveness section.

7. Introduction (page 2): Please delete the sentence "However, the Army agreed with EPA to complete the second review by December 31, 2005", since this Report will not be finalized and concurred by December 31, 2005.

8. Investigation of areas under IWTP (page 13): Since the RBAAP is closed under BRAC, the IWTP Source Investigation should be completed. This should be included as an issue in the issue section and a recommendation that the IWTP investigation be completed soon.

9. Section IV – Remedial Actions, Remedy Implementation subsection, 1st paragraph (page 13): Did the Closure and Post-Closure Maintenance Plan include the access controls and warning signage? Please add a paragraph, somewhere in this subsection, to describe the access controls and warning signage. Please confirm whether it was specified in the aforementioned plan.

10. Potential Toxicity Changes (page 28): EPA agrees that its policy is to not change a standard after the ROD has been issued unless there is a change in the underlying assumptions made during the ROD (i.e. change in exposure, change in toxicity, etc.). Although there has not been a change as of now, EPA has initiated a reassessment of the health risks associated with cyanide. EPA would like this Report to mention that a reassessment is underway and that it will need to be updated in subsequent 5 year reviews after the reassessment is completed.

11. Section VI – Five-Year Review Findings, Data Review subsection (page 29): Are there any security logs or records in the O&M reports (or other location) that document security breaches, if any? If so, please discuss this data somewhere in this Data Review subsection. The security of the landfill and the GWTP are of particular interest. Such a discussion would support the conclusion that the warning signage and access controls are effective at protecting the integrity of the remediation systems. Since the landfill is capped, unauthorized personnel are not likely to be exposed to contamination at the landfill. However, we are concerned with the integrity of the cap itself (and the GWTS). The Inspection subsection does mention that no significant cap damage was observed, and that the fencing was secure and is closely monitored.

12. Groundwater Capture: Page 35 states "In the A- and A'-zones, the figures indicate that a small portion of the groundwater from the cyanide and MW49A chromium source areas could potentially flow between well MW109B and the EW113 wells. Down gradient wells monitor this area and would detect groundwater not captured before it would cross the facility boundary." The only well down gradient is MW104B, but Figures 5 & 6 show that this down gradient well would not detect any release. Please provide information to support the statement that groundwater not captured would be detected. Also, please indicate how the RBAAP plans to obtain complete capture.

13. Section VII – Technical Assessment, Question A, Implementation of Institutional Controls and Other Measures section (page 40): Please revise the section to read as follows, *"The institutional control at the site, as specified in the ROD, consists of a RCRA Consent Agreement requiring the "Post-ROD" future activity of investigating and mitigating (if needed) the soils beneath the IWTP source area. Although not specifically required by the ROD, site security actions, including warning signage, security fencing, and limited access to the entire facility, have been implemented at the landfill cap and GWTP areas on the site. Of the security actions, the signage can be considered an "institutional control," working in conjunction with other controls (fencing, security guards).*

    The site access controls are in place and have been successful in preventing unauthorized access to the landfill cap and GWTP areas. This has prevented any damage to the remedial systems that could be caused by unauthorized entry. The owner envisions implementing deed restrictions at the landfill, to ensure continued integrity of the landfill cover, since the RBAAP is closed under the BRAC 2005 recommendations.

The IWTP source area and its associated wastewater influent pipeline systems remain capped by concrete, asphalt, and buildings. If the IWTP is closed pursuant to RCRA, additional investigation of conditions in these areas will be required under the RCRA program Consent Agreement to evaluate the need for supplemental remedial actions.

The landfill and the IWTP areas continue to be owned and controlled by the U.S. government. There are no current plans to transfer these properties; however, the site has been listed in the BRAC list, property ownership of the site might change. The land use at RBAAP continues to be commercial and industrial use by the Army, its contractor NI Industries, and various private companies that lease space at the facility. There are no plans underway by the local jurisdictions to change the land use at the RBAAP.

No institutional controls are in place or were selected in the ROD to prevent exposure to the contaminated groundwater while the groundwater remediation process is underway."

14. Section VII – Technical Assessment, Question C (page 43): Please edit to read as follows, *"New information has come to light as follows: No ICs are in place to protect against the future use of contaminated groundwater while the groundwater is undergoing remediation. In addition, no ICs are in place that would protect against future use of the landfill for inappropriate uses or to restrict the site to industrial use. As mentioned earlier in this section, however, the owner has indicated that it envisions implementing deed restrictions on the landfill area if the RBAAP is closed, per 2005 BRAC recommendations. It is also noted that the ROD does not require either type of IC mentioned above."*

15. Section VII – Technical Assessment, Technical Assessment Summary subsection, last sentence (page 43): Please delete the last sentence and replace it with the following, *"However, some form of institutional control is needed to ensure no unacceptable exposure to contaminated groundwater occurs during the groundwater remediation process. Also, deed restrictions at the landfill cap area are needed in order to protect the integrity of the cap in the future."*

16. Additional Technology Assessment: Under Recommendations and Follow-up on page ES-3, the Report states that 'The Army also intends to complete ongoing remedial technology evaluations and make recommendations on the need for and type of additional remedial actions" However, on page 38, the Report states "Although the evaluation of ozone has not been completed, injection of sodium dithionite has apparently been effective in reducing hexavalent Chromium. Based on current declining groundwater trends and the post-ROD action requirements, continued evaluation of potential supplemental actions in the A-zone appears to be unnecessary."

EPA would support continued analysis of in-situ technologies and has had success with sodium dithionite injection. Although this assessment is not considered an issue, still EPA believes that a recommendation that this technology assessment be finished should be included. In light of the proposed closure and the continued pump and treat O&M costs, it makes sense to investigate remedies that potentially reduce the need for on-going pump and treat after the facility changes ownership. The Army should clarify the document as to what it intends to do regarding additional technology assessment.

17. Section VIII - Issues, Table 6 (page 44): Please replace the first row to read as follows, *"There are no institutional controls in place for the landfill area to prevent inappropriate uses in the future that could impact the integrity of the cap. No. Yes."*

Please add a row to the table, stating the following, *"There are no institutional controls in place to ensure that no inappropriate use of contaminated groundwater occurs while the groundwater remediation is occurring. No. Yes."*

18. Section IX – Recommendations and Follow-up Actions, Table 7 (page 45): Please replace the first row to read as follows, *"Implement deed restrictions."*

    Please add a row to the table, stating the following, *"Analyze options for groundwater institutional controls; select and implement appropriate ICs."*

19. Section X – Protectiveness Statements, 1st paragraph (page 47): Please edit the third through last sentences as follows, *"The landfill remedial action is currently protective of human health and the environment. The groundwater remedial action is operating as designed and is currently protective of human health and the environment. ~~Accordingly, the remedy for RBAAP is protective of human health and the environment.~~ However, in order for the remedy to remain protective in the long term, institutional controls must be implemented as specified below."*

20. Section X – Protectiveness Statements, Landfill subsection (page 47): Please edit the last sentence as follows, *"The landfill remedy is currently protective of human health and the environment. However, in order to ensure continued protectiveness, deed restrictions that prevent inappropriate use of the landfill area are needed."*

21. Section X – Protectiveness Statements, Groundwater subsection (page 47): Please edit the last sentence as follows, *"The groundwater remedial action is currently protective of human health and the environment. However, in order to ensure continued protectiveness during the groundwater remediation, some form of institutional control is needed to prevent inappropriate uses of the groundwater."*

    Please delete the last paragraph of the section, *"Long-term protectiveness . . ."*

22. Groundwater Data: It would be helpful to have a table with the actual quarterly data from each well. Plates 1-3 contain contours from past quarter's data but present only the current data. For example, MW13A is shown as not sampled but it is in the center of 2000 ppb cyanide contour.

23. Ecorisk Screening: There was no ecorisk assessment screening documented in the Report. Ned Black, Regional CERCLA Ecologist/Microbiologist, has completed the ecorisk screening for RBAAP (please see the attachment). It should be included as an appendix of the Report and the conclusions should be mentioned in the body of the text.

Response to EPA Comments on Draft Second Five-Year Review Report for Riverbank Army Ammunition Plant
City of Riverbank, California
November 2005

GENERAL COMMENTS

Comment 1. The Riverbank Army Ammunition Plant (RBAAP) is now officially on the Base Realignment and Closure (BRAC) list. Please update all the text in the Draft Second Five-Year Review Report (the Report) to reflect the current status for the RBAAP as a BRAC site.

Response: The text in the Report will be reviewed and updated as necessary to reflect the current BRAC status of the RBAAP site.

Comment 2: A signature page for all agencies' signatures (e.g., the Army, EPA, Department of Toxic Substances Control, and Regional Water Quality Control Board) needs to be included in the Report. It should follow the site-wide protectiveness statement. A sample of the signature page will be forwarded to the Army via email.

Response: A signature page will be included in the Report following the site-wide protectiveness statement.

Comment 3. It is not clearly documented in the Report whether the administrative components (e.g., notification of potentially interested parties of initiation of review process, etc.) and community involvement (e.g., community involvement prior and post review, community involvement activities such as notices, fact sheets, etc.) were carried out during and after the review. Please provide this information within the Report.

Response: Following regulatory agency acceptance of this Response to Comments on the Draft Second Five-Year Review Report, a public meeting will be held to fully advise the interested parties of the review process. This meeting also will include an update of the recent actions taken. An administrative record is kept at the RBAAP, which is always available for review by the public. Recent community involvement has been limited to visits to several local residents to provide questions that result in an exchange of information regarding the progress of the RBAAP program. The completion of notices, fact sheets and meetings has not been accomplished at this time due to the high volume of changes and additions being implemented in this revised 5-year review. Again, following regulatory agency approval of this document, all will be implemented immediately. Also, due to the complexity of information for this review, an effective exchange of information is more readily accomplished with an open public meeting o the interested parties.

Comment 4. The Report needs to be more specific about what type of institutional controls (ICs) have been implemented at the site. Without knowing more specifics, we cannot evaluate if the ICs are effective. Are there any land use covenants in place, and have there been any amendments to the Base Master Plan (BMP)? If a land use covenant has been prepared and recorded, it should be attached as an appendix to the Report. If amendments to the BMP have been made to incorporate the ICs, a reference to the BMP should be made.

Response: The Army has implemented, maintained and enforced land use controls [LUCs] consistent with the selected remedial actions in the 1994 Record of Decision for the Riverbank Army Ammunition Plant. To address the comments on the Draft second 5-year review related to LUC [IC] issues and as previously planned, the Army will develop a document to serve as a property management plan to address all relevant and necessary LUCs associated with the RBAAP remedial actions as described in the ROD and/or with the existing RCRA Permit. With respect to the comments related to the need for ICs to prevent future use of groundwater, the Army will further research possible existing county or city ordnances regarding well regulations/restrictions which may act as an IC for groundwater. However, it should be noted that contaminant concentrations off-post are currently below MCLs and all residences within the extent of contaminated groundwater were provided with public water. If there are no existing city or county ordnances in place and since the contaminant concentrations are now below cleanup levels, the need for ICs to restrict future groundwater use seem potentially unwarranted and would be difficult to implement short of purchasing water rights.

The Plan will identify land use controls with specific implementation actions to used to implement (if not already done), maintain and enforce the LUCs by the Army, by a subsequent property owner and users resulting from transfer process under BRAC 05, and potentially the state and local jurisdictions. The Plan will describe several LUC objectives, the LUC, and the location where the LUC is or will be applied. The implementation actions may include, but not be limited to, CERCLA 121(c) five-year remedy reviews with periodic monitoring and reports, notification to regulators prior to modification or termination of LUCs, generating a map showing the areas where LUCs are implemented and identification of POCs at the facility. In addition the Plan will integrate the Army standardized Finding of Environmental Suitability notification procedure in advance of leasing or transferring the property under BRAC 05. The Report will be revised to include the concept of a property management plan with additional details and recommendations for appropriate sites.

Based on current projections this plan will be developed and provided to the regulatory agencies for review and finalized in FY06.

Comment 5. The Report should indicate if a land use covenant implementation plan has been prepared for the site.

Response: See response to General Comment 4.

Comment 6. The ROD identifies ICs as part of the remedy for the landfill, but is silent on whether ICs are appropriate for the rest of the site. Site conditions at the rest of the site need to be evaluated to make sure whether they are protective without ICs. The Report states that the site is used for industrial use, but without a land use covenant or other appropriate form of ICs, that use could change to residential. If any area was clean enough for continued industrial use but not clean enough for residential use, then ICs would be needed to ensure no inappropriate future use occurs (i.e., it must remain industrial use). Also, are there currently any well drilling prohibitions, restrictions on use of existing wells, or restrictions on groundwater usage? Some types of ICs are needed to prevent inappropriate use of currently contaminated groundwater.

Response: See response to General Comment 4.

Comment 7. According to the ROD summary provided in the Report, it does not appear that the ROD called for any of the ICs or other control measures discussed in the Report. If

ICs are required for the remedy to be protective and if they are not in place, the Army should evaluate whether an Explanation of Significant Differences or a ROD Amendment will be needed to document any ICs that were not identified in the ROD.

Response: The ROD does identify access and deed restrictions with respect to the Landfill on Page 2-96. As stated in response to comment 4, the Army will provide a property management plan to address all relevant and necessary LUCs associated with RBAAP.

Comment 8. ICs are needed at the landfill whether or not the base closes. Please provide information on the ICs for the landfill.

Response: See response to General Comment 4.

Comment 9. The Army should evaluate if ICs are needed to prevent anyone from using the contaminated groundwater while the groundwater remediation is ongoing. Such ICs could consist of existing "governmental ICs," which are ICs that rely on existing well permitting systems in place at the city or county level. The Army needs to include the recommendations in the specific comments to analyze the possible ICs for the groundwater and select an appropriate one. The effort to identify the appropriate ICs could consist of looking up the existing regulations already on the books at the local level, and talking to the local jurisdiction to see if they are aware of the contamination. The result could be that the local jurisdiction needs to pass a new policy that recognizes the contamination and assures no well permits would be given in that area.

Response: According to the 1994-ROD institutional controls were not specified as a component of the groundwater remedy although the Permanent Potable Water Supply (PPWS) response action provided residents with a public water supply for domestic use and limits use of groundwater for irrigation only. As suggested by the comment, the Army will determine if there are any official restrictions through the city or county and further assess the need for some form of IC in the forthcoming property management plan.

Comment 10. The Report should state who is responsible for ongoing monitoring and enforcement of the ICs.

Response: See response to General Comment 4.

Comment 11. The warning signage can be considered to be an "informational institutional control," but the fencing is an engineering control (not institutional), and a security guard is more of an O&M activity. Please clarify the types of ICs in the Report.

Response: The types of IC's will be addressed and clarified in the text.

Comment 12. The RCRA Consent Agreement for the IWTP area can be considered an "enforcement institutional control." Please clarify the type of IC in the Report.

Response: See response to General Comment 4. The RCRA Consent Agreement for the IWTP will be identified as an enforcement IC.

Comment 13. If land-use zoning is to be considered an IC, as implied by this Report, it will have to be described and discussed further in the Report.

Response: See response to General Comment 4. It is the Army's intention to provide details concerning LUCs in the property management plan.

Comment 14. The position the Army takes in the Report on the status of the A zone is not clear and appears somewhat contradictory. The Report says both that the Army is awaiting results from the technology review and that supplemental actions in the A zone are unnecessary. The current plans for addressing the A zone and the current status of the technology evaluation should be clarified.

Response: The Army will clarify the text to indicate that the A-zone supplemental action evaluations are unnecessary and have been discontinued.

Comment 15. There is increased residential development in the area of the site and there are "currently" no drinking water wells operating within the area of contamination. Is there a possibility that drinking water wells could be sited in the area of contamination in the future? What is being done, or can be done, to ensure that no wells are sited in the area of contamination in the future.

Response: See response to General Comment 9.

Comment 16. In May of 2003, the House of Representatives, Committee on Energy and Commerce requested that DOD provide a survey of perchlorate use of all DOD facilities. Since the RBAAP is a military site that manufactured ammunition, including grenades, there is reason to be concerned that perchlorate may have been used/disposed at the site. EPA understands that perchlorate sampling was conducted at the site as part of the remedial investigation. Since that time, however, the sampling methodology and reference dose have changed, calling into question the reliability of the original sampling. Please describe and/or provide documentation of any perchlorate sampling or monitoring that the Army has conducted at the site since the ROD was signed in 1994.

Response: While it is true that RBAAP has manufactured various ammunition requirements since its existence, none of the production operations have included any manufacture of explosive or included the loading of that same explosive. The past and present production operations have only included the manufacture of the metal parts for the ammunition case or projectile. In the case of the grenade produced at RBAAP, again, this only included the metal parts for the body of the grenade.

When the Army undertook the sampling effort to address any possible sites where perchlorate might be found, RBAAP was exempted from any sampling requires due to the fact that no possible use or spill of perchlorate had ever taken place at this installation.

Comment 17. The ROD indicates that the landfill cap will be maintained to ensure its integrity for a period of 20 years. Please provide information on the long-term maintenance that will be needed after this 20 years period is over.

Response: The five-year review process will be used at the end of the 20-year period to evaluate whether continued maintenance of the landfill cap cover is necessary to protect human health and the environment, including water quality.

SPECIFIC COMMENTS

Comment 1. Executive Summary (page ES-1): The report states that ICs at the landfill remain in place and are effective. It is not clear what form the ICs take. Please provide specific descriptions of the ICs. In the recommendation section of the Report, it states that deed restrictions will need to be implemented if the site is closed. Does this refer to deed restrictions for the landfill or deed restrictions for the rest of the site? The ICs need to be specifically described so the protectiveness statement can be evaluated.

Response: See response to General Comment 4.

Comment 2. Executive Summary, Landfill section (page ES-1): Please edit the second through last sentences as follows, *"Institutional controls and access controls at the landfill remain in place and are effective. The access controls at the RBAAP facility ~~is~~ consist of ~~fully fenced~~ fencing, ~~and access is controlled through~~ a manned gate and security patrols. The institutional control consists of warning signs ~~are in place~~ at the landfill. The landfill remedy is currently protective of human health and the environment, but deed restrictions are required in order for the remedy to remain protective in the long term."*

Response: See response to General Comment 9.

1. Executive Summary, Groundwater section (page ES-1): Please edit the last sentence as follows, "*The groundwater remedial action is currently protective of human health and the environment, but some form of institutional control is needed to prevent inappropriate use of the contaminated groundwater while the groundwater remediation is occurring."*

Response: See response to General Comment 9.

2. Five-Year Review Summary Form, Issues section (page ES-3): Please replace the first bullet to read as follows, *"There are no institutional controls in place for the landfill area to prevent inappropriate uses in the future that could impact the integrity of the cap."*

   Please add a bullet stating the following, *"There are no institutional controls in place to ensure that no inappropriate use of contaminated groundwater occurs while the groundwater remediation is occurring."*

Response: Since the Army intends to provide a detailed property management plan, which will identify and address LUC implementation related to current and future use the following statements are suggested in place of the text provided:

"Although there are currently no institutional controls in place for the landfill area to prevent inappropriate uses in the future that could impact the integrity of the cap, the Army intends to identify LUCs which will be documented in the Property Management Plan. The Plan will identify land use controls with specific implementation actions to used to implement (if not already done), maintain and enforce the LUCs by the Army, by a subsequent property owner and users resulting from transfer process under BRAC 05, and potentially the state and local jurisdictions.

"Although there are currently no institutional controls in place to ensure that no inappropriate use of contaminated groundwater occurs while the groundwater remediation is occurring the

Army intends to analyze options for groundwater institutional controls, identify any necessary LUCs and document the results in the Property Management Plan.

3. Five-Year Review Summary Form, Recommendations and Follow-up Actions section (page ES-3): Please replace the first bullet to read as follows, *"Implement deed restrictions at the landfill area."*

   Please add a bullet stating the following, *"Analyze options for groundwater institutional controls; select and implement ICs to restrict residential use of the site if appropriate."*

Response: The text will be changed as recommended.

4. Five-Year Review Summary Form, Protectiveness Statement (page ES-4): Please edit as follows, *"The landfill remedial action is currently protective, based on . . . The groundwater remedial action is operating as designed and is currently protective. However, in order for the remedy to remain protective in the long term, institutional controls must be implemented as follows: Deed restrictions that prevent inappropriate use of the landfill area are needed and some form of institutional control is needed to prevent inappropriate uses of the groundwater while the remediation is occurring."* Please delete the last sentence, *"Because both of the . . ."* Please delete the Long-Term Protectiveness section.

Response: With respect to groundwater ICs the following text is suggested: *"The landfill remedial action is currently protective, based on . . . The groundwater remedial action is operating as designed and is currently protective. However, in order for the remedy to remain protective in the long term, institutional controls must be implemented as follows: Deed restrictions that prevent inappropriate use of the landfill area are needed and the Army will analyze options for groundwater institutional controls and will document the findings in the property management plan.*

5. Introduction (page 2): Please delete the sentence "However, the Army agreed with EPA to complete the second review by December 31, 2005", since this Report will not be finalized and concurred by December 31, 2005.

Response: The sentence will be deleted as requested.

6. Investigation of areas under IWTP (page 13): Since the RBAAP is closed under BRAC; the IWTP Source Investigation should be completed. This should be included as an issue in the issue section and a recommendation that the IWTP investigation be completed soon.

Response: The IWTP area is a RCRA Part B-permitted facility and must be closed investigated in accordance with RCRA requirements when operations cease at the facility. Additional investigation of the IWTP area may be required under state RCRA requirements, with remediation under the RCRA requirements, and a coordinated cleanup and abatement order issued by Cal-EPA/RWQCB, if warranted. No remedial action was required at the time the ROD was issued because the sampling results from the remedial investigation did not indicate concentrations of inorganics above background levels at the IWTP area. Although the RBAAP facility will be closed under BRAC, there is no current schedule for the implementation of BRAC or RCRA-related activities.

7. Section IV – Remedial Actions, Remedy Implementation subsection, 1st paragraph (page 13): Did the Closure and Post-Closure Maintenance Plan include the access controls and warning signage? Please add a paragraph, somewhere in this subsection, to describe the access controls and warning signage. Please confirm whether it was specified in the aforementioned plan.

Response: According to the Closure and Post-Closure Maintenance Plan, access to the RBAAP site is restricted to employees and authorized vehicles at all times. Although the landfill itself is not fenced, the entire RBAAP property is fenced, gated at all points of access, and all visitors are required to check in at the main gate. The RBAAP is monitored 24-hours a day, 7 days a week.

A paragraph will be added in this subsection to describe the access controls and warning signage at the landfill.

8. Potential Toxicity Changes (page 28): EPA agrees that its policy is to not change a standard after the ROD has been issued unless there is a change in the underlying assumptions made during the ROD (i.e. change in exposure, change in toxicity, etc.). Although there has not been a change as of now, EPA has initiated a reassessment of the health risks associated with cyanide. EPA would like this Report to mention that a reassessment is underway and that it will need to be updated in subsequent 5-year reviews after the reassessment is completed.

Response: A sentence will be added to this section that acknowledges that the EPA has initiated a reassessment of the health risks associated with cyanide and that the results of this reassessment will need to be updated in subsequent 5-year reviews after it is completed.

9. Section VI – Five-Year Review Findings, Data Review subsection (page 29): Are there any security logs or records in the O&M reports (or other location) that document security breaches, if any? If so, please discuss this data somewhere in this Data Review subsection. The security of the landfill and the GWTP are of particular interest. Such a discussion would support the conclusion that the warning signage and access controls are effective at protecting the integrity of the remediation systems. Since the landfill is capped, unauthorized personnel are not likely to be exposed to contamination at the landfill. However, we are concerned with the integrity of the cap itself (and the GWTS). The Inspection subsection does mention that no significant cap damage was observed, and that the fencing was secure and is closely monitored.

Response: Security records for the landfill and GWTP are maintained on both the daily operations report and the weekly operations report by the AGSC treatment plant operator. When the treatment plant operator is not in attendance at the GWTP, the facility is secured and locked. Weekly inspections of the landfill and landfill cap are conducted by the GWTP operator and documented on inspection checklists. There have been no security breaches at the GWTP or the landfill over the past five years. No significant cap damage has been observed or documented during the landfill inspections. Rodent infestations at the landfill have been reduced or eliminated through the implementation of a professional rodent control management program. NI Industries maintains a record of any and all events that occur on each work shift. Incident Reports are generated to report any incident that is considered outside of normal operations and serious incidents are reported to the Commander's Representative and other enforcement agencies, as necessary. There have been no documented security breaches at the RBAAP facility in the past five years. This information will be included in the Inspection subsection of the Report.

10. Groundwater Capture: Page 35 states "In the A- and A'-zones, the figures indicate that a small portion of the groundwater from the cyanide and MW49A chromium source areas could potentially flow between well MW109B and the EW113 wells. Down gradient wells monitor this area and would detect groundwater not captured before it would cross the facility boundary." The only well down gradient is MW104B, but Figures 5 & 6 show that this down gradient well would not detect any release. Please provide information to support the statement that groundwater not captured would be detected. Also, please indicate how the RBAAP plans to obtain complete capture.

Response: The text will be revised to clarify that while the figures do show flow between extraction wells MW109B and EW113, it is the net flow over multiple quarters that is important and capture is being maintained over these longer time periods.

11. Section VII – Technical Assessment, Question A, Implementation of Institutional Controls and Other Measures section (page 40): Please revise the section to read as follows, *"The institutional control at the site, as specified in the ROD, consists of a RCRA Consent Agreement requiring the "Post-ROD" future activity of investigating and mitigating (if needed) the soils beneath the IWTP source area. Although not specifically required by the ROD, site security actions, including warning signage, security fencing, and limited access to the entire facility, have been implemented at the landfill cap and GWTP areas on the site. Of the security actions, the signage can be considered an "institutional control," working in conjunction with other controls (fencing, security guards).*

    The site access controls are in place and have been successful in preventing unauthorized access to the landfill cap and GWTP areas. This has prevented any damage to the remedial systems that could be caused by unauthorized entry. The owner envisions implementing deed restrictions at the landfill, to ensure continued integrity of the landfill cover, since the RBAAP is closed under the BRAC 2005 recommendations.

    The IWTP source area and its associated wastewater influent pipeline systems remain capped by concrete, asphalt, and buildings. If the IWTP is closed pursuant to RCRA, additional investigation of conditions in these areas will be required under the RCRA program Consent Agreement to evaluate the need for supplemental remedial actions.

    The landfill and the IWTP areas continue to be owned and controlled by the U.S. government. There are no current plans to transfer these properties; however, the site has been listed in the BRAC list, property ownership of the site might change. The land use at RBAAP continues to be commercial and industrial use by the Army, its contractor NI Industries, and various private companies that lease space at the facility. There are no plans underway by the local jurisdictions to change the land use at the RBAAP.

    No institutional controls are in place or were selected in the ROD to prevent exposure to the contaminated groundwater while the groundwater remediation process is underway."

Response: The text will be changed.

12. Section VII – Technical Assessment, Question C (page 43): Please edit to read as follows, *"New information has come to light as follows: No ICs are in place to protect against the future use of contaminated groundwater while the groundwater is undergoing*

remediation. In addition, no ICs are in place that would protect against future use of the landfill for inappropriate uses or to restrict the site to industrial use. As mentioned earlier in this section, however, the owner has indicated that it envisions implementing deed restrictions on the landfill area if the RBAAP is closed, per 2005 BRAC recommendations. It is also noted that the ROD does not require either type of IC mentioned above."

Response: The 1994-ROD does identify deed restrictions in the detailed description of the alternative (Alternative 3) page 2-96. The Army suggests the following language: *"New information has come to light as follows: No ICs are in place to protect against the future use of contaminated groundwater while the groundwater is undergoing remediation. In addition, no ICs are in place that would protect against future use of the landfill for inappropriate uses or to restrict the site to industrial use. As mentioned earlier in this section, however, the owner has indicated that it envisions implementing deed restrictions on the landfill areas specified in the 1994 ROD if the RBAAP is closed, per 2005 BRAC recommendations. The Army will analyze options for groundwater institutional controls and will document the ICs for both the Landfill and for groundwater in the forthcoming property management plan."*

13. Section VII – Technical Assessment, Technical Assessment Summary subsection, last sentence (page 43): Please delete the last sentence and replace it with the following, *"However, some form of institutional control is needed to ensure no unacceptable exposure to contaminated groundwater occurs during the groundwater remediation process. Also, deed restrictions at the landfill cap area are needed in order to protect the integrity of the cap in the future."*

Response: The Army suggests the following language: In *order for the remedy to remain protective in the long term, institutional controls must be implemented for the Landfill as identified in the 1994 ROD as a deed restriction and institutional controls will be identified and implemented if appropriate for groundwater. The Army will analyze options for groundwater institutional controls and will document the ICs for both the Landfill and for groundwater in the forthcoming property management plan.*

14. Additional Technology Assessment: Under Recommendations and Follow-up on page ES-3, the Report states that 'The Army also intends to complete ongoing remedial technology evaluations and make recommendations on the need for and type of additional remedial actions." However, on page 38, the Report states "Although the evaluation of ozone has not been completed, injection of sodium dithionite has apparently been effective in reducing hexavalent Chromium. Based on current declining groundwater trends and the post-ROD action requirements, continued evaluation of potential supplemental actions in the A-zone appears to be unnecessary."

EPA would support continued analysis of in-situ technologies and has had success with sodium dithionite injection. Although this assessment is not considered an issue, still EPA believes that a recommendation that this technology assessment be finished should be included. In light of the proposed closure and the continued pump and treat O&M costs, it makes sense to investigate remedies that potentially reduce the need for on-going pump and treat after the facility changes ownership. The Army should clarify the document as to what it intends to do regarding additional technology assessment.

Response: At present, the Army does not intend to complete the evaluation of ozone and sodium dithionite technologies as originally proposed, and will revise the text of the Report to clarify the

current plans. The use of these technologies at RBAAP was focused on treatment of residual unsaturated A-zone chromium and cyanide. However, the declining water levels at the site make this evaluation unnecessary, and the discontinuation of these technologies will allow limited resources to be focused elsewhere. The Army concurs that technologies, which have the potential to reduce the need for ongoing GWTS O&M, could achieve significant cost savings. The Army currently is implementing a Characterization Study at RBAAP, which is required to not only more fully identify any existing contaminant plumes, but also provide a method to more effectively address them.

15. Section VIII - Issues, Table 6 (page 44): Please replace the first row to read as follows, *"There are no institutional controls in place for the landfill area to prevent inappropriate uses in the future that could impact the integrity of the cap. No. Yes."*

Please add a row to the table; stating the following, *"There are no institutional controls in place to ensure that no inappropriate use of contaminated groundwater occurs while the groundwater remediation is occurring. No. Yes."*

Response: With respect to the second bullet would suggest the following text: *"There are no institutional controls in place to ensure that no inappropriate use of contaminated groundwater occurs while the groundwater remediation is occurring. However all potentially affected residences have been provided with a public water supply for domestic use as part of the Permanent Potable Water Supply Response Action and which limits groundwater use to irrigation only. No. TBD."*

16. Section IX – Recommendations and Follow-up Actions, Table 7 (page 45): Please replace the first row to read as follows, *"Implement deed restrictions."*

Response: Would suggest that the text reads " *Implement appropriate deed restrictions prior to property transfer.*

Please add a row to the table, stating the following, *"Analyze options for groundwater institutional controls; select and implement appropriate ICs."*

Response: The Army suggests the following text: *"Analyze options for groundwater institutional controls; select and implement ICs if determined to be appropriate."*

17. Section X – Protectiveness Statements, 1st paragraph (page 47): Please edit the third through last sentences as follows, *"The landfill remedial action is currently protective of human health and the environment. The groundwater remedial action is operating as designed and is currently protective of human health and the environment. ~~Accordingly, the remedy for RBAAP is protective of human health and the environment.~~ However, in order for the remedy to remain protective in the long term, institutional controls must be implemented as specified below."*

Response: The Army suggests the following text: *"The landfill remedial action is currently protective of human health and the environment. The groundwater remedial action is operating as designed and is currently protective of human health and the environment. ~~Accordingly, the remedy for RBAAP is protective of human health and the environment.~~ However, in order for the remedy to remain protective in the long term, institutional controls must be evaluated and implemented as appropriate. Institutional controls and the implementation of institutional controls will be identified and documented in the forthcoming property management plan.*

18. Section X – Protectiveness Statements, Landfill subsection (page 47): Please edit the last sentence as follows, *"The landfill remedy is currently protective of human health and the environment. However, in order to ensure continued protectiveness, deed restrictions that prevent inappropriate use of the landfill area are needed."*

Response: The Army suggests the following text: *"The landfill remedy is currently protective of human health and the environment. However, in order to ensure continued protectiveness, deed restrictions that prevent inappropriate use of the landfill area are needed." The Army will document LUCs in the forthcoming property management plan, which will address the requirement to implement appropriate deed restrictions prior to property transfer.*

19. Section X – Protectiveness Statements, Groundwater subsection (page 47): Please edit the last sentence as follows, *"The groundwater remedial action is currently protective of human health and the environment. However, in order to ensure continued protectiveness during the groundwater remediation, some form of institutional control is needed to prevent inappropriate uses of the groundwater."*

    Please delete the last paragraph of the section, *"Long-term protectiveness . . ."*

Response: The Army suggests the following text: *"The groundwater remedial action is currently protective of human health and the environment. However, in order to ensure continued protectiveness the Army will analyze options for groundwater institutional controls and will select and implement ICs if determined to be appropriate."*

20. Groundwater Data: It would be helpful to have a table with the actual quarterly data from each well. Plates 1-3 contain contours from past quarter's data but present only the current data. For example, MW13A is shown as not sampled but it is in the center of 2000 ppb cyanide contour.

Response: A table with the actual quarterly groundwater data from each well covering five quarters of analytical results is provided in each quarterly groundwater monitoring report. We have attached the historical table to this response to comments for your review.

21. Ecorisk Screening: There was no ecorisk assessment screening documented in the Report. Ned Black, Regional CERCLA Ecologist/Microbiologist, has completed the ecorisk screening for RBAAP (please see the attachment). It should be included as an appendix of the Report and the conclusions should be mentioned in the body of the text.

Response: The Ecorisk Screening Report for RBAAP will be included as an appendix of the Report and the conclusions will be documented in the body of the text.

California Regional Water Quality Control Board

Central Valley Region

Robert Schneider, Chair

Alan C. Lloyd Ph.D
Secretary for Environmental Protection

Arnold Schwarzenegger
Governor

Sacramento Main Office

Internet Address: http://www.swrcb.ca.gov/rwqcb5
11020 Sun Center Drive #200 Rancho Cordova, CA 95670-6114
Phone (916) 464-3291

APPROVED

author _____

senior _____

23 December 2005

Mr. Paul Zianno
USACE
1325 J. Street
Sacramento, California 95814

DRAFT FIVE-YEAR REVIEW REPORT, SECOND FIVE-YEAR REVIEW REPORT FOR RIVERBANK ARMY AMMUNITION PLANT, RIVERBANK, STANISLAUS COUNTY

The Regional Water Quality Control Board (Regional Board) staff reviewed the November 2005, *Draft Five Year Review Report, Second Five Year Review Report For Riverbank Army Ammunition Plant, City of Riverbank, Stanislaus County, California* (Report) prepared by the Army. The Report was prepared pursuant to the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and covers the operational period from January 2001 through December 2004. The Report was submitted one year early. The purpose of the Report is to evaluate whether the selected remedy at the site is effective and in compliance with the laws and regulations that apply.

Our comments on the Report are presented below.

General Comments

1. Applicable Relevant and Appropriate Requirements (ARARs), listed in Table 2-1 of the Record of Decision (ROD), require that "groundwater will be extracted and treated until the aquifer meets federal and state maximum contaminant levels (MCLs) and state Water Quality Objectives (WQOs)..." Discussions in several sections of the Five-Year Review however, imply that the goal of the treatment system is to achieve containment, rather than cleanup and restoration of the groundwater aquifer. Examples of this circumstance are described below:

   - Page 17, last paragraph, the text reads, "Figure 3 shows the actual cumulative gallons extracted and treated at RBAAP for the period from January 2001 through November 2004 versus the flow rate required for containment…"

   - Page 29, last paragraph, the text reads, " target extraction rates have been modified several times in response to changing contaminant conditions and ongoing attempts to

optimize and minimize the amount of water being extracted, while still providing complete containment of the contamination…"

- Page 29, last paragraph, the text reads, "the target extraction rate has been supported by simulations of groundwater flow that demonstrate the ability of the pumping scenario to contain the areas of contamination."

Containment infers that polluted groundwater will be prevented from spreading and further migration. An extraction system that is designed to provide only containment at RBAAP would violate the Army's commitment in the ROD and is not sufficient to restore the beneficial uses of groundwater.

The purpose of the groundwater remedy, as defined in the ROD, is repeated on Page 11 of the Five-Year Review: "to provide full capture of the chromium and cyanide A'-, B-, and C-zone plumes…" The key concepts for a technical capture zone analysis are outlined in the EPA, guidance document entitled *A Systematic Approach for Evaluation of Capture Zone At Pump and Treat System*. This guidance document recommends the use of six main converging lines of evidence to demonstrate attainment of capture. Regional Board staff have, and will be referring to this document to evaluate capture at RBAAP. The Army is strongly encouraged to compare site data to the criteria presented in this guidance to determine whether the extraction system at RBAAP is achieving capture and ultimate cleanup of the chromium and cyanide plumes in the A-, B- and C-zones.

2. Regional Board staff are concerned with violations to permit No. R5-2004-0054, issued for injection of the in-situ application of sodium dithionite solution. Violations include; (1) the unreported and unauthorized February 2005 injection of 4,000 gallons of sodium dithionite solution via unpermitted injection points MW17A-3 and MW17A-4, (2) the July 2005 unpermitted discharge of fluids, extracted from the study area, to the ground water treatment system (GWTS), and (3) groundwater parameters including magnesium, alkalinity, sulfate, nitrate, and total dissolved solids that remain elevated above baseline levels despite the extraction of more than 20,000 gallons of groundwater from the unpermitted injection points. The repeated violations are being considered for enforcement actions, at this time.

3. Until October 2005 extracted groundwater at RBAAP was treated using a combination of the interim groundwater treatment system (IGWTS) and the GWTS. The IGWTS was deactivated in October 2005 as part of system optimization efforts. However, the text on the first paragraph of Page 16, reads, "…recent system upgrades and modifications have been made, and the following draft updates to the earlier plans reflect current operations:", and does not discuss the deactivation of the IGWTS. Please update the text to disclose all current treatment system modifications and the effect(s) the modifications have had on the treatment system.

4. The due date for this Report is 21 September 2006. However, it was completed one year early through an agreement between the EPA and the Army. Please clarify the purpose for early preparation of the Five-Year Review Report.

Specific Comments

1. Figures 5 through 8, and text in the second paragraph on page 35 indicate that capture of the A-zone cyanide plume is unachievable under a pumping rate of 180 gallons per minute (gpm). This simulation was produced using data obtained approximately one year ago. Since then, the Army has modified the pumping rates and extraction well selection. Extraction simulations provided in the 3rd Quarter 2005 report indicate that capture is achievable using a reduced pumping rate of 110 gpm from alternate extraction wells. Please update the text and figures in the Report to be more consistent with recent groundwater monitoring and extraction system data.

2. Page 45. This page addresses the need for potential remedial actions for A-zone source areas. The discussion presents recommendations for continued in-situ treatment of chromium using sodium dithionite and initiating in-situ treatment of cyanide using ozone. The Regional Board will require full attainment of baseline conditions at Site MW17 before the Army can be permitted to proceed with additional in-situ applications of sodium dithionite. Bench scale testing, for effectiveness and by-products, of ozone injection into cyanide contaminated subsurface soils, is necessary prior to implementation of an in-situ ozone pilot study. Submittal of a Report of Waste Discharge (ROWD) detailing the necessary information will also be required before Regional Board staff can determine if Waste Discharge Requirements (WDRs) will be required for ozone injections.

3. Page 25, third paragraph, the text states, “As noted above, several interviews were also conducted with members of the community (see attachment B for interview details).” The Report contains neither an Attachment B nor interview details. Please correct this deficiency.

Regional Board staff cannot concur that the current remedies in place will meet the cleanup objectives agreed to in the ROD until the deficiencies discussed above are corrected in the Final Report due **23 January 2006**.

If you have any questions please contact me at (916) 464-4811 or at betaylor@waterboards.ca.gov.

BRIAN E. TAYLOR, R.G.
Engineering Geologist

cc list on next page

cc: Xuan Mai-Tran - USEPA, San Francisco
Jim Pinasco – CALEPA-DTSC, Sacramento
David Towell – CH2MHILL, Reno
John Ashley -- Norris Industries, Riverbank
Brownell Turner – Riverbank, California
Paul Schafer – U.S. Army Environmental Center, Maryland
Jim Gansel – Modesto, California
Erik Appel– AHTNA, West Sacramento

Response to RWQCB Comments on Draft Second Five-Year Review Report for Riverbank Army Ammunition Plant
City of Riverbank, California
November 2005

GENERAL COMMENTS

Comment 1. Applicable Relevant and Appropriate Requirements (ARARs), listed in Table 2-1 of the Record of Decision (ROD), require that "groundwater will be extracted and treated until the aquifer meets federal and state maximum contaminant levels (MCLs) and state Water Quality Objectives (WQOs)..." Discussions in several sections of the Five-Year Review however, imply that the goal of the treatment system is to achieve containment, rather than cleanup and restoration of the groundwater aquifer. Examples of this circumstance are described below:

- **Page 17, last paragraph, the text reads, "Figure 3 shows the actual cumulative gallons extracted and treated at RBAAP for the period from January 2001 through November 2004 versus the flow rate required for containment…"**

- **Page 29, last paragraph, the text reads, " target extraction rates have been modified several times in response to changing contaminant conditions and ongoing attempts to optimize and minimize the amount of water being extracted, while still providing complete containment of the contamination…"**

- **Page 29, last paragraph, the text reads, "the target extraction rate has been supported by simulations of groundwater flow that demonstrate the ability of the pumping scenario to contain the areas of contamination."**

Containment infers [sic] that polluted groundwater will be prevented from spreading and further migration. An extraction system that is designed to provide only containment at RBAAP would violate the Army's commitment in the ROD and is not sufficient to restore the beneficial uses of groundwater.

The purpose of the groundwater remedy, as defined in the ROD, is repeated on Page 11 of the Five-Year Review: "to provide full capture of the chromium and cyanide A'-, B-, and C-zone plumes…" The key concepts for a technical capture zone analysis are outlined in the EPA, guidance document entitled *A Systematic Approach for Evaluation of Capture Zone At Pump and Treat System*. This guidance document recommends the use of six main converging lines of evidence to demonstrate attainment of capture. Regional Board staff have, and will be referring to this document to evaluate capture at RBAAP. The Army is strongly encouraged to compare site data to the criteria presented in this guidance to determine whether the extraction system at RBAAP is achieving capture and ultimate cleanup of the chromium and cyanide plumes in the A-, B- and C-zones.

Response: The Army concurs that the objective of the remedy is to provide capture, not containment, and will revise the text to remove references to containment.

Comment 2. Regional Board staff are concerned with violations to permit No. R5-2004-0054, issued for injection of the in-situ application of sodium dithionite solution. Violations include; (1) the unreported and unauthorized February 2005 injection of 4,000 gallons of sodium dithionite solution via unpermitted injection points MW17A-3 and MW17A-4, (2) the July 2005 unpermitted discharge of fluids, extracted from the study area, to the ground water treatment system (GWTS), and (3) groundwater parameters including magnesium, alkalinity, sulfate, nitrate, and total dissolved solids that remain elevated above baseline levels despite the extraction of more than 20,000 gallons of groundwater from the unpermitted injection points. The repeated violations are being considered for enforcement actions, at this time.

Response: Comment noted.

Comment 3. Until October 2005 extracted groundwater at RBAAP was treated using a combination of the interim groundwater treatment system (IGWTS) and the GWTS. The IGWTS was deactivated in October 2005 as part of system optimization efforts. However, the text on the first paragraph of Page 16, reads, "…recent system upgrades and modifications have been made, and the following draft updates to the earlier plans reflect current operations," and does not discuss the deactivation of the IGWTS. Please update the text to disclose all current treatment system modifications and the effect(s) the modifications have had on the treatment system.

Response: The IGWTS was deactivated on October 31, 2005 and a modified flow regime was initiated on November 1, 2005. However, these changes occurred well outside of the Five-Year Review period and will not be included in the Report. The language will be clarified to reflect the conditions at the time of the Five-Year Review.

Comment 4. The due date for this Report is 21 September 2006. However, it was completed one year early through an agreement between the EPA and the Army. Please clarify the purpose for early preparation of the Five-Year Review Report.

Response: The statutory due date for the Second Five-Year Review Report is based on the date of the EPA approval of the First Five-Year Review Report, namely September 21, 2001. The evaluation for this five-year review was completed early, however, due to a desire to get the five-year reviews back on a five-year schedule from the original triggering event on June 5, 1995 (the initiation of the remedial action specified in the ROD). See the response to EPA Specific Comment 7 for the Army's proposed text change.

SPECIFIC COMMENTS

Comment 1. Figures 5 through 8, and text in the second paragraph on page 35 indicate that capture of the A-zone cyanide plume is unachievable under a pumping rate of 180 gallons per minute (gpm). This simulation was produced using data obtained approximately one year ago. Since then, the Army has modified the pumping rates and extraction well selection. Extraction simulations provided in the 3rd Quarter 2005 report indicate that

capture is achievable using a reduced pumping rate of 110 gpm from alternate extraction wells. Please update the text and figures in the Report to be more consistent with recent groundwater monitoring and extraction system data.

Response: The most recent changes to the groundwater extraction system are outside the Five-Year Review period and will be addressed in the Third Five-Year Review Report. The most recent changes to the groundwater extraction system and operational data are provided in each of the quarterly groundwater monitoring reports.

Comment 2. Page 45. This page addresses the need for potential remedial actions for A-zone source areas. The discussion presents recommendations for continued in-situ treatment of chromium using sodium dithionite and initiating in-situ treatment of cyanide using ozone. The Regional Board will require full attainment of baseline conditions at Site MW17 before the Army can be permitted to proceed with additional in-situ applications of sodium dithionite. Bench scale testing, for effectiveness and by-products, of ozone injection into cyanide contaminated subsurface soils, is necessary prior to implementation of an in-situ ozone pilot study. Submittal of a Report of Waste Discharge (ROWD) detailing the necessary information will also be required before Regional Board staff can determine if Waste Discharge Requirements (WDRs) will be required for ozone injections.

Response: Comment noted.

Comment 3. Page 25, third paragraph, the text states, "As noted above, several interviews were also conducted with members of the community (see attachment B for interview details)." The Report contains neither an Attachment B nor interview details. Please correct this deficiency.

Response: The text will be revised to indicate that Attachment 2, not Attachment B, contains the interview details. These details can be found on page 2-2 on the Site Inspection Checklist.

Mr. Paul Zianno
Department of the Army USACE – Sacramento District
1325 J Street, CESPK-PM-M
Sacramento, CA 95814-2922

Draft Second Five-Year Review Report for Riverbank Army Ammunition Plant

Mr. Paul Zianno

The Department of Toxic Substances Control (DTSC) has reviewed the following Report "Draft Five-Year Review Report, Second Five-Year Review Report for Riverbank Army Ammunition Plant, City of Riverbank, Stanislaus County, California". The Draft Report was submitted in November 2005.

General Comments:

1. Detailed components of applied institutional controls are not well documented throughout the Report.

2. The Draft Five-Year Review implies that public interest in the remedial activities at Riverbank Army Ammunition Plant (RBAAP) is minimal. This position is only supported through assumption in the Report. The Army needs to develop and implement community out reach strategies to accurately determine public interest regarding RBAAP.

3. The Five-Year Review should be revised to reflect RBAAPs inclusion on the Base Closure List.

Specific Comments:

ES-1: The text should include a listing of institutional controls (IC) implemented for the landfill.

ES-1: The Draft Report should provide some statistical data to corroborate the stated reduction in ground water contaminate levels.

ES-3: Please revise the text to indicate RBAAPs inclusion on the Base Closure List.

Page 4: The Draft Five-Year Review indicates RBAAP is in a primarily rural setting. The text should also reflect that housing construction is increasing in the vicinity of RBAAP.

Page 24: The Draft Five-Year Review states that community interest in remedial activities is low. The Draft Five-Year Review does not support this statement through any community outreach activity such as interviews or a fact sheet. DTSC can not support this statement without the Army implementing a program to gage community interest for RBAAP.

Page 38: Please provide a listing of post-Record of Decision (ROD) action requirements.

Page 38: The Draft Five-Year Review accurately states that ground water levels are currently declining. The Report further recommends a suspension of any supplemental A-zone action due to the declining ground water levels. DTSC recommends that supplemental A-zone actions be revisited if ground water levels rise in the future.

Page 40: The Army should begin preparing enhanced land use controls (LUC) required under Base closure. The enhanced elements of LUCs, including deed restrictions should be listed. Dispute resolution agreements as well as ROD requirements should be reviewed and implemented where necessary.

Should you have any questions, you may contact me at (916) 686-1647 or jpinasco@dtsc.ca.gov.

Sincerely,

Jim Pinasco
Hazardous Substances Engineer
Department of Toxic Substances Control

Cc:

Xuan-Mai Tran
United States Environmental Protection Agency
Region IX
75 Hawthorne Street
San Francisco, CA 94105

Brian Taylor

State of California, Regional Water Quality Control Board
Central Valley Region
11020 Sun Center Drive, #200
Rancho Cordova, CA 95670-6114

Linda Gumas
Riverbank Army Ammunition Plant
P.O. Box 670
Riverbank, CA 95367-0670

Mike Kipp
Department of the Army, SFIM-AEC-CDS
5179 Hoadley Road
Aberdeen Proving Ground, MD 21010-5401

Jim Gansel
SOTA Environmental Technology
2116 Churchill Avenue
Modesto, CA 95350-2700

Christine Dougherty
Ahtna Government Services Corporation
3680 Industrial Boulevard, Suite 600H
West Sacramento, CA 95691-6504

Neil Morgan-Butcher
ARCADIS G&M Inc.
155 Montgomery Street, Suite 1510
San Francisco, CA 94104-4120

Army Responses to the Department of Toxic Substances Control (DTSC) Comments on the "Draft Five-Year Review Report, Second Five-Year Review Report for Riverbank Army Ammunition Plant, City of Riverbank, Stanislaus County, California."

GENERAL COMMENTS

Comment 1. Detailed components of applied institutional controls are not well documented throughout the Report.

Response: The Army has implemented, maintained and enforced land use controls [LUCs] consistent with the selected remedial actions in the 1994 Record of Decision for the Riverbank Army Ammunition Plant. To address the comments on the Draft second 5-year review related to LUC [IC] issues and as previously planned, the Army will develop a document to serve as a property management plan to address all relevant and necessary LUCs associated with the RBAAP remedial actions as described in the ROD and/or with the existing RCRA Permit. With respect to EPA's comments related to the need for ICs to prevent future use of groundwater, the Army will further research possible existing county or city ordnances regarding well regulations/restrictions which may act as an IC for groundwater. However, it should be noted that contaminant concentrations off-post are currently below MCLs and all residences within the extent of contaminated groundwater were provided with public water. If there are no existing city or county ordnances in place and since the contaminant concentrations are now below cleanup levels, the need for ICs to restrict future groundwater use seem potentially unwarranted and would be difficult to implement short of purchasing water rights.

The Plan will identify land use controls with specific implementation actions to used to implement (if not already done), maintain and enforce the LUCs by the Army, by a subsequent property owner and users resulting from transfer process under BRAC 05, and potentially the state and local jurisdictions. The Plan will describe several LUC objectives, the LUC, and the location where the LUC is or will be applied. The implementation actions may include, but not be limited to, CERCLA 121(c) five-year remedy reviews with periodic monitoring and reports, notification to regulators prior to modification or termination of LUCs, generating a map showing the areas where LUCs are implemented and identification of POCs at the facility. In addition the Plan will integrate the Army standardized Finding of Environmental Suitability notification procedure in advance of leasing or transferring the property under BRAC 05. The Report will be revised to include the concept of a property management plan with additional details and recommendations for appropriate sites.

Based on current projections this plan will be developed and provided to the regulatory agencies for review and finalized in FY06.

Comment 2. The Draft Five-Year Review implies that public interest in the remedial activities at Riverbank Army Ammunition Plant (RBAAP) is minimal. This position is only supported through assumption in the Report. The Army needs to develop and implement community out reach strategies to accurately determine public interest regarding RBAAP.

Response: While it is true that statements in the Report regarding the level of public interest in RBAAP were not based on a broad, systematic survey of the community, public interest has been relatively low over the last several years, and several of the formerly active neighbors were interviewed and did not express heightened interest. Nevertheless, the Army is in the process of

revising and updating its Public Involvement and Response Plan for the RBAAP facility. As part of this update, the Army will develop and implement community outreach strategies to accurately determine public interest related to the RBAAP. In addition, as discussed in Section VI of the Report, the Army intends to hold a public meeting to solicit input and encourage greater involvement. The Army has elected to hold this meeting in spite of the fact that it is not strictly required as part of the five-year review process.

Comment 3. The Five-Year Review should be revised to reflect RBAAPs inclusion on the Base Closure List.

Response: Although language currently exists in the Five-Year Review regarding the inclusion of the RBAAP on the BRAC list, the text will be revised to reflect its current status.

SPECIFIC COMMENTS

Comment 1. ES-1: The text should include a listing of institutional controls (IC) implemented for the landfill.

Response: See response to General Comment 1.

Comment 2. ES-1: The Draft Report should provide some statistical data to corroborate the stated reduction in ground water contaminant levels.

Response: An analysis and statistical data to corroborate the reduction in groundwater contaminant concentrations is provided in each quarterly groundwater monitoring report. However, text will be added to the Five-Year Review to justify the statement that groundwater contaminant concentrations are being reduced by the implemented remedy.

Comment 3. ES-3: Please revise the text to indicate RBAAP's inclusion on the Base Closure List.

Response: Comment noted and text will be updated.

Comment 3. Page 4: The Draft Five-Year Review indicates RBAAP is in a primarily rural setting. The text should also reflect that housing construction is increasing in the vicinity of RBAAP.

Response: Comment noted and text will be revised to reflect that residential construction is increasing in the vicinity of RBAAP.

Comment 4. Page 24: The Draft Five-Year Review states that community interest in remedial activities is low. The Draft Five-Year Review does not support this statement through any community outreach activity such as interviews or a fact sheet. DTSC can not support this statement without the Army implementing a program to gage community interest for RBAAP.

Response: See response to General Comment 2.

Comment 5. Page 38: Please provide a listing of post-Record of Decision (ROD) action requirements.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105

March 16, 2006

Mr. Paul Zianno
Department of the Army USACE – Sacramento District
1325 J Street, CESPK-PM-M
Sacramento, CA 95814-2922

Re: Review of the Army's Response to EPA Comments on the Draft Second Five-Year Review Report for Riverbank Army Ammunition Plant, Riverbank, California, February 2006

Dear Mr. Zianno:

The U.S. Environmental Protection Agency (EPA) Region 9 has received an electronic version of the Army's Response to EPA comments on the Draft Second Five-Year Review Report for Riverbank Army Ammunition Plant, Riverbank, California, dated February 16, 2006. We have reviewed the Army's response and our comments are enclosed.

The majority of the Army's responses are adequate. However, the purpose of the Five-Year Review is to identify issues that might affect protectiveness at sites where waste was left in place above the Unlimited Use/Unrestricted Exposure levels. An important issue for long-term protectiveness is whether the site has adequate land use control. The Five-Year Review only needs to identify the need for the institutional controls, but does not require specifying which institutional control will be implemented. EPA will not be able to concur on this Second Five-Year Review until this information is included in the review.

If there are any questions, please contact me at (415) 972-3002.

Sincerely,

Xuan-Mai Tran
Remedial Project Manager
Federal Facilities and Site Cleanup Branch

cc: (See Distribution List)

Enclosure

RIVERBANK AMRY AMMUNITION PLANT DISTRIBUTION LIST

Jim Pinasco
Department of Toxic Substances Control
8800 Cal Center Drive
Sacramento, CA 95826-3200

Brian Taylor
State of California, Regional Water Quality Control Board
Central Valley Region
11020 Sun Center Drive, #200
Rancho Cordova, CA 95670-6114

Linda Gumas
Riverbank Army Ammunition Plant
P.O. Box 670
Riverbank, CA 95367-0670

Mike Kipp
Department of the Army, SFIM-AEC-CDS
5179 Hoadley Road
Aberdeen Proving Ground, MD 21010-5401

Jim Gansel
SOTA Environmental Technology
2116 Churchill Avenue
Modesto, CA 95350-2700

Christine Dougherty
Ahtna Government Services Corporation
3680 Industrial Boulevard, Suite 600H
West Sacramento, CA 95691-6504

Neil Morgan-Butcher
ARCADIS G&M Inc.
155 Montgomery Street, Suite 1510
San Francisco, CA 94104-4120

Review of the Army's Response to EPA comments
Draft Riverbank Army Ammunition Plant
Riverbank, Stanislaus County, California
February 16, 2006

GENERAL COMMENTS

1. This comment has been addressed adequately.

2. This comment has been addressed adequately.

3. This comment has been partially addressed. The response to this comment is a little confusing. The first part of the response states that "Following regulatory agency acceptance of this Response to Comments on the Draft Second Five-Year Review, a public meeting will be held to fully advise the interested parties of the review process." Then, toward the end, the response states that "Again, following regulatory agency approval of this document, all will be implemented immediately." Is the "document" referred to the RTC or the entire Second Five-Year Review (FYR)? In order to address this comment, a public notice in the local newspaper(s) is required prior to the finalization of the Report. The information on this notice (e.g., the date that the notice was published) and the information on the planned public meeting have to be included in the text of the Report. The actual notice in the local newspaper(s) has to be included in the FYR as an attachment.

4. This comment has been partially addressed. The Army mentioned that they will prepare an Institutional Controls (ICs) Plan that will identify specific actions to implement for the various areas of the site. However, in the FYR, the Army needs to identify the areas within the site that contain waste left in place above the Unlimited Use/Unrestricted Exposure (UU/UE) levels, and whether those areas have adequate land use controls (LUCs). Although, the FYR needs to document this information, it does not need to identify what the Army will specifically do about it (e.g., which specific ICs will be implemented).

5. This comment has been addressed adequately.

6. Please see General Comment 4.

7. This comment has been addressed adequately.

8. This comment has been addressed adequately.

9. This comment has been partially addressed. The FYR needs to document that the groundwater cleanup goal has not been attained in all locations (both on-site and off-site), and thus some form of IC is needed.

10. This comment has been addressed adequately.

11. This comment has been addressed adequately.

12. This comment has been addressed adequately.

13. This comment has been addressed adequately.

14. This comment has been addressed adequately.

15. This comment has been addressed adequately.

16. The response states that "When the Army undertook the sampling effort to address any possible sites where perchlorate might be found, RBAAP was exempted from any sampling requires due to the fact that no possible use or spill of perchlorate had ever taken place at this installation." Please clarify in the response to document which agency exempted the RBAAP from perchlorate sampling.

17. This comment has been addressed adequately.

SPECIFIC COMMENTS

1. Executive Summary (page ES-1): Please see General Comment 4.

2. Executive Summary, Landfill section (page ES-1): This comment has not been addressed. The response refers to the response to General Comment 9 which addresses a groundwater question, not the landfill wording that we have suggested.

3. Executive Summary, Groundwater section (page ES-1): This comment has not been addressed. We have suggested the wording in order to reflect the current protectiveness.

4. Five-Year Review Summary Form, Issues section (page ES-3): The response states that "The Plan will identify land use controls with specific implementation actions to use to implement (if not already done) …" This implies that there may or may not already be some form of LUCs in place. The purpose of the FYR is to figure out whether or not there are some form of LUCs in place for those areas that have waste left in place above the UU/UE levels. However, the Army's proposed wording would be fine if the phrase "(if not already done)" is deleted.

5. This comment has been addressed adequately.

6. This comment has been addressed adequately.

7. This comment has been addressed adequately.

8. Investigation of areas under IWTP (page 13): We agree that the IWTP area must be closed in accordance with RCRA requirements. However, as a CERCLA site, EPA would like to be included in this coordination.

9. This comment has been addressed adequately.

10. This comment has been addressed adequately.

11. This comment has been addressed adequately.

12. This comment has been addressed adequately.

13. This comment has been addressed adequately.

14. This comment has been addressed adequately.

15. This comment has been addressed adequately.

16. This comment has been addressed adequately.

17. Section VIII – Issues, Table 6 (page 44): This comment has been partially addressed. Since "There are no institutional controls in place to ensure that no inappropriate use of contaminated groundwater occurs while the groundwater remediation is occurring.", there should be a "Yes" under the "Affects Future Protectiveness", not "TBD".

18. Section IX – Recommendations and Follow-up Actions, Table 7 (page 45): This comment has not been addressed. The Army has proposed the wording "Analyze options for groundwater institutional control; select and implement ICs if determined to be appropriate." We are not concurred with this wording because we need to make the determination in the FYR as to whether groundwater ICs are needed or not. If contamination in groundwater is above UU/UE now, then some form of ICs is need.

19. Section X – Protectiveness Statements, 1st paragraph (page 47): This comment has been partially addressed. The wording needs to be modified as follows in order to be acceptable: "The landfill remedial action is currently protective of human health and the environment. The groundwater remedial action is operating as designed and is currently protective of human health and the environment. ~~Accordingly, the remedy for RBAAP is protective of human health and the environment.~~ However, in order for the remedy to remain protective in the long term, institutional controls must be ~~evaluated and~~ implemented as appropriate. Institutional controls and the implementation of institutional controls will be identified, evaluated and documented in the forthcoming property management plan.

20. This comment has been addressed adequately .

21. Section X – Protectiveness Statements, Groundwater subsection (page 47): This comment has been partially addressed. The wording needs to be modified as follows in order to be acceptable: "The groundwater remedial action is currently protective of human health and the environment. However, in order to ensure continued protectiveness the Army will analyze options for groundwater institutional controls and will select and implement appropriate ICs ~~if determined to be appropriate~~."

22. Groundwater Data: This comment has been partially addressed. The table should be included in the FYR for completeness.

23. This comment has been addressed adequately.

California Regional Water Quality Control Board

Central Valley Region

Robert Schneider, Chair

Linda S. Adams
Secretary for Environmental Protection

Arnold Schwarzenegger
Governor

Sacramento Main Office
11020 Sun Center Drive #200, Rancho Cordova, California 95670-6114
(916) 464-3291
http://www.waterboards.ca.gov/centralvalley

15 September 2006

Mr. Brownell P. Turner
Commanders Representative
Riverbank Army Ammunition Plant
5300 Claus Road
Riverbank, Ca. 95367

Mr. Paul Zianno
USACE
1325 J. Street
Sacramento, California 95814

SECOND FIVE YEAR REVIEW REPORT, RIVERBANK ARMY AMMUNITION PLANT (RBAAP), 5300 CLAUS ROAD, RIVERBANK, STANISLAUS COUNTY

California Regional Water Quality Control Board Central Valley Region (Regional Water Board) staff reviewed the 1 August 2006, *Final Second Five Year Review Report For Riverbank Army Ammunition Plant, City of Riverbank, Stanislaus County, California* (Report) prepared by the Army. The Report was prepared pursuant to the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and covers the operational period from January 2001 through December 2004. The purpose of the Report is to provide an assessment of the protectiveness of remedial actions conducted at this facility.

To insure protectiveness of the landfill and groundwater remedial measures, the Report indicates that the Army will provide land use covenants (LUCs) and institutional controls (ICs) for three areas: (1) the Landfill Site, (2) Production and conveyance Areas associated with the Industrial Wastewater Treatment Plant (IWTP) and (3) On-Site Groundwater, in a forthcoming Property Site Management Plan and in the final Five Year Review report.

Specific Comments

1. The groundwater cleanup goal at the Riverbank Army Ammunition Plant (RBAAP) is based on the existing water quality objective (WQO) of 50 micrograms per liter (μg/L) for total chromium. Based on the results of a Risk Assessment study[1] performed by the Office of Environmental Health Hazard Assessment (OEHHA), Public Health Goals (PHGs) of 2.5 μg/L for total chromium, and 0.2 μg/L for

[1] Office of Health Hazard Assessment, 1999, Public Health Goal For Chromium in Drinking Water, California Environmental Protection Agency

chromium six (CrVI) are currently proposed. Therefore, the current WQO of 50 μg/L may no longer be protective and may undergo revision following promulgation of the proposed PHGs. Groundwater extraction and cleanup at the Riverbank Plant should continue even after the goal of 50 μg/L is reached as we have indications that this level is not protective of beneficial uses of this resource.

2. Please provide a schedule for the proposed Property Management Plan, that will identify LUC requirements and IC implementation. Please indicate when this document will be submitted to the regulatory agencies.

3. Page 51, last paragraph. The text states, "At the time of transfer of the property, the appropriate restriction on groundwater use will be identified and incorporated as a restrictive covenant in the deed." The Army must record a land-use restriction covenant with the Stanislaus County assessor's office. The Army must send a draft proposal for the land use restriction for our review and concurrence prior to recording it with the County.

This Report updates the November 2005, *Draft Five Year Review Report, Second Five Year Review Report For Riverbank Army Ammunition Plant, City of Riverbank, Stanislaus County, California* and has addressed comments, discussed in our 23 December 2005 Comment Letter. Responses to the comments listed above do not require revisions to the Report and may be submitted in a separate letter.

If you have any questions please contact me at (916) 464-4811 or at betaylor@waterboards.ca.gov.

BRIAN E. TAYLOR, R.G.
Engineering Geologist

cc: John Hamill- USEPA, San Francisco
Jim Pinasco – CALEPA-DTSC, Sacramento
Paul Schafer – U.S. Army Environmental Center, Maryland
Jim Gansel – Modesto, California
Valentin Constantinescu – AHTNA, West Sacramento
David Towell – CH2MHILL, Reno
Mr. Anthony Mendes -- Norris Industries, Riverbank

Response to RWQCB's Comments (letter dated 9/15/06) on the
Second Five Year Review Report, Riverbank Army Ammunition Plant (RBAAP), 5300 Claus Road, Riverbank, Stanislaus County

September 27, 2006

Comment No. 1.

"The groundwater cleanup goal at the Riverbank Army Ammunition Plant (RBAAP) is based on the existing water quality objective (WQO) of 50 micrograms per liter (µg/L) for total chromium. Based on the results of a Risk Assessment study performed by the Office of Environmental Health Hazard Assessment (OEHHA), Public Health Goals (PHGs) of 2.5 µg/L for total chromium, and 0.2 µg/L for chromium six (CrVI) are currently proposed. Therefore, the current WQO of 50 µg/L may no longer be protective and may undergo revision following promulgation of the proposed PHGs. Groundwater extraction and cleanup at the Riverbank Plant should continue even after the goal of 50 µg/L is reached as we have indications that this level is not protective of beneficial uses of this resource."

Response to Comment No. 1

The Army contacted Mr. Allan Hirsch with the California EPA Office of Environmental Health Hazard Assessment concerning the status of the draft PHG. Mr. Hirsh indicated that a draft PHG is currently under development but has not been finalized at this point in time. The Army will continue to abide by the terms set forth in the 1994 Record of Decision which was signed by the USEPA, DTSC and the Regional Water Quality Control Board.

Comment No. 2.

"Please provide a schedule for the proposed Property Management Plan, that will identify LUC requirements and IC implementation. Please indicate when this document will be submitted to the regulatory agencies."

Response to Comment No. 2

The Army is in the process of developing a Property Management Plan for RBAAP to address necessary LUCs associated with the RBAAP remedial actions as described in the 1994 ROD and with the existing RCRA Permit.

It is anticipated that the PMP will be provided to the regulatory agencies for review in late November 2006. Based on regulatory review the Army anticipates that the PMP will be finalized by late February and implemented beginning in March 2007.

Comment No. 3

“Page 51, last paragraph. The text states, "At the time of transfer of the property, the appropriate restriction on groundwater use will be identified and incorporated as a restrictive covenant in the deed." The Army must record a land-use restriction covenant with the Stanislaus County assessor's office. The Army must send a draft proposal for the land use restriction for our review and concurrence prior to recording it with the County.”

Response to Comment No. 3

The Army agrees with the comment and prior to transfer will provide a Finding of Suitability to Transfer (FOST) to the USEPA, DTSC and Regional Water Quality Control Board for review. The FOST will provide a description of the proposed land use restriction to be recorded in the deed.