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FINAL
FIRST FIVE-YEAR REVIEW REPORT FOR OPERABLE UNIT 2 AND OPERABLE UNIT 4 SCHOFIELD ARMY BARRACKS, ISLAND OF OAHU, HAWAII

Prepared for
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EXECUTIVE SUMMARY

This report documents the first five-year review conducted for Schofield Army Barracks and evaluates the protectiveness of the implemented remedies for Operable Unit (OU) 2 (Groundwater) and OU 4 (Former Landfill) at Schofield Army Barracks on the Island of Oahu, Hawaii. OU 1 and OU 3 were approved for no further action following their remedial investigations, and thus do not require five-year reviews.

The OU 2 remedy primarily consists of the following components:

- Wellhead treatment of extracted groundwater for domestic and municipal use that exceed the Maximum Contaminant Levels (MCLs) for trichloroethene (TCE) and carbon tetrachloride (CCl_4) at the Schofield Barracks Supply Wells and Del Monte-owned Well 3-2803-05
- Long-term groundwater monitoring to identify increasing concentrations of TCE and CCl_4 (contaminants) in groundwater to allow the Army to procure funds for and institute wellhead treatment of domestic use groundwater before contaminant concentrations reach the MCLs
- Conducting five-year reviews.

The treatment portion of the remedy had already been implemented before the ROD was approved in September 1996, and the interim long-term monitoring program was initiated in June 1996. The quarterly and semiannual long-term monitoring program for OU 2 was instituted in April 1997 and continues to the present (2002). Operation and maintenance (O&M) costs for wellhead treatment at the Del Monte well are reimbursed by the Army.

The OU 4 remedy consists of the following components:

- Regrading and repairs to the existing landfill cover system
- Maintenance of the existing landfill cover and venting system
- Restricted access to the former landfill
- Long-term groundwater and landfill gas monitoring

- Conducting five-year reviews.

Implementation of the selected remedy for OU 4 occurred in several construction phases. The trigger for this five-year review was the start of OU 4 remedy construction on March 10, 1997. OU 4 achieved construction completion when the final inspection was performed on July 21, 1998. Landscaping activities were completed on August 7, 1998. Operations and maintenance (O&M) activities have been conducted since the completion of the remedy, and include general inspections, general maintenance, groundwater and landfill gas monitoring, record keeping, and reporting.

This first five-year review identified that the remedies were constructed in accordance with the requirements of the OU 2 ROD and the OU 4 ROD. The remedies are functioning as designed and continue to be protective of human health and the environment by implementing quarterly groundwater and landfill gas monitoring and quarterly inspection of the former landfill. The five-year review identified that maintenance needed to be conducted on monitoring well casings and that cracks had developed in the landfill cover system, but these items have been repaired or are scheduled for repairs to be completed by May 2002. Results from the monitoring well network show that the plumes are not migrating downgradient and should not impact additional wells.

The Army will continue to maintain and operate the groundwater treatment systems and the monitoring well network until TCE and CCl_4 MCLs are achieved in groundwater, and will respond to any unforeseen increases in TCE levels downgradient of Schofield Barracks. The Army will also continue maintenance of the landfill cover system and access restrictions to prevent contact of contents with human receptors or the environment. Therefore, the remedies are effective and protective. The next five-year site review is scheduled to take place by March 2007.

1.0 INTRODUCTION

This five-year review of Schofield Army Barracks, Island of Oahu, Hawaii (Schofield Barracks) Operable Unit (OU) 2 and OU 4 was prepared and conducted by Harding ESE, Inc. (Harding ESE) for the U.S. Army Garrison Hawaii (Army), under Contract No. GS10F0157K, Order Number DAPC50-01-F-0106. This five-year review report was prepared in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and the National Contingency Plan (NCP).

This is the first five-year review for Schofield Barracks OU 2 and OU 4. The date for the performance of the five-year review for OU 2 and OU 4 was defined as five years past the initiation of remedial action on March 10, 1997, pursuant to the OU 4 Record of Decision (ROD) (Harding Lawson Associates [HLA], 1996c) and the OU 2 ROD (HLA, 1996d).

The following subsections present the purpose, authority, organizations and agencies involved, description and status of the OUs, and report organization.

1.1 Purpose

The purposes of this five-year review for Schofield Barracks OU 2 and OU 4 are to:

- Evaluate whether the implemented remedies described in the OU 2 ROD (HLA, 1996d) and the OU 4 ROD (HLA, 1996c) are protective of human health and the environment as intended. Evaluation of the remedies is supported by observations, data, and interpretations within this report.
- Identify deficiencies or issues, if any, found during the review.
- Identify recommendations to address them.

1.2 Authority

The Army must implement five-year reviews in accordance with CERCLA and the NCP. CERCLA §121, as amended, 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 than each five years after the initiation of such remedial action..." This requirement is further supported by NCP; 40 Code of Federal Regulations (CFR) 300.430(f)(4)(ii), which 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."

1.3 Organizations and Agencies Involved

The Army is the lead agency under CERCLA and is conducting the five-year review. The EPA and DOH are the regulatory agencies responsible for reviewing the five-year review report. Harding ESE was contracted by the Army to gather and assess the five-year review data and to prepare this report. In addition to conducting and preparing the five-year review, Harding ESE conducted groundwater monitoring for OU 2 from April 1997 through March 2002 in accordance with the Final Operation and Maintenance, and Long-Term Groundwater Monitoring Plan for Operable Unit 2 (OU 2 O&M Plan) (HLA, 1996e). Since OU 4 remedial action was initiated in 1997, the U.S. Army Directorate of Public Works (DPW) at Schofield Barracks has been in charge of conducting quarterly landfill inspections in compliance with the Final Operation and Maintenance and Long-Term Monitoring Plan for Operable Unit 4 (OU 4 O&M Plan) (HLA, 1996f). In addition to these quarterly site inspections, quarterly landfill gas monitoring for OU 4 was performed by Harding ESE from June 1998 through July 2001.

1.4 Overview of Schofield Barracks

Four operable units were established to address the potential areas of contamination at Schofield Barracks:

- OU 1 – Possible TCE Sources
- OU 2 – Groundwater Contamination
- OU 3 – Remaining Onpost Sites Suspected to Contain Contamination Sources
- OU 4 – Former Schofield Barracks Landfill

A summary of each operable unit is described below. OU 2 and OU 4 proceeded through the CERCLA process and are included in this five-year review. OU 1 and OU 3 required no further action following the RIs because no onpost sources of TCE contamination were found, and OU 1 and OU 3 are not included as part of this five-year review.

1.4.1 Operable Unit 1

OU 1 consisted of onpost sites that were suspected to be likely sources of TCE. Ten sites on the Schofield Barracks Main Post and East Range were identified on the basis of past operational practices that may potentially have used TCE. These ten potential source areas were investigated during the OU 1 RI, and no contaminants were found that posed unacceptable risks to human health or the environment. Therefore, the OU 1 RI Report (HLA, 1995c) concluded that OU 1 required no further action, thus OU 1 is not included in this five-year review.

1.4.2 Operable Unit 2

OU 2 consists of the groundwater beneath Schofield Barracks, which is contaminated primarily with TCE and carbon tetrachloride (CCl_4). This groundwater is 550 to 650 feet below ground surface (bgs) and is part of the groundwater body known as the Schofield High-level Water Body. It is called a "high-level" water body because the groundwater levels beneath Schofield Barracks are much higher than groundwater levels in the nearby coastal areas because of underground geologic structures that act as dams to groundwater flow. Most of the groundwater beneath Schofield Barracks originates as rainfall in the Koolau and Waianae mountain ranges to the east and west. This rainfall seeps into the ground in the mountain areas and moves through the subsurface eventually reaching Schofield Barracks. A small

amount of water also seeps into the ground in the Schofield Barracks area and reaches the underlying groundwater. The groundwater beneath Schofield Barracks eventually flows over the northern and southern groundwater dams into the coastal water bodies to the north and south.

Groundwater data collected during the OU 2 RI suggest that at least two separate TCE and CCl_4 sources exist. It is likely that the TCE migrated from these ground surface locations through the soil and bedrock to the underlying groundwater. The Former Landfill (OU 4) was identified as the source of the TCE and CCl_4 in the groundwater underlying that site. The Schofield Barracks water supply wells are currently extracting groundwater containing TCE and CCl_4 from the groundwater beneath Schofield Barracks (OU 2) and treating the extracted water via air stripping at the Schofield Barracks Water Treatment Plant (WTP) to reduce the TCE and CCl_4 concentrations to U.S. Environmental Protection Agency (EPA) Maximum Contaminant Levels (MCLs) before the water is distributed for human use. The source for the TCE contamination in the Schofield Barracks water supply wells is suspected to be somewhere in the Schofield Barracks East Range, but was not found after extensive investigative effort. This source investigation was performed under the OU 1 RI (Section 1.4.1).

1.4.3 Operable Unit 3

OU 3 consists of all onpost areas of potential environmental concern not identified in other OUs. A total of 63 sites were identified on the basis of past operational practices that may have impacted the environment. These potential source areas were investigated during the OU 3 RI and no contaminants were found that posed unacceptable risks to human health or the environment. Therefore, the OU 3 RI Report (Uribe and Associates, 1996) concluded that OU 3 required no further action, thus OU 3 is not included in this five-year review.

1.4.4 Operable Unit 4

OU 4 consists of a former landfill located on Schofield Barracks. The former landfill was constructed in approximately 1942 and remained operational until December 1981. The former landfill encompasses approximately 35 acres, is covered with a soil cap, and does not contain a bottom or top liner system. The landfill contents consist of a variety of solid wastes (primarily domestic waste from base housing), industrial wastes (vehicle and equipment maintenance waste, sewage sludge, solvents, waste), medical wastes, and construction and demolition waste from various military installations on Oahu. In addition, ordnance explosives (OE) and unexploded ordnance (UXO) have been identified in the landfill contents.

1.5 Report Organization

This report documents and evaluates observations and data for OU 2 and OU 4 obtained from historical documents prepared prior to the signing of the RODs, and review of recent regulations, documents, and data collected subsequent to the ROD approval as part of the five-year site review. This report has been divided into thirteen sections. Section 1.0 presents the purpose and authority for conducting the review, the organizations involved, and definitions of the OUs. Section 2.0 presents the site chronology. Section 3.0 presents background information. Section 4.0 presents the remedial actions taken for each OU. Section 5.0 describes the progress made since the remedy implementation. Section 6.0 presents the five-year review process and its findings. Section 7.0 presents a technical assessment of the review findings. Section 8.0 presents issues associated with each OU, and Section 9.0 presents recommendations and follow-up actions. Section 10.0 presents protectiveness statements, and Section 11.0 describes the schedule for the next review. Section 12.0 presents acronyms and abbreviations, and Section 13.0 presents references.

2.0 SITE CHRONOLOGY

A chronology of events and public relations activities related to the OU 2 and OU 4 CERCLA programs is presented below. The events and activities listed span the period from the discovery of TCE in groundwater in 1985 until the present.

CHRONOLOGY OF SITE EVENTS AND COMMUNITY RELATIONS FOR OU 2 AND OU 4	
Event	**Date**
Schofield Barracks issued a press release regarding the detection of TCE in the Schofield Barracks Supply wells and the temporary switch to city and county water supplies.	May 1985
Schofield Barracks issued a press release regarding the placement of the installation on the NPL.	August 1990
Schofield Barracks Public Affairs Office and Environmental Office addressed the Wahiawa Neighborhood Board regarding Army plans to conduct investigations on Schofield Barracks to identify sources of TCE.	October 1990
A Federal Facility Agreement (FFA) was negotiated among the U.S. Environmental Protection Agency (EPA), the State of Hawaii, and the Army. The FFA identified Schofield Barracks as being under the jurisdiction, custody, or control of the U.S. Department of Defense (DOD) and subject to the Defense Environmental Restoration Program (DERP). Four OUs were defined, including OU 2 (Groundwater) and OU 4 (Former Landfill).	September 1991
The work plan for the Preliminary Assessment/Site Investigation (PA/SI) for OUs 1, 2, and 4 was finalized and the PA/SI for OUs 1, 2, and 4 began.	November 1991
Schofield Barracks and U.S. Army Toxic and Hazardous Materials Agency (USATHAMA) submitted press releases requesting public involvement in locating the source(s) of TCE contamination in and around Schofield Barracks.	January 1992
Schofield Barracks and USATHAMA conducted interviews with twenty local residents to assist in the development of a Community Relations Plan for the Schofield Barracks Installation Restoration Program (IRP).	January 1992
The PA/SI for OU 2 and OU 4 was completed.	May 1992
The Army finalized the Community Relations Plan for Schofield Barracks and placed copies in the newly established information repositories located in the Mililani Public Library, the Wahiawa Public Library, The Hawaii Department of Health, and the Directorate of Public Works in Building 300 of Wheeler Army Airfield.	June 1992
The work plans for the OU 2 and OU 4 Remedial Investigation/Feasibility Study (RI/FS) were finalized and the OU 2 and OU 4 RIs began.	January 1993
Schofield Barracks and USAEC conducted a public meeting at the Hale Koa at Wahiawa District Park in Wahiawa to provide the public with an update on the IRP and the results of the first phase of the investigations.	February 1993
In conjunction with the public meeting, the Army published and distributed a fact sheet that provided an update on the IRP and initial investigative results.	February 1993

CHRONOLOGY OF SITE EVENTS AND COMMUNITY RELATIONS FOR OU 2 AND OU 4	
Event	Date
Schofield Barracks and USAEC conducted public availability sessions at the Hale Koa at Wahiawa District Park and at the Schofield Barracks Post Library to provide an update on the IRP.	September 1994
In conjunction with the public availability sessions, the Army solicited interest in the formation of a Restoration Advisory Board (RAB) comprised of local citizen representatives, Army representatives, and regulatory agency representatives that would oversee the conduct of the Army's IRP at Schofield Barracks.	September 1994
The Army presented a poster display that summarized installation restoration efforts and plans for Schofield Barracks at the 1st Hawaii National Technologies Conference sponsored by the Hawaii Department of Health.	September 1994
In conjunction with the public availability session, the Army published and distributed a fact sheet that provided an update on the IRP and initial investigative results.	September 1994
The RI/FS for OU 4 was completed.	December 1995
The RI/FS for OU 2 was completed.	February 1996
Schofield Barracks conducted a public review period for the OU 4 Proposed Plan.	April 1996
Schofield Barracks and USAEC conducted a public meeting to present the OU 4 Proposed Plan and solicit public comments.	May 1996
Schofield Barracks conducted a public review period for the OU 2 Proposed Plan.	May 1996
Schofield Barracks and USAEC conducted a public meeting to present the OU 2 Proposed Plan and solicit public comments.	June 1996
The OU 2 ROD was approved.	September 1996
The OU 4 ROD was approved.	September 1996
The OU 2 Long-term Monitoring Program began.	April 1997
The OU 4 Long-term Monitoring Program began.	June 1998
Construction for OU 4 remedial action began.	March 1997
Final inspection for OU 4 remedial action was conducted.	July 1998
Schofield Barracks was removed from the NPL.	August 2000
Activities for First Five-Year Review for Schofield Barracks OUs 2 and 4 began.	August 2001

3.0 BACKGROUND

This section presents descriptions of the physical characteristics, land and resource use, general history and history of CERCLA-related events, and definitions of operable units at Schofield Barracks.

3.1 Physical Characteristics

Schofield Barracks is located in the Schofield Plateau between the Waianae and Koolau Mountain Ranges in central Oahu (Figure 3.1). It is the Army's largest installation outside the continental United States. It currently serves primarily as the home of the 25th Infantry Division (Light), whose mission is to be prepared to respond to an emergency at a moment's notice. In support of this mission, the division's main activity is training. Installation facilities include a medical facility, community and housing support facilities, and transportation and repair facilities.

The groundwater body underlying the Schofield Plateau is known as the Schofield High-level Water Body (Figure 3.2). The water table (potentiometric surface) elevation of the Schofield High-level Water Body is approximately 275 feet above mean sea level (msl). This elevation is lower than the adjacent dike-impounded water bodies to the east (Koolau Mountain Range) and west (Waianae Mountain Range) and higher than the basal water bodies to the north (Waialua Basal Water Body) and south (Honolulu-Pearl Harbor Basal Water Body) that have elevations of less than 50 feet above sea level.

The northern and southern boundaries of the Schofield High-level Water Body (characterized as ground-water dams) have been inferred from water-level measurements in domestic and irrigation wells on either side of the groundwater dams and by geophysical surveys. The dams impede groundwater flow to the Honolulu-Pearl Harbor and Waialua Basal Water Bodies. However, the nature and locations of these water body boundaries are not precisely known.

3.2 Land and Resource Use

The property incorporated within the Schofield Barracks Main Post, the Schofield Barracks East Range, and Wheeler Army Airfield are owned and operated by the Army as active military installations. The towns of Wahiawa and Mililani, other military properties, and private properties are adjacent to Schofield Barracks or in the surrounding vicinity. Some of the private properties are used for agricultural purposes such as growing sugar cane and pineapples.

Groundwater is the principal source of drinking water for the population of Oahu and is the source of fresh water for other uses. Most of the groundwater wells in the Schofield Barracks area are used as municipal water supplies or have irrigation uses.

3.3 History of Contamination

Schofield Barracks was originally established in 1908 as a base for the Army's mobile defense of Pearl Harbor and the Island of Oahu. It served as a major support facility during World War II, temporarily housing more than one million troops. It also served as a support and training facility during the Korean and Vietnam wars. Since the Vietnam War, it has served primarily as a training facility.

In 1985, TCE, a commonly used cleaning solvent, was detected in groundwater from the Schofield Barracks water-supply wells. The source of the TCE contamination could not be identified; however, it is likely that the TCE migrated from one or more ground surface locations through the soil and bedrock to the underlying groundwater.

The Former Landfill was an open burn dump from approximately 1942 until 1967, when it was converted to a sanitary landfill in response to provisions of the Clean Air Act (Ecology and Environment, Inc., 1981; Kennedy Engineers, 1980b). The Former Landfill was used to dispose of a wide variety of solid wastes from various military installations, of which the major contributors were Schofield Barracks,

Wheeler Air Force Base (currently Wheeler Army Airfield), and the Wahiawa Radio Station (U.S. Army Support Command, Hawaii, 1983; Kennedy Engineers, 1980b). Most of the waste deposited in the landfill was domestic refuse from the surrounding base housing (Ecology and Environment, Inc., 1981); however, wastes were also disposed from various industrial operations (e.g., vehicle and equipment maintenance and construction). Tripler Army Medical Center (TAMC) reportedly contributed medical wastes including pathogenic, infectious, and pharmaceutical (expired and unusable drugs) wastes (Ecology and Environment, Inc., 1981; Kennedy Engineers, Inc., 1980b).

Other materials reportedly disposed in the Former Landfill were organic solvents, sewage sludge, asbestos, pesticide containers, unusable paints, metallic debris, vegetation, and tree stumps (Environmental Science and Engineering, 1984). Hazardous materials, including live munitions, acids, and solvents, were also reported to have been dumped in the landfill (Asquith, 1982; Kennedy Engineers, 1980b). HLA personnel interviewed Mr. Steve Kim, Directorate of Health Services, TAMC, on December 6, 1991. Mr. Kim reported that a mortar round and a rocket casing had been excavated from the landfill in the past. In addition, Ecology and Environment, Inc., (1981) reported that 90-millimeter (mm) shells exploded onsite when they were struck by a landfill tractor. The EPA Field Investigation Team report (Ecology and Environment, Inc., 1981) cited two explosions of drummed material labeled methyl ethyl ketone, and indicated that an area may exist where 20- to 25-gallon glass containers containing concentrated sulfuric acid are buried. No records were available concerning the types, amounts, or volumes of wastes disposed at the Former Landfill, but the rate has been estimated at 100 tons per day (Kennedy Engineers, 1980b).

3.4 Initial Response

In September 1986, the Army installed an air stripping treatment unit to remove the TCE from the water prior to use in the water-supply system. In 1987, the EPA established a MCL for TCE of 5 parts per

billion (ppb) in drinking water. TCE has not been detected above this limit in the treated groundwater from the Schofield Barracks water-supply wells.

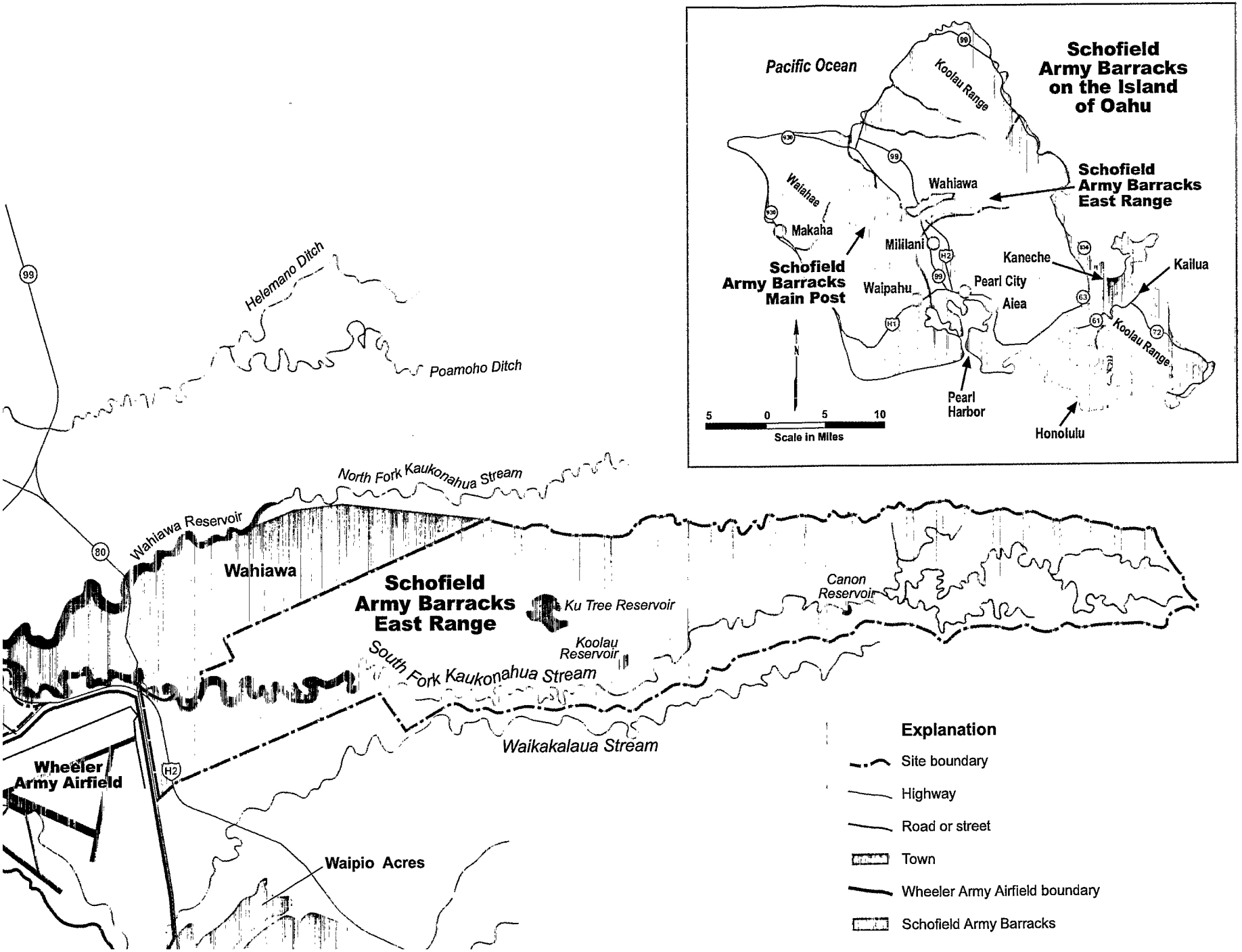
As a result of the detection of TCE in the water from the onsite water-supply wells, Schofield Barracks was placed on the National Priorities List (NPL) in August 1990. The NPL is a list of sites, developed by the EPA, which pose a risk to public health or the environment. Section 120 of CERCLA requires federal facilities to investigate and remediate past releases of hazardous wastes that pose a risk.

3.5 Basis for Taking Action

Groundwater was extensively sampled during preparation of the Final Operable Unit 2 Remedial Investigation Report, Schofield Army Barracks, Island of Oahu, Hawaii (OU 2 RI) (HLA, 1996b) and the Final Feasibility Study Report for Operable Unit 2, Schofield Army Barracks, Island of Oahu, Hawaii (OU 2 FS) (HLA, 1996a) to characterize the nature and extent of contamination in groundwater in the Schofield Barracks and Wheeler Army Airfield area. The only analytes detected above MCLs in the groundwater system beneath Schofield Barracks and Wheeler Army Airfield were TCE, CCl_4, antimony, and manganese. Other chlorinated volatile organic compounds (VOCs), such as tetrachloroethene, were detected in some wells at very low concentrations (less than MCLs). Contaminants were detected in two plume areas: (1) beneath the Former Landfill area and (2) beneath the Schofield Barracks East Range and Wheeler Army Airfield (East Range/Wheeler) area. TCE was the only contaminant detected in the East Range/Wheeler plume area and was also detected in the vicinity of the Former Landfill. Figure 3.3 shows the 1996 horizontal extent of TCE greater than 5.0 micrograms per liter (µg/l) in the groundwater system beneath Schofield Barracks (HLA, 1996d). The horizontal extent of CCl_4, antimony, and manganese contamination was limited to the immediate vicinity of the Former Landfill. Maximum concentrations of CCl_4 from 1999 to 2001 are presented in Figure 3.4. The inorganic analytes antimony and manganese were detected above MCLs inconsistently. Because of this inconsistency and because these inorganic analytes were not detected above MCLs during later RI/FS sampling events, the detections of antimony

and manganese above MCLs were believed to be anomalous. Therefore, only TCE and CCl_4 were retained as chemicals addressed in the OU 2 FS.

The results of the OU 4 RI (found in the OU 4 FS) (HLA, 1995b) indicate that TCE and CCl_4 are present within the landfill contents and suggest that they have leached downward to the water table via infiltration and percolation. Thus, the remedial action objectives for OU 4 included controlling this apparent TCE and CCl_4 source by mitigating water infiltration and migration through the landfill contents.



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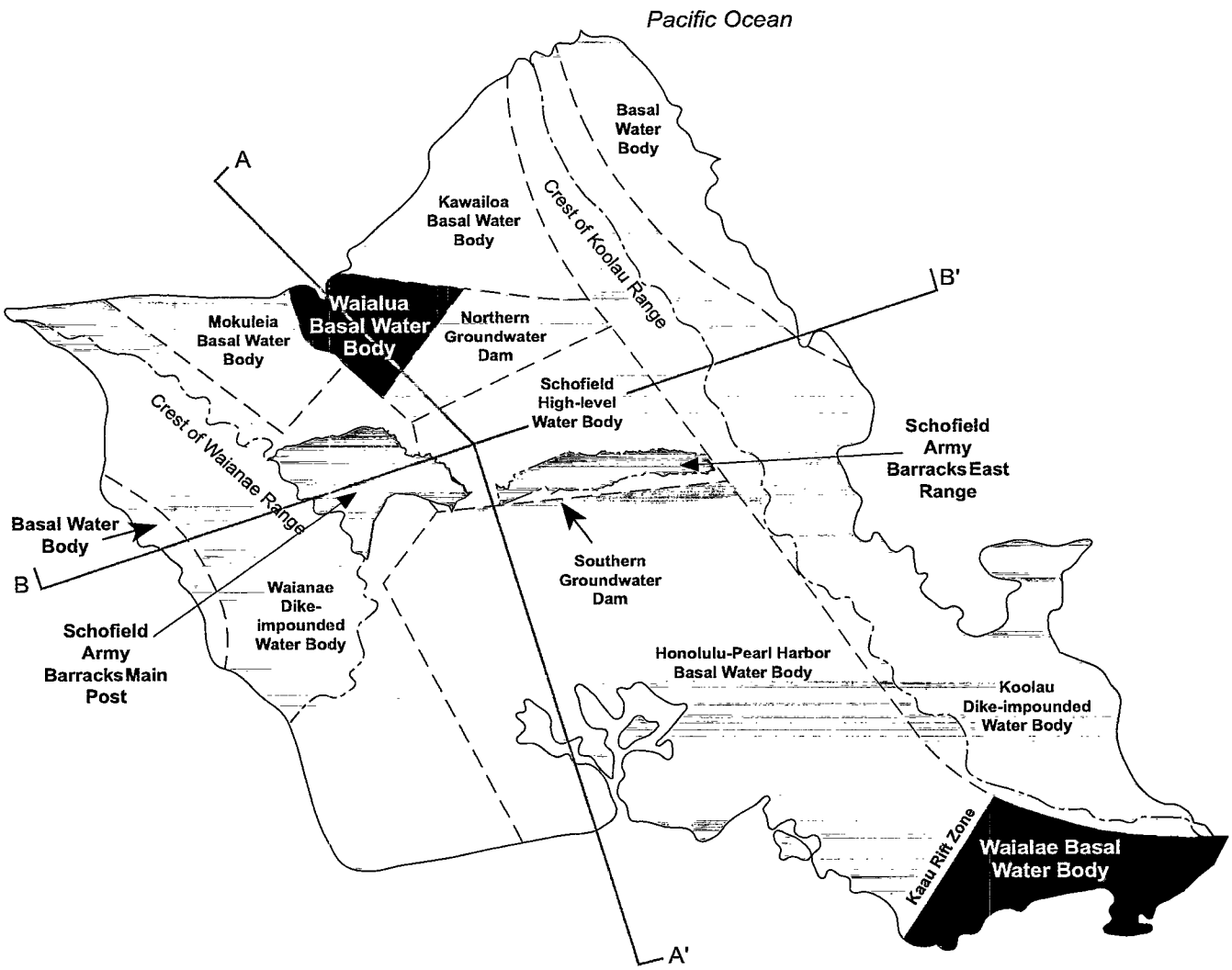

Explanation

- - — — Boundary between groundwater bodies
- Schofield Army Barracks
- Basal Water Body
- Schofield High-level Water Body
- Dike-impounded Water Body
- Groundwater dam
- A A' Generalized cross section line

N

Scale
5 0 5 10 Miles

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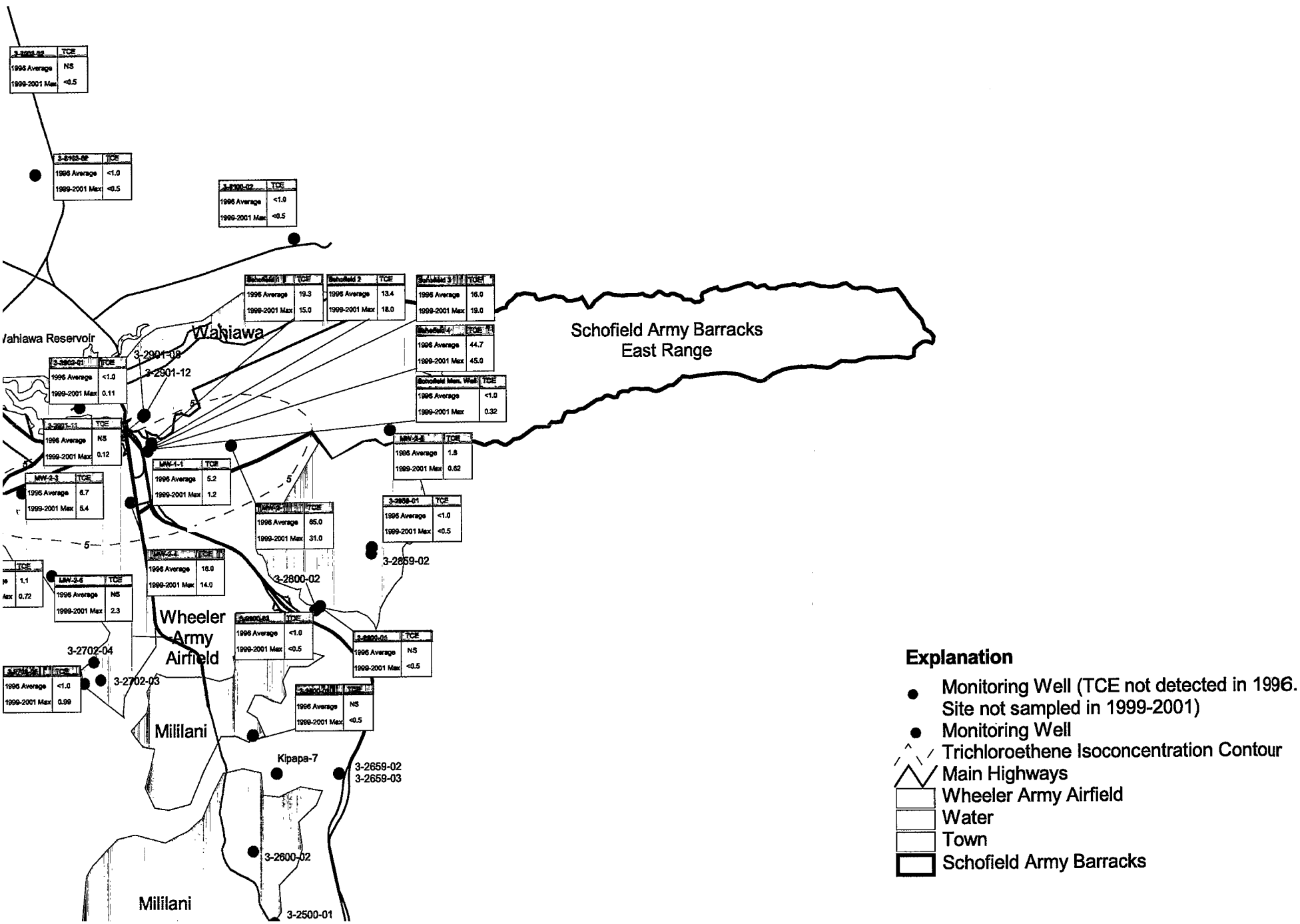
U.S. Department of the Army
U.S. Army Garrison, Hawaii

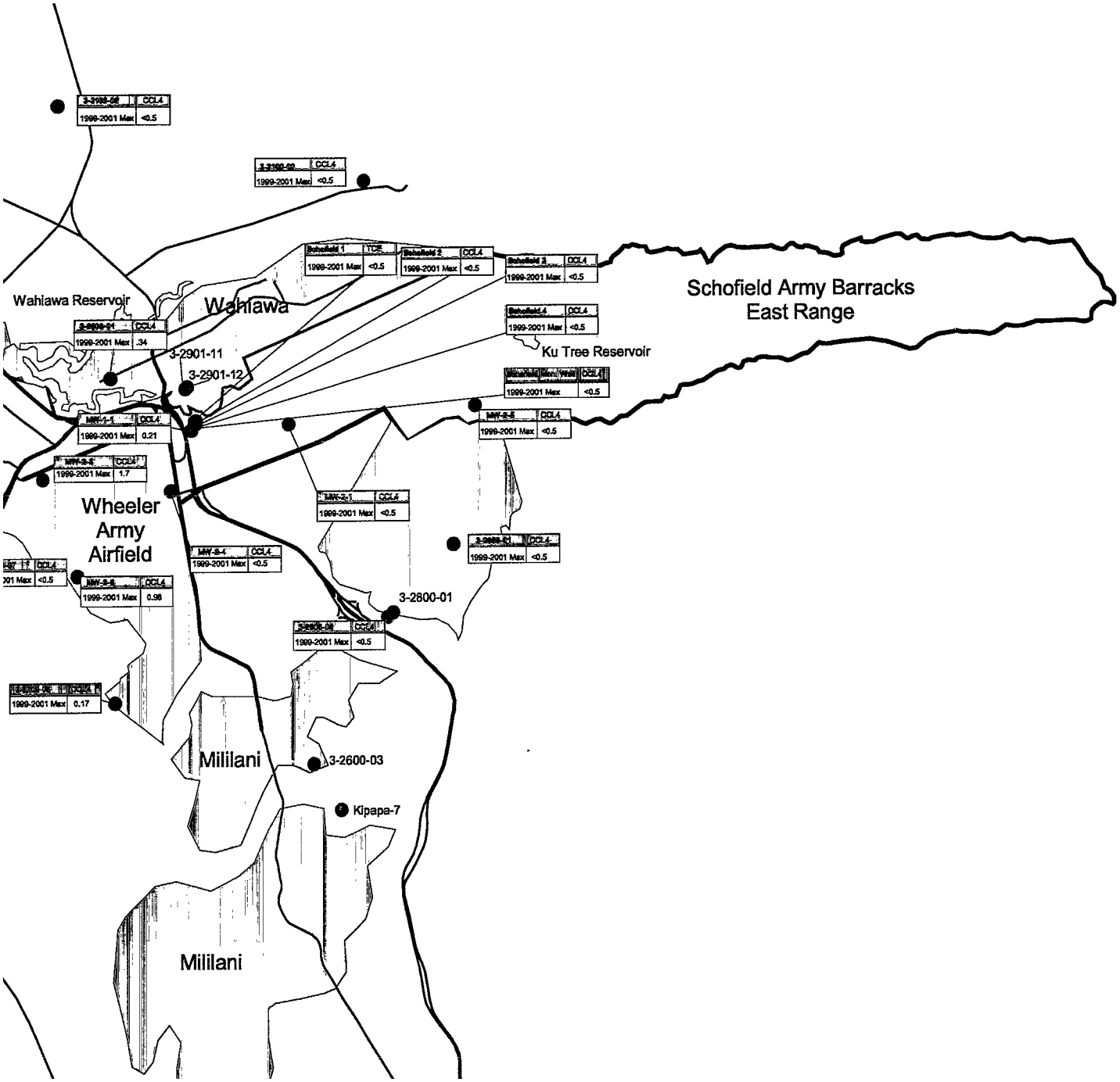
Schofield Army Barracks,
Island of Oahu, Hawaii

Figure 3.2

Regional Groundwater Systems of Oahu, Hawaii



Schofield Army Barracks
East Range
Wahiawa
Wahiawa Reservoir
Wheeler
Army
Airfield
Mililani
Mililani
Kipapa-7
3-2901-08
3-2901-12
3-2800-02
3-2859-02
3-2702-04
3-2702-03
3-2659-02
3-2659-03
3-2600-02
3-2500-01
Explanation
Monitoring Well (TCE not detected in 1996. Site not sampled in 1999-2001)
Monitoring Well
Trichloroethene Isoconcentration Contour
Main Highways
Wheeler Army Airfield
Water
Town
Schofield Army Barracks



Explanation

- Monitoring Well
- Main Highways
- Wheeler Army Airfield
- Water
- Town
- Schofield Army Barracks

4.0 REMEDIAL ACTIONS

This section presents the remedial action objectives (RAOs) and the remedies selected and implemented for OU 2 and OU 4 at Schofield Barracks.

4.1 Operable Unit 2 Remedial Actions

The RAOs and remedy selected and implemented for OU 2 are summarized in the following subsections.

4.1.1 Operable Unit 2 Remedial Action Objectives

The RAOs for OU 2 (HLA, 1996a) are the following:

- Mitigate the risk to human health and the environment from potential exposure to contaminated groundwater.
- Satisfy state and federal applicable or relevant and appropriate requirements (ARARs).

4.1.2 Selected Remedy for Operable Unit 2

The selected remedy (HLA, 1996d) provides protection of human health and the environment by reducing potential risks associated with domestic use of the contaminated groundwater. The remedy includes the following components:

- Continue treatment for contaminants of concern (COCs) present in extracted groundwater at the Schofield Barracks Supply Wells and at the Del Monte Fresh Produce, Inc. (Del Monte) water supply system at Kunia Village (Well 3-2803-05) by air stripping at the wellhead followed by discharge of the treated water to the distribution system.
- The Army must consult with EPA and the State of Hawaii Department of Health (DOH) prior to abandoning the Schofield Barracks water supply wells, because production at these wells may help to control plume migration.
- Implement long-term sampling and analysis of water supply wells, agricultural wells, and monitoring wells in the region.
- Implement the contingency of wellhead treatment on any water supply wells that are impacted by the plume from Schofield Barracks above one-half of the MCL as established under the Safe Drinking Water Act (SDWA).

- Upgrade the treatment system or pay any incremental costs for treatment caused by contamination from Schofield Barracks at wells that already have a treatment system in place.
- Conduct five-year site reviews with the Hawaii DOH and the EPA to ensure that human health and the environment continue to be protected.

In addition, Hawaii DOH requires that any new wells installed as water-supply wells under SDWA be sampled for the SDWA-specified analytes, which include TCE and CCl_4. Also, any new wells that are installed within the area covered by the long-term monitoring network will be added to the existing long-term monitoring network presented in Figure 3.3. Should these new wells be or become contaminated with COCs at the trigger concentrations described in Figures 4.1 and 4.2 and the contamination be shown to be directly attributed to Schofield Barracks, the selected wellhead treatment alternative would be implemented to address this contamination. The purpose of the groundwater monitoring portion of the selected remedy is to assess groundwater conditions and to track the movement of the TCE- and CCl_4-plumes to provide an early warning of potential contamination and to assess whether wellhead treatment is warranted (see Figures 4.1 and 4.2).

The details of the long-term groundwater monitoring plan, evaluation process for implementation of wellhead treatment, and description of conditions at existing water wells are presented in the OU 2 O&M Plan (HLA, 1996e).

4.1.3 Operable Unit 2 Remedy Implementation

The OU 2 selected remedy was implemented immediately following the OU 2 ROD (HLA, 1996d) approval. Wellhead treatment via air stripping continued at the Schofield Barracks WTP and at the Del Monte Well 3-2803-05. Additionally, after approval of the OU 2 ROD, the Army reimbursed Del Monte for the capital cost of the air stripping tower and began reimbursing Del Monte for costs associated with operating the air stripper that treats groundwater from Well 3-2803-05 and provides a drinking water supply for Kunia Village. No additional wells have required treatment since that time. The OU 2 interim

long-term monitoring program was conducted through January 1997. Beginning in April 1997, the quarterly and semiannual long-term monitoring program for OU 2 was instituted and continues to the present (2002).

4.1.4 Operable Unit 2 System Operations and Maintenance

The OU 2 remedy components that are currently being implemented are long-term groundwater monitoring, wellhead treatment of groundwater at the Schofield Barracks water treatment plant, and wellhead treatment at Del Monte Well 3-2803-05. The components of the OU 2 remedy that incur O&M costs are the following:

- Long-term groundwater monitoring program implementation
- Schofield Barracks groundwater treatment system operation
- Del Monte air stripper system O&M

O&M activities are described below and associated costs for each of these activities are summarized in Table 4.1.

Long-term Groundwater Monitoring Program Implementation

The long-term monitoring program incorporates a network of wells that includes onpost monitoring wells, the Schofield Barracks water supply wells, and offpost domestic/municipal and irrigation wells. Some of the wells are sampled and analyzed quarterly and some are sampled and analyzed semiannually, according to the program defined in the OU 2 O&M Plan (HLA, 1996e). Analyses are performed for TCE and CCl_4. Groundwater monitoring reports are prepared quarterly. In addition, the eleven onpost monitoring wells require continuing maintenance, which has included pump and wiring repair or replacement for most or all of the eleven wells. Total yearly costs for the long-term groundwater monitoring program are presented in Table 4.1.

Schofield Barracks Water Treatment Plant Operation and Maintenance

The Schofield Barracks WTP is designed to remove TCE and tetrachloroethene (PCE) from groundwater by air stripping treatment before distribution of the groundwater to the public. The Schofield Barracks WTP consists primarily of five packed air stripping towers (one remains on standby), four extraction wells (one remains on standby), a chlorination system, a fluorination system, process pumps, groundwater extraction pumps, process controls and instrumentation, piping and associated appurtenances. A complete description of the overall treatment plant equipment and its subsystems with respect to design parameters, operations, and maintenance are provided in Appendix A.

O&M is performed by Schofield Barracks. O&M consists primarily of replacement of bag filters every two weeks, wash down of one packed air stripper tower weekly, replacement of flow meters and flow sensors as needed, one operator checking the plants operation every day, and quarterly influent and effluent WTP water sampling. Associated annual O&M costs are presented in Table 4.1.

Del Monte Air Stripper Treatment System Operation and Maintenance

The Del Monte Air Stripper Treatment System (ASTS) is designed to remove TCE and CCl_4 from groundwater extracted from Well 3-2803-05 by air stripping treatment before distribution of the groundwater to the Kunia Village water supply. The Del Monte ASTS consists primarily of one air stripping tower, one extraction well, one process pump, one groundwater extraction pump, process control and instrumentation, piping and associated appurtenances.

O&M is performed by Del Monte and associated costs are reimbursed by Schofield Barracks. The costs reimbursed to date are those for air stripper tower installation, blower replacement, and routine O&M. The reimbursed total cost provided to Del Monte by Schofield Barracks is presented in Table 4.1.

The ongoing O&M activities being performed by Schofield Barracks and Del Monte are in accordance with the OU 2 O&M Plan (HLA, 1996e) and are successfully meeting the requirements stated in the OU 2 ROD.

4.2 Operable Unit 4 Remedial Actions

This section presents a summary of remedial action objectives and remedy selection and implementation for OU 4.

4.2.1 Operable Unit 4 Remedial Action Objectives

The following RAOs were selected from the EPA's Presumptive Remedy for CERCLA Municipal Landfill Sites guidance document (EPA, 1993) to provide protection to human health and the environment for the media of concern identified in the OU 4 ROD (HLA, 1996c), which include landfill contents and landfill gas.

- Prevent direct contact with landfill contents.
- Reduce contaminant transport to groundwater.
- Control surface-water runoff and erosion.
- Control landfill gas.

4.2.2 Selected Remedy for Operable Unit 4

The selected remedy provides protection of human health and the environment by reducing potential risks associated with direct contact of the landfill contents and potential transport of contaminants to groundwater. The remedy includes the following major components:

- Regrade the existing landfill cover to generally match the 1983 engineered drainage grade.
- Remove the existing Guinea grass and revegetate with another type of grass that is more appropriate for a landfill cover.
- Perform long-term maintenance of the landfill cover.

- Maintain existing landfill gas venting.
- Install additional gas monitoring points at the perimeter of the landfill.
- Implement institutional controls (landfill gas and groundwater monitoring, five-year site review, land-use restrictions, and site security).

4.2.3 Operable Unit 4 Remedy Implementation

Implementation of the selected remedy began on March 10, 1997 and occurred in several different construction phases. The final inspection was performed on July 21, 1998. Landscaping activities were completed on August 7, 1998. Remedial activities consisted of the following:

- Clearing and grubbing of existing vegetation and selected trees and shrubbery
- Repairing landfill cracks
- Filling of landfill subsidence areas
- Regrading the surface of the landfill cover to maintain a positive slope to promote surface water runoff
- Landscaping with new vegetation
- Repairing a portion of the existing central drainage system
- Repairing eroded areas on the sides of the existing central drainage system
- Installing a cement rubble masonry (CRM) channel
- Installing nine new gas monitoring wells and modifying five existing monitoring wells

Upon completion of remedial activities, EPA determined that the landfill cap, drainage and monitoring systems were complete, functional, and operational.

4.2.4 Operable Unit 4 System Operations and Maintenance

O&M of the landfill cover was conducted in general accordance with the OU 4 O&M Plan (HLA, 1996f). The purpose of O&M of the landfill cover was to provide information to assist in the performance of the

remedial action. O&M requirements include general inspection requirements, general maintenance requirements, long-term monitoring, recordkeeping, and reporting.

General inspection requirements included quarterly inspections of the landfill cover, vegetative cover, side slopes, drainage system, existing landfill gas wells, perimeter landfill gas monitoring system, groundwater monitoring well network, security fence, access roads, and survey monuments. The OU 4 O&M Plan also requires additional inspections of the landfill cover, side slopes, and drainage system after heavy rainfall events and after major storm or earthquake events.

Following are general maintenance requirements for the different components of OU 4:

- Vegetative Cover: Conducting perimeter control and spot control to prevent reinvasion of Guinea grass and other undesirable vegetative species, and annual mowing of the vegetative cover.
- Side Slopes: Backfilling with topsoil and compacting damaged areas to the final grade. Placing erosion matting in areas where erosion or slumping is persistent until vegetation is adequately established.
- Drainage System: Repairing any structures found to be damaged, clogged, or incapable of conveying runoff flows.

Any damaged perimeter landfill gas monitoring wells, existing landfill gas wells, and groundwater monitoring wells were required to be repaired or replaced accordingly. Also, any damaged security fences, access roads, and survey monuments required immediate repair.

Long-term monitoring for OU 4 consisted of monitoring of the perimeter landfill gas wells. Hawaii State regulations require that landfill gas not exceed the lower explosive limit (LEL) at the landfill boundary. Therefore, quarterly landfill gas monitoring was required to evaluate gas concentrations. Landfill gas monitoring results were to be submitted to EPA and the Hawaii DOH. Immediate notification of EPA and the Hawaii DOH was also required if the LEL for methane gas was exceeded.

O&M costs for the OU 4 remedy include landfill gas monitoring, landfill landscaping (re-grading, application of herbicide to remove Guinea grass, etc.), landfill cover crack repair (from settlement), and repair/replacement of any other component becoming damaged from the above list. Table 4.2 details O&M costs from 1997 to 2002.

As shown in Table 4.2, the most significant cost is due to landfill cover crack repair. The cost of landfill landscaping has also been substantial due to revegetation of the regraded area. Since landfill gas monitoring is performed as routine maintenance, the associated cost has been relatively consistent.

The ongoing OU 4 O&M activities being performed by Schofield Barracks are in accordance with the OU 4 O&M Plan (HLA, 1996f) and are successfully meeting the requirements stated in the OU 4 ROD.

Table 4.1: Operation and Maintenance Cost for Operable Unit 2 Remedy

	1997	1998	1999	2000	2001	TOTAL
Long-term Groundwater Monitoring Program Implementation	$344,407	$227,803	$125,949	$257,951	$259,636	$1,215,746
Schofield Barracks Water Treatment Plant Air Stripper Operation and Maintenance and Monitoring*	42,200	47,050	47050	47,050	47,050	230,400
Del Monte Air Stripper Treatment System Operation and Maintenance#	352,175	73,381	19,896	20,692	21,520	487,664
Totals	$738,782	$348,234	$192,895	$325,693	$328,206	$1,933,810

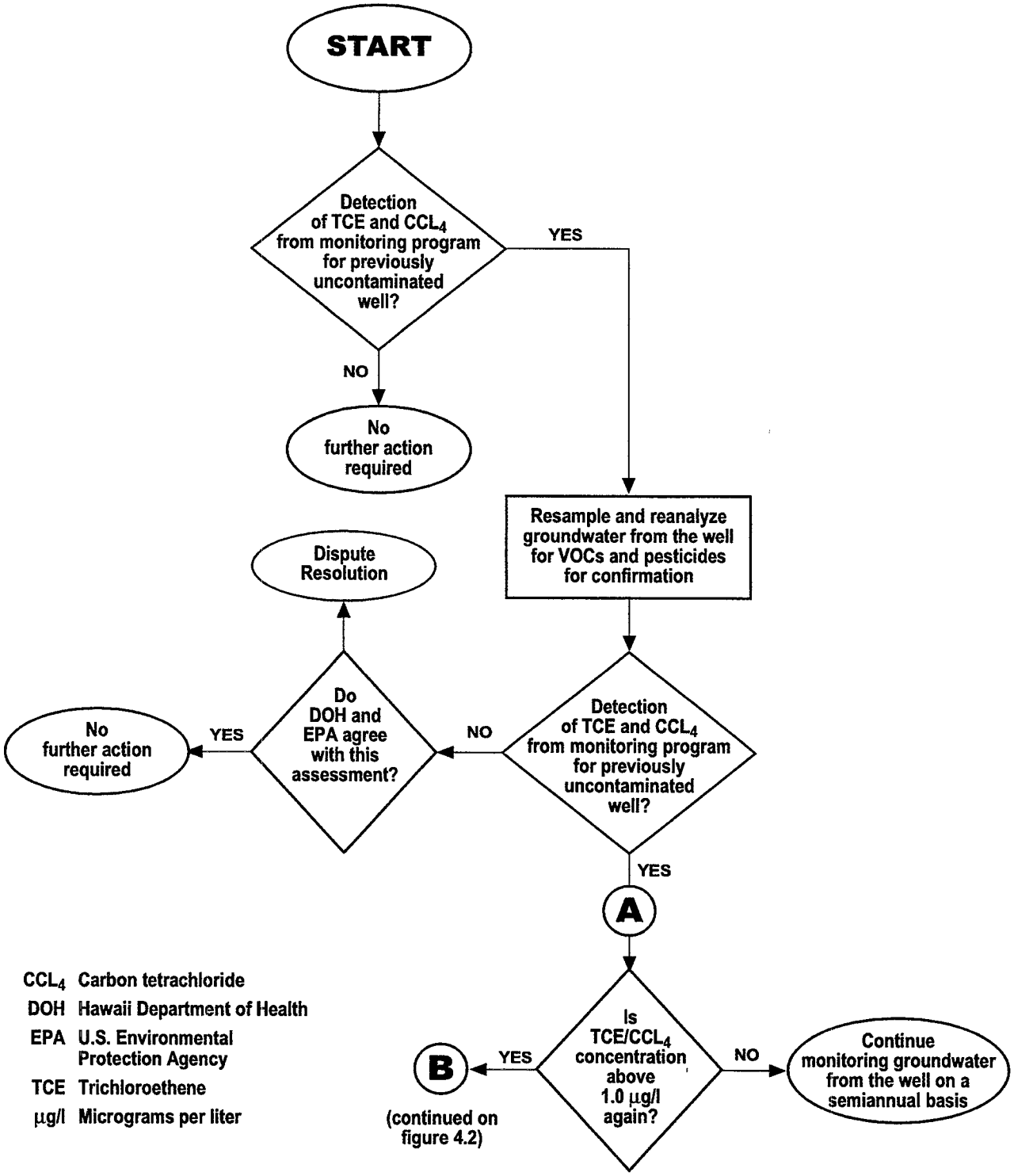
* Includes routine operation and maintenance, and quarterly operations monitoring

\# Includes air stripper treatment tower reimbursement in 1997, blower replacement in 1998, and routine operation and maintenance

Table 4.2: Operation and Maintenance Cost for Operable Unit 4 Remedy

	1997	1998	1999	2000	2001	2002	Total
Landfill Gas Monitoring	$0	$25,071	$17,910	$28,456	$28,898	$29,000*	$129,335
Landfill Landscaping	$0	$13,059	$52,237	$52,956	$53,704	$54,000*	$225,956
Landfill Crack Repair (1)	$0	$0	$0	$256,344	$20,186	$0	$276,530
Landfill Crack Repair (2)	$0	$0	$0	$0	$20,000	$1,153,040	$1,173,040
Totals	$0	$38,130	$70,147	$337,756	$122,788	$1,236,040	$1,804,861

* - Estimated value



CCL_4 Carbon tetrachloride
DOH Hawaii Department of Health
EPA U.S. Environmental Protection Agency
TCE Trichloroethene
µg/l Micrograms per liter

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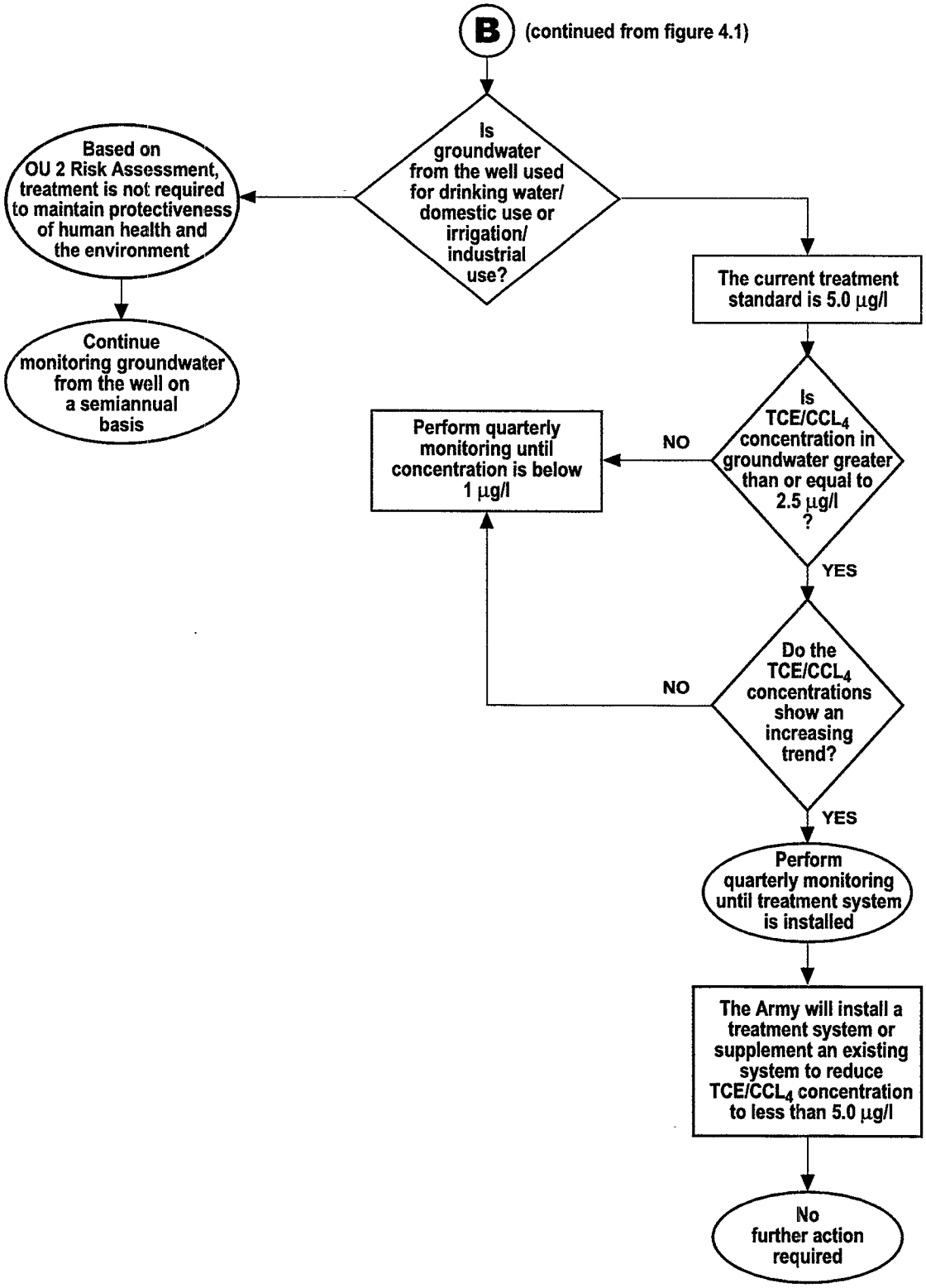
U.S. Army Garrison, Hawaii

Schofield Army Barracks,
Island of Oahu, Hawaii

Figure 4.1

Impact Evaluation for Potential Wellhead Groundwater Treatment



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U.S. Army Garrison, Hawaii

Schofield Army Barracks,
Island of Oahu, Hawaii

Figure 4.2

Well Use Evaluation and Action Identification for Potential Wellhead Groundwater Treatment

5.0 PROGRESS OR CHANGES SINCE REMEDY IMPLEMENTATION

This is the first five-year review for Schofield Barracks, so there is not a previous five-year review against which to compare. However, changes that have occurred since remedy implementation are presented in this section.

5.1 Changes in Operable Unit 2 Conditions

The OU 2 long-term monitoring program has been in effect since the signing of the OU 2 ROD (HLA, 1996d) in 1996. The program is performed in accordance with the OU 2 O&M Plan (HLA, 1996e). The program incorporates onsite water-supply wells and monitoring wells, as well as offsite municipal supply wells and irrigation wells in the surrounding area. Part of the OU 2 wells – the Schofield Barracks water supply wells, the onsite OU 2 monitoring wells, and other wells where TCE and CCl_4 detections have occurred, are sampled quarterly for TCE and CCl_4. Other OU 2 wells and the OU 4 monitoring wells and offsite downgradient wells are sampled semiannually.

Over the past five years, the distribution of contaminants in groundwater has changed very little. Certain wells have shown slightly increasing trends in TCE or CCl_4 or both. Other wells have exhibited slightly decreasing trends. Groundwater from Well 3-2803-05 has exhibited increasing TCE concentrations to the point of exceeding the 5 μg/l MCL during August 2000, and groundwater from Well 3-2803-01 has exceeded the 2.5 μg/l action level. Maximum concentration maps of TCE and CCl_4 are presented in Figures 3.3 and 3.4, respectively. The concentrations of CCl_4 have also increased in several wells, but they have not exceeded the action level of 2.5 μg/l in any offsite wells to date. CCl_4 concentrations have exceeded the 2.5 μg/l action level only in groundwater from onsite OU 4 monitoring wells MW-4-1, MW-4-3, and MW-4-4.

5.2 Changes in Operable Unit 4 Conditions

Notable issues were observed and recorded throughout the quarterly inspections of OU 4. Table 5.1 summarizes the OU 4 quarterly inspections conducted from the completion of the remedial action in 1998 to 2001. No significant changes in the OU 4 conditions have been observed.

Most of the observations have been related to maintenance issues. The most significant observations have been swales and cracks that have formed due to settlement of the landfill contents. Additionally, sparse vegetation and corrosion of the protector casings on the monitoring wells have been observed. Maintenance actions on these items have either been completed or are in the process of being completed.

Table 5.1: Summary of Landfill Quarterly Inspection Reports

Inspection of	Condition		Action Required?		Comments	Date of Corrective Action
	Adequate/ Stable	Damaged/ Deteriorating	yes	no		
1. Facility Access Control System						
A. Security Fence						
1. Gaps Beneath Fence	X			X	No deficiencies observed	NA
2. Chain-Link Fabric	X			X	No deficiencies observed	NA
4. Fence Posts-6/27/01		X		X	Fence still intact--no action required	NA
9/5/01		X		X	Fence still intact--no action required	NA
B. Site Access Gates						
1. Gate Locks	X			X	No deficiencies observed	NA
2. Gate Operation	X			X	No deficiencies observed	NA
C. Warning Signs	X			X	No deficiencies observed	NA
D. Access Roads	X			X	No deficiencies observed	NA
2. Runon/Runoff Controls						
A. Northern Runoff Control Berms	X			X	No deficiencies observed	NA
B. Center Drainage Channel-1/29/99		X		X	Hairline crack noted in riprap of drainage chute	NA
7/21/99		X		X	Hairline crack noted in January has not grown in size and does not appear to affect the structural integrity	NA
6/28/00	X		X		The drainage chute contained surface debris. Debris was cleaned out during inspection.	Jun-00
10/31/00	X		X		The drainage chute contained surface debris. Debris was cleaned out during inspection.	Oct-00
6/27/01		X		X	Some signs of erosion and possible mongoose burrows	NA
C. Northern Drainage Channel-1/29/99	X		X		The concrete drop pit was filled with mud, rocks, and debris. Corrective action was taken subsequent to the inspection.	Jan-99
D. Western Drainage Channel-6/27/01		X	X		Grades are more pronounced due to settlement	Planned for Jan-02
E. Northcentral Side Slope Drainage Chute	X			X	No deficiencies observed	NA
F. Northern Side Slope Drainage Chute	X			X	No deficiencies observed	NA
G. Northwestern Side Slope Drainage Chute	X			X	No deficiencies observed	NA
3. Final Cover System (Top and Side Slopes)						
A. Vegetation Establishment						
1. Barren Areas-10/26/98		X		X	Northern corner is barren--much of the grass is dying	NA
10/31/00		X		X	Vegetation just north of central swale affected	NA
2/21/01		X		X	Several areas where grass is no longer present	NA
6/27/01		X		X	Several areas where grass is no longer present	NA
9/5/01		X		X	Several areas where grass is no longer present	NA
2. Tree Growth	X			X	No deficiencies observed	NA
B. Slope Failure/Slumping	X			X	No deficiencies observed	NA
C. Cracking/Settlement-3/13/00		X	X		Southeastern section	Jan-01
6/28/00		X	X		Southeastern section	Jan-01
8/26/00		X	X		Southeastern section	Jan-01
10/31/00		X	X		Southeastern section settling--contract to correct awarded	Jan-01
2/21/01		X	X		Cracks found in northwestern corner	Planned for Jan-02
6/27/01		X	X		Settlement in northwestern corner	Planned for Jan-02
9/5/01		X	X		Northwestern section showing signs of settlement	Planned for Jan-02

Table 5.1 (continued)

D. Erosion Damage-4/27/99		X	X		Previously noted in Western Channel	Planned for Jan-02
3/13/00		X		X	Slight signs of erosion in northwestern corner	NA
8/26/00		X		X	Slight signs of erosion in northwestern corner	NA
10/31/00		X	X		Southeastern section--contract to correct awarded	Planned for Jan-02
E. Debris Accumulation-10/26/98	X		X		Removed several pieces of PVC	Oct-98
3/13/00	X		X		Debris cleaned in Central Drainage Channel	Mar-00
F. Animal Burrows-6/27/01		X		X	Possible mongoose burrows in Central Swale	Sep-01
9/5/01		X		X	Some holes in Center Drainage Channel. Rodenticide was placed near the openings of the burrows discovered on 6/27/01--no further damage noted.	NA
G. Fire/Explosion Damage	X			X	No deficiencies observed	NA
4. Gas Monitoring/Control System						
A. Well Casing and Cap	X			X	No deficiencies observed	NA
B. Protective Casing-6/27/01	X			X	No deficiencies observed	NA
C. Grout Seal	X			X	No deficiencies observed	NA
5. Groundwater Monitoring System						
A. Monitoring Wells						
1. Well Casing and Cap-4/27/99		X	X		Casings showing signs of corrosion	Planned for Jan-02
2. Protective Casing-11/15/99		X	X		Casing is rusted	Planned for Jan-02
3/13/00		X	X		Casing is rusted	Planned for Jan-02
6/28/00		X	X		Casing is rusted	Planned for Jan-02
8/26/00		X	X		Casing is rusted	Planned for Jan-02
10/31/00		X	X		Casing is rusted	Planned for Jan-02
2/21/01		X	X		Casing is rusted	Planned for Jan-02
6/27/01		X	X		Corrosion evident on cover and hinges	Planned for Jan-02
9/5/01		X	X		Evidence of corrosion on cover and hinge	Planned for Jan-02
3. Locks	X			X	No deficiencies observed	NA
4. Grout Seal	X			X	No deficiencies observed	NA

6.0 FIVE-YEAR REVIEW PROCESS AND FINDINGS

The five-year review process consists of review components and public involvement and are discussed in this section. Additionally, the findings of the review process are described in this section.

6.1 Five-Year Review Process

EPA Region 9 was notified about the initiation of the five-year review during July 2001. The Army five-year review team included Jon Fukuda of the Schofield Barracks Directorate of Public Works and James Daniel of the U.S. Army Environmental Center. Mark Ripperda is the team member from EPA and Michael Miyasaka is the team member from DOH. Review team members from Harding ESE included Cathy Armstead, Brad Coleman P.E., Kerry Conner, Chen Sam Lee P.E., and Ron Soroos. All of these individuals were involved in the RI, FS, or ROD portions of the CERCLA process for OU 2 and OU 4.

During August 2001, the Harding ESE review team established the review schedule whose components include the following:

- Document Review
- Data Review
- Remedy Inspection
- Five-Year Review Report Development and Review
- Public Involvement

The following subsections describe the review process performed for document and data and remedy inspection by OU. Additionally, public involvement is described for both OUs and the findings of the review process in the following subsections.

6.2 Findings of Operable Unit 2 Review

The five-year review process for OU 2 included document and data review and remedy inspection. The findings of the various portions of the OU 2 review are presented separately in the following subsections.

6.2.1 Operable Unit 2 Document and Data Review

Documents relevant to the Schofield Barracks CERCLA process were reviewed as a part of the five-year review process. Historical documents, recent documents, and onsite documents were reviewed as part of the process. A list of documents reviewed during the five-year review process is found in Appendix B.

6.2.1.1 Operable Unit 2 Historical Documents

Relevant historical documents such as the OU 2 RI and FS reports and ROD (HLA, 1996b, 1996a, and 1996d) and the Comprehensive Five-Year Review Guidance (EPA, 2001) were reviewed as part of the five-year review. Discussions regarding the findings of each document reviewed are presented below.

Operable Unit 2 Remedial Investigation Report

The OU 2 RI Report (HLA, 1996b) presents information gathered from 1993 through 1995 to characterize aquifer properties, groundwater quality, the nature and extent of groundwater contamination underneath Schofield Barracks and the surrounding area, and health risks posed by contaminated groundwater. The report presents baseline conditions against which to compare long-term groundwater monitoring data from 1996 to 2001. The baseline conditions were reviewed for groundwater levels, TCE and CCl_4 concentrations and distributions, other detected analytes, and groundwater modeling results.

Some of the conclusions of the RI report are the following:

- TCE contamination in groundwater was detected in the vicinity of (1) the Former Landfill and (2) the area including the Schofield Barracks East Range, Wheeler Army Airfield, and Kunia. CCl_4 was detected only in the Former Landfill area.
- The vertical distribution of TCE in groundwater underlying the Wheeler Army Airfield and East Range areas appears to increase with depth to an elevation of approximately 75 feet below the

water table (200 feet above msl), and then decrease to less than the MCL at approximately 275 feet below the water table (0 feet above msl). Consistent with this observation, TCE is present in groundwater extracted from all four of the Schofield Barracks onpost water supply wells, but TCE concentration is greatest in groundwater from Schofield Barracks Supply Well Number 4, the deepest of the four.

- The primary mechanism for migration of VOCs through the saturated zone is advective flow in the dissolved phase and the direction of movement is primarily driven by pumping in the aquifer and by groundwater gradients.
- Modeling results indicate that TCE concentration above the MCL may potentially impact some downstream receptors (to the south) within 100 years.
- The chemicals TCE and CCl_4 were identified as COCs. There are no current human health or environmental risks in either area where COCs were detected because the groundwater is being treated to below detectable levels of TCE prior to use at Schofield Barracks.

Operable Unit 2 Feasibility Study Report

The OU 2 FS (HLA, 1996a) was prepared to evaluate remedial technologies to address risk assessment results from the OU 2 RI. The FS defined RAOs to serve as a basis for selecting technologies and developing remedial action alternatives. The RAOs for OU 2 groundwater that were used in the OU 2 FS were to mitigate the risk to human health and the environment from potential exposure to contaminated groundwater, and to satisfy state and federal ARARs.

To address the RAOs, two remedial action alternatives were formulated; one which incorporated a groundwater pump and treat system and one which incorporated wellhead groundwater treatment. The results of a preliminary evaluation (Appendix A of the OU 2 Feasibility Study [HLA, 1996a]) indicated that a pump and treat remedy, even for containment, was impracticable; thus it was not carried through the detailed analysis comparison. The evaluation concluded that the wellhead treatment option would be protective of human health and the environment; thus it was selected as the preferred remedial alternative. Other components of the selected remedy include groundwater monitoring to assure that receptors are not exposed to COC concentrations exceeding the MCLs.

Operable Unit 2 Record of Decision

The OU 2 ROD (HLA, 1996d) was prepared to document the selected remedy, summarize the rationale for remedy selection, and document other aspects of the decision. The selected remedy provides protection of human health and the environment by reducing potential risks associated with domestic use of the contaminated groundwater. The components of the OU 2 remedy are discussed in Section 4.0.

Operable Unit 2 Operation and Maintenance and Long-Term Groundwater Monitoring Plan

The OU 2 O&M Plan (HLA, 1996e) was prepared to document the long-term monitoring program, sampling and analysis procedures, contingencies for revising the program, O&M requirements, and reporting requirements. Important items discussed in the plan are the monitoring well network, sampling frequencies, and contingency for applying wellhead treatment. The monitoring network is shown in Figure 3.3 of this report. The monitoring frequency for the various wells is presented in Table 6.1. The procedural diagram for changing monitoring frequency for a well, or for applying wellhead treatment based on changing COC concentrations is presented in Figures 4.1 and 4.2.

6.2.1.2 Operable Unit 2 Regulatory Update and Recent Documents and Analytical Data Review

This section summarizes the recently promulgated standards and ARARs identified in the OU 2 ROD, recently prepared OU 2 documents and recently collected analytical data from OU 2. Recent is defined as data, documents and regulatory standards developed within the last five years (i.e., 1996 through 2001). The findings of the recent document review are summarized in the following subsections.

Regulatory Update of Applicable or Relevant and Appropriate Requirements for Operable Unit 2

As part of the five-year review process, the ARARs presented in the Final OU 2 ROD (HLA, 1996d) were reviewed to confirm whether they had been revised, replaced, or deleted in the past five years. The

ARARs tables presented in the OU 2 ROD (Tables 2.2 and 2.3) have been revised and are presented in Appendix C. The changes in the ARARs are shown in italic type in Tables C.1 and C.2.

A summary of OU 2 ARARs changes is as follows:

- Location-Specific ARARs
  - Several ARAR citations have been corrected from Hawaii Code (HC) to Hawaii Revised Statutes (HRS).
  - 33 CFR 328(a)(3), Migratory Bird Rule, was deleted from the CFR.
  - 50 CFR 227, which relates to threatened or endangered habitat, was deleted from the CFR as of October 1, 1999.
- Action-Specific ARARs
  - Hawaii Administrative Rule (HAR) 11-60.1-68, related to air stripper emissions, was modified but is still applicable.

The updated location-, chemical-, and action-specific ARARs are listed below. The text is shown in italic type where ARARs have been revised from those stated in the ROD:

- Location-specific ARARs:
  - 16 United States Code (USC) 661 et seq., 662 and 663, requiring actions to be taken to prevent, mitigate, or compensate for project-related damages or losses to fish and wildlife resources.
  - Clean Water Act (CWA) 404, 33 CFR 320-330, and 40 CFR 230, prohibiting discharges that cause or contribute to significant degradation of the water of ecosystems. 33 CFR 328(a)(3), Migratory Bird Rule, was deleted from the CFR.
  - HAR 183D-61 et seq., prohibiting interference with wild birds or their nests.
  - CWA 404, prohibiting the discharge of fill material into aquatic ecosystems that would jeopardize endangered, threatened, or rare species.
  - HAR 194D-4, 16 USC 1531 et seq., 50 CFR 402 prohibiting actions that jeopardize endangered or threatened species or critical habitat of such species as designated in 50 CFR 17 or 50 CFR 226. 50 CFR 227 was deleted on October 1, 1999.

- Chemical-specific ARARs:
  - *40 CFR Part 141.2, defining SDWA MCLs and maximum contaminant level goals (MCLGs).*
  - *40 CFR 161.50, listing MCLGs for organic contaminants.*
  - *40 CFR 161.61, listing MCLs for organic contaminants.*
  - *EPA, Office of Water, Drinking Water Standards and Health Advisories, EPA 822-B-00-001, Summer 2000.*
- Action-specific ARARs:
  - HAR 11-60.1-33(a)(1)-(7) and (b), prohibiting the discharge of visible fugitive dust emissions beyond the property lot line on which the dust originates and requiring precautions to prevent fugitive dust emissions.
  - *HAR 11-60.1-68, requiring monitoring of VOC emissions if emissions are greater than 0.1 ton per year for each hazardous air pollutant.*
  - 40 CFR Part 141, (b) and (g), defining MCLs.

Operable Unit 2 Quarterly Groundwater Monitoring Reports

The long-term groundwater monitoring reports prepared up to November 2001 were reviewed. Two interim long-term monitoring reports covering the period from June 1996 through January 1997 were also reviewed. Quarterly monitoring reports covering the period from April 1997 to November 2001 were also reviewed. These reports evaluate trends in groundwater sampling analytical data from late 1991 to the present. The following is a summary of conclusions that are stated in the reviewed quarterly reports:

- The concentrations of TCE and CCl_4 detected in groundwater from the OU 2 onsite monitoring wells, and offsite production and irrigation wells during Round 22 are similar to the concentrations and distributions observed in groundwater samples collected during previous sampling rounds. As shown on the TCE concentration contour map for 1999-2001 (Figure 3.3), the contours shown in the OU 2 ROD from 1996 still fit the 1999-2001 data. However, a few wells have shown increasing or decreasing trends.
- The following apparent trends have been noted in recent quarterly reports:
  - Increasing TCE concentrations in OU 2 wells: MW-2-4 (10.44 µg/l average in 1996-97 samples to 13.50 µg/l average in 2000-01 samples). Although Well 3-2803-05 does not show a consistent increasing trend, the TCE concentration in this well is the only one in

offpost wells to exceed the 5.0 µg/l MCL (May 4, 2000). Well 3-2803-01 has had a TCE concentration exceeding the 2.5 µg/l action level during many quarterly sampling events over the past five years.

- Decreasing TCE concentrations in OU 2 wells: Schofield Barracks Supply Well 1 (12.68 µg/l average in 1996-97 samples to 10.63 µg/l average in 2000-01 samples) and Monitoring Wells MW-2-1 (39.00 µg/l average in 1996-97 samples to 29.75 µg/l average in 2000-01 samples), and MW-2-3 (8.38 µg/l average in 1996-97 samples to 4.70 µg/l average in 2000-01 samples).

- No discernible trends in CCl_4 concentrations are suggested for OU 2 onsite monitoring wells.

- Increasing TCE concentrations in OU 4 wells: MW-4-3 (12.25 µg/l average in 1996-97 samples to 16.00 µg/l average in 2000-01 samples) and MW-4-4 (18.50 µg/l average in 1996-97 samples to 22.00 µg/l average in 2000-01 samples).

- Decreasing TCE concentrations in OU 4 wells: MW-4-1 (26.25 µg/l average in 1996-97 samples to 21.00 µg/l average in 2000-01 samples).

- Increasing CCl_4 concentrations in OU 4 wells: MW-4-3 (1.99 µg/l average in 1996-97 samples to 2.65 µg/l average in 2000-01 samples) and MW-4-4 (2.28 µg/l average in 1996-97 samples to 3.85 µg/l average in 2000-01 samples).

- Other OU 4 wells do not show discernible CCl_4 trends.

- As shown in Figure 6.1, April to June 2001 results from VOC analyses performed by EPA Method 8260 (Harding ESE, 2001c) indicate the following detected compounds in addition to TCE and CCl_4:

  - Groundwater samples from OU 4 onsite monitoring wells and Monitoring Well MW-2-2 contain low-level estimated concentrations of several chlorinated and non-chlorinated VOCs. The detected VOCs include 1,2-dichloroethane, acetone, carbon disulfide, chloroform, cis-1,2-dichloroethene, methylene chloride, and tetrachloroethene (PCE). The estimated concentrations for these VOCs in these five wells are at least a factor of ten less than the primary MCLs.

  - Groundwater samples from two offsite production or irrigation wells, 3-2703-02 and 3-3103-01, had low-level estimated detections of the nematicide 1,2-dichloropropane (0.42 and 0.13 µg/l, respectively; MCL = 5 µg/l), and groundwater from offsite Well 3-2902-01 had a low-level estimated detection of 0.63 µg/l of methyl tert butyl ether (MTBE; no current regulatory standard). These three wells also had low-level estimated detections of acetone (2.5 to 6 µg/l; no current regulatory standard), methylene chloride (0.16 µg/l in Well 3-2703-02; MCL = 5 µg/l), and tetrachloroethene (0.43 µg/l; MCL = 5 µg/l). The estimated concentrations for these VOCs in these three wells are at least a factor of ten less than the primary MCLs.

- The historical water levels for the eleven onpost monitoring wells were plotted for the period 1996 to 2001. The plot shows consistent trends between the wells during this period. From a low point in early 1996, water levels rose uniformly approximately 6.5 feet to a high point in late

1997. After late 1997, the water levels declined to near the 1996 levels by late 1999. From late 1999 to mid-2001, water levels were stable. This type of analysis was done to evaluate whether flow pathways may have changed in the past five years. From the consistent changes in the water levels over time, it appears that any changes in flow directions within the aquifer are unlikely.

6.2.2 Operable Unit 2 Remedy Inspections

Site visits were conducted during August 2001 to several OU 2 locations, including the onpost groundwater monitoring wells, the Schofield Barracks Water Treatment Plant, and the Del Monte air stripper. These visits are described in this section, and an inspection checklist for the onpost monitoring wells is presented in Appendix D.

Onpost Groundwater Monitoring Wells

Onsite inspections of the Schofield Barracks onsite groundwater monitoring wells were conducted during the period from November 1 to 5, 2001. Items that were inspected included pump motors and visible wiring, water level sounding tubes, surface well casings, concrete pads, and protective housings around the surface casings. The findings of the inspections included (1) inoperable pump motors in three of the eleven wells and (2) substantial wear and weathering (rust) of the steel protective housings around the tops of ten of the eleven wells. The pump motors and wiring for the three wells have been repaired. The housings for the ten wells are in the process of being improved by repair, refinishing, and partial replacement by more durable materials. The housing repairs are to be completed during April 2002.

Schofield Barracks Water Treatment Plant

A site visit to the Schofield Barracks water treatment plant was made on August 14 and 15, 2001. A photograph of the air stripper towers is presented in Appendix E. The System Description for the Schofield Barracks Water Treatment Plant is found in Appendix A. Samples are reportedly collected from the influent and effluent by both the Hawaii DOH and the Army and analytical results indicate TCE and PCE concentrations have consistently been below the analytical detection limit of 0.5 micrograms per

liter (µg/l). Although this visit was not a detailed inspection, the treatment plant was found to be operating and functioning as designed.

Del Monte Air Stripper Treatment System

A site visit to the Del Monte water treatment plant at Kunia village was made on August 14 and 15, 2001. A photograph of the air stripper tower is presented in Appendix E. Samples are reportedly collected from the influent and effluent by the Hawaii Department of Health and analytical results indicate TCE and CCl_4 concentrations have consistently been below the analytical detection limit of 0.5 µg/l. Although this visit was not a detailed inspection, the treatment plant was found to be operating and functioning as designed.

6.3 Findings of Operable Unit 4 Review

The five-year review process for OU 4 included document and data review and remedy inspection. The findings of the various portions of the OU 2 review are presented separately in the following subsections.

6.3.1 Operable Unit 4 Document and Data Review

Similar to the OU 2 document and data review process, relevant documents were reviewed including historical documents (OU 4 RI and FS reports, the OU 4 ROD, and the Comprehensive Five-Year Review Guidance (EPA, 2001)). Onsite documents and recent documents containing analytical data such as quarterly landfill inspection reports and landfill gas monitoring reports were also reviewed.

6.3.1.1 Operable Unit 4 Historical Documents

The historical documents that were reviewed consist of the OU 4 Phase I RI/Phase II SAP (HLA, 1995a), the OU 4 RI Phase II and FS (HLA, 1995b), and the OU 4 ROD (HLA, 1996c).

Operable Unit 4 Phase I Remedial Investigation Report

Results of the OU 4 Phase I RI are presented in the Final Sampling and Analysis Plan for Operable Unit 4 Phase II Remedial Investigation and Feasibility Study Field Program (OU 4 Phase I RI/Phase II SAP)

(HLA, 1995a). The purpose of the OU 4 Phase I RI was to collect the information necessary to evaluate the nature of contamination within the Former Landfill and the impacts to surrounding media. This investigation included a surface geophysical program, a shallow soil-gas survey, surface soil sampling, surface water and sediment sampling, a soil boring program that included subsurface soil sampling and deep soil gas sampling, lysimeter installation and leachate sampling, monitoring well installation, water-level monitoring, and groundwater sampling. The results and conclusions of the investigation are as follows:

- Contaminants, including TCE were detected in the shallowest deep-soil gas, subsurface soil, leachate, and groundwater samples within the Former Landfill.
- Low concentrations of VOCs, semivolatile organic compounds (SVOCs), and pesticides detected in surface water and sediment samples indicated that the landfill had very little impact on these media.
- Surface soil and downwind ambient air samples exhibited either no organic compounds, or very low levels of organic compounds indicating that surface exposure to contaminants did not likely pose a threat to human health and the environment.
- TCE and a few other VOCs detected in subsurface soil samples, leachate samples, and groundwater samples indicated that likely, the Former Landfill was contributing contaminants to the groundwater.

Operable Unit 4 Phase II Remedial Investigation

After completing Phase I of the OU 4 RI, Phase II was conducted. OU 4 Phase II results are found in the OU 4 FS (HLA, 1995b). Objectives of the OU 4 Phase II RI were to assess (1) whether the existing landfill cap needed upgrading; (2) whether the landfill was stable; (3) the amount of landfill gas generation; (4) vadose zone underlying the landfill; and (5) aquifer characteristics and groundwater contamination levels. Types of field studies for the OU 4 Phase II RI included site clearing (vegetation and UXO), evaluation of the existing cap, long-term settlement testing, slope stability surveying, landfill gas evaluating, groundwater monitoring, leachate monitoring, soil-gas sampling, well drilling and installing, aquifer testing, HydroPhysical™ testing, in situ air permeability testing, and infiltration testing. Following is a summary of the OU 4 Phase II RI results:

- The only soil type observed within the existing landfill cover was reddish brown elastic silt.
- The existing soil appeared to be suitable material for a repaired or re-graded cover.
- The landfill slopes appeared to be stable under static conditions based on the slope stability analysis.
- Surface water run-on appears to be adequately controlled except at one berm opening.
- Only very low concentrations of a few VOCs and pesticides were detected in surface water and sediment samples near the Former Landfill. Therefore, the landfill has very little impact on these media.
- TCE was detected in several media (soil-gas, leachate, and groundwater) near boring 07LFSB008 indicating that the Former Landfill was a likely source of TCE to the groundwater beneath the landfill.
- In general, the groundwater flow direction varied from a northerly component in the western portion of the landfill to southeast under the eastern portion of the landfill.
- Soil Vapor Extraction (SVE) was only feasible at two soil depths near Landfill lysimeter 8.
- Saprolite (some of the material between the waste contents and the groundwater table consists of saprolite) infiltration occurred at a relatively rapid rate.

Operable Unit 4 Feasibility Study

The OU 4 FS (HLA, 1995b) was prepared in direct response to the OU 4 Phase I and II RIs. After presenting the site history, the OU 4 Phase II RI results, and the summary of site information, the OU 4 FS discussed identification and screening of technologies, development of alternatives, a detailed evaluation of alternatives, a comparison of alternatives, and selection of a preferred alternative. Four alternatives were developed to implement as a remedy for OU 4:

1. No Further Action. Under this alternative no further remedial action would be taken. This alternative was required as part of the NCP which provided a baseline against which other alternatives were compared.
2. Maintenance of the Landfill Cover. This alternative included the following components:
    - Regrade existing landfill cover to match previously engineered drainage grade
    - Long-term maintenance of the landfill cover

- Long-term groundwater monitoring using existing monitoring wells
- Passive landfill gas venting system
- Landfill gas monitoring at the landfill boundary
- Institutional controls (i.e. land use restrictions, site security)

3. Maintenance and Revegetation of the Landfill Cover. This alternative was preferred and became the selected remedy (with some minor modifications). In addition to all of the components of alternative 2, it included removing the existing grass with Roundup® herbicide and revegetating with grasses such as Bermuda grass or Buffel grass.

4. Maintenance and Revegetation of the Landfill Cover with Vapor Extraction. This alternative included all of the components of alternative 3 with the addition of installing a vapor extraction system in the vadose zone beneath the Former Landfill.

After a detailed comparative analysis of the alternatives, Alternative 3 was chosen as the preferred remedy because it was superior to Alternatives 1 and 2 in terms of protection of human health and the environment. Short-term risks associated with the implementation of Alternative 3 were slightly higher than for Alternatives 1 and 2 because of the application of an herbicide. However, the long-term benefits associated with Alternative 3 were more advantageous with respect to improving the integrity and performance of the cover. Alternative 4 provided a means to reduce toxicity and volume; however, the associated health risks outweighed the benefit of only removing an estimated 2 to 14 gallons of TCE per year.

The OU 4 ROD (HLA 1996c) presented a response action for OU 4 in which it described the site characterization, the site risks, the different alternatives, the comparative analysis of alternatives, and the selected remedy. Other topics such as the site history, site description, and site assessment were also discussed. The OU 4 ROD included specific details and minor modifications of Alternative 3 (selected remedy) presented in the OU 4 FS, such as using a mix of Buffalo grass and annual rye to revegetate. A summary of the specific components of the selected remedy is presented in Sections 4.2.2 and 4.2.3 of this report. Additionally, the OU 4 ROD discussed cost effectiveness and compliance with ARARs.

6.3.1.2 Operable Unit 4 Regulatory Update and Recent Documents and Analytical Data Review

Onsite and recent documents containing analytical data include the landfill gas monitoring reports and the quarterly landfill inspection reports.

Update of Applicable or Relevant and Appropriate Requirements for Operable Unit 4

As part of the five-year review process, the ARARs presented in the Final OU 4 ROD (HLA, 1996c) were reviewed to confirm whether they had been revised, replaced, or deleted in the past five years. The ARARs tables presented in the ROD (Tables 2.3 and 2.4) have been updated and are presented in Appendix C. The changes in the ARARs are shown in italic type in Tables C.3 and C.4.

A summary of ARARs changes is as follows:

- Action-Specific ARARs
  - Several ARAR citations have been corrected from HC to HRS.
  - Requirements under Long-term Groundwater Monitoring and Maintenance of the Landfill Cover have been revised to state that a period less than the postclosure care period is sufficient to show protectiveness of human health and the environment if this demonstration is approved by the director [HAR S11-58.1-17(b)(2)(a).
  - Air Emissions from the Passive Landfill Gas Collection system and Active Vapor Extraction System, a correction from volatile organic compounds to ozone was made.
- Location-Specific ARARs
  - Several ARAR citations have been corrected from HC to HRS.

The updated ARARs are presented below:

- Action-specific ARARs:
  - Fugitive dust emission limitations contained in HAR 11-60.1-33(a)(1-7)(b).

- HAR 11-55-34.02(b)(2), Appendix C, and HAR 11-55-34.04(b), Appendix A, requiring a National Pollutant Discharge Elimination System (NPDES) permit and monitoring for storm-water runoff associated with construction activity.
- HAR 11-58.1-16, requirements for groundwater monitoring during the postclosure care period at MSWLF units.
- HAR 11-58.1-17(a)(9)(A, B), which requires a notation be placed on the landfill property following closure of the Municipal Solid Waste Landfill (MSWLF) to indicate the land was used as a landfill.
- HAR 11-58.1-17(b) requiring postclosure care of the landfill for 30 years.
- HAR 11-59-4(f) and (h) limiting the emission of ozone to 100 micrograms per cubic meter (µg/m3) in one hour.
- HAR 11-60.1-68 requiring monitoring and measurement of VOC emissions if emissions are greater than 1 ton per year for each air pollutant.

- Chemical-specific ARARs
  - None.
- Location-specific ARARs
  - None.

Quarterly Landfill Gas Monitoring Reports

Quarterly landfill gas monitoring was conducted in accordance with the selected remedy described in the OU 4 ROD. Landfill gas monitoring was performed at the Former Landfill to check if methane concentrations at the perimeter of the landfill exceeded the LEL. Such concentrations would be in violation of the HAR 11-58-1.17, identified as an ARAR for OU 4 (Appendix C). Each quarterly landfill gas monitoring report included a table of results, a gas probe location map, and a gas probe installation diagram. The table of results included the gas probe location number, probe depth, atmospheric pressure, barometric pressure in the probe, methane concentration, oxygen concentration, and carbon dioxide concentration. The data collected as part of the long-term landfill gas monitoring program are presented in Appendix F. The highest methane concentration presented in any of the reports reviewed resulted in 4.5 percent by volume, or 90.0 percent of the LEL, at Probe 4 in June 1998. Most measurements resulted

in 0 percent methane concentrations, and at no time was the LEL exceeded during the quarterly landfill gas monitoring. Barometric pressure readings in the probe were usually equal to the atmospheric pressure readings.

Quarterly Landfill Inspection Reports

Other data that is relevant for the five-year review is contained in the quarterly landfill inspection reports because they documented performance of the OU 4 remedy on a regular basis. As summarized in Table 5.1 and detailed in Appendix G, the most serious problem observed in the performance of the remedy was cracking of the landfill cover due to settlement. A secondary issue related to performance of the OU 4 remedy has been the maintenance of the vegetative cover. The first mention of Guinea Grass reinvading the buffalo and rye grass was in the OU 4 quarterly landfill inspection report dated October 26, 1998. Reinvasion of the grass continued to be a problem until the year 2000. Although reinvasion of the grass was no longer a major issue, maintenance of the buffalo and rye grass due to lack of rainfall, has been an issue. The landfill surface cracks are repaired and vegetation is maintained when necessary on an ongoing basis as part of the Schofield Barracks operations and maintenance program.

6.3.2 Operable Unit 4 Remedy Inspection

The OU 4 remedy inspection was conducted at the Former Landfill on August 14-15, 2001, by Brad Coleman and Chen Sam Lee of Harding ESE, accompanied by Jon Fukuda of the Schofield Barracks DPW. The purpose of the onsite inspection was to assess the effectiveness and protectiveness of the remedy. The inspection included an assessment of the security fence, signs, institutional controls, access roads, general site conditions, landfill surface, vegetative surface, drainage system, and landfill cover penetrations (landfill gas wells, groundwater monitoring wells, etc.).

An inspection checklist was filled out during the onsite inspection to assist in proper and complete documentation (See Appendix H). Checklist sections included site information, interviews with the

O&M site manager, verification of onsite documents and records, review of O&M costs, inspection of access and institutional controls, general site conditions, and landfill covers which included the landfill surface, the drainage system, and cover penetrations.

Cracking and settlement of the landfill cover is currently the most significant maintenance issue. As shown in Figure 6.3, there is significant cracking in the eastern, western, and northwestern areas of the Former Landfill. Most of the cracks range from 100-400 feet in length; however, a few of them are approximately 700 feet in length in the western area. Most of the cracks have widths of 3 inches or less, but in some areas the cracks are 6 inches wide or more. Photographs illustrating the cracks in the cover are presented in Appendix E. The vegetative cover also continues to be a problem, mostly due to the lack of rainfall. There are several barren patches over the landfill cover and much of the grass is brown where it has taken root. However, erosion of the barren areas was not evident.

The following are additional observations made during the five-year review site inspection:

- Access and institutional controls are currently in good condition.
- Roads are adequate.
- There is no vandalism evident.
- There is no evidence of slope instability.
- Monitoring wells are properly secured, functioning, and routinely sampled. Some of the casings are corroded, but they are scheduled for repair by April 2002.
- One of the fence posts was knocked over, as shown in Figure 6.3, but the chain-link fence is still secure and intact.

6.4 Public Involvement For OU 2 and OU 4

The following subsections present discussions of historical public involvement and public involvement being conducted for the five-year review process.

6.4.1 Summary of Historical Public Involvement

In the past, the Army has undertaken several steps in public and community awareness, including the issuance of employee bulletins and post newspaper articles for Schofield Barracks employees, media interviews, news releases, and meetings with local officials and neighborhood boards for offpost residents. The Army has also held public meetings, issued fact sheets, and established an Army contact for the public at the Schofield Barracks Public Affairs Office. Copies of material related to the project have been available for public review at four different repositories.

On April 11, 1996, the Army presented the Proposed Plan for OU 4 at Schofield Barracks to the public for review and comment; however, no written comments were submitted during the 30-day public review and comment period. Also, a public meeting was held on May 1, 1996.

Additional efforts include implementing a progressive public relations and involvement program for environmental activities at Schofield Barracks. A Technical Review Committee, comprised of representatives from the Army, the EPA, the State of Hawaii DOH, and members of the general public, was established and meets periodically to involve the public in decisions made regarding investigation results, proposed work, and potential remedial actions (HLA, 1996g).

6.4.2 Public Involvement Conducted For Five-Year Review

Public notice of the Schofield Barracks five-year review is being conducted through both a posted fact sheet and a community mailing, in accordance with the Schofield Barracks Community Relations Plan (HLA, 1997a). In compliance with Appendix A of the Comprehensive 5-Year Review Guidance (EPA, 2001) these public notice documents will include:

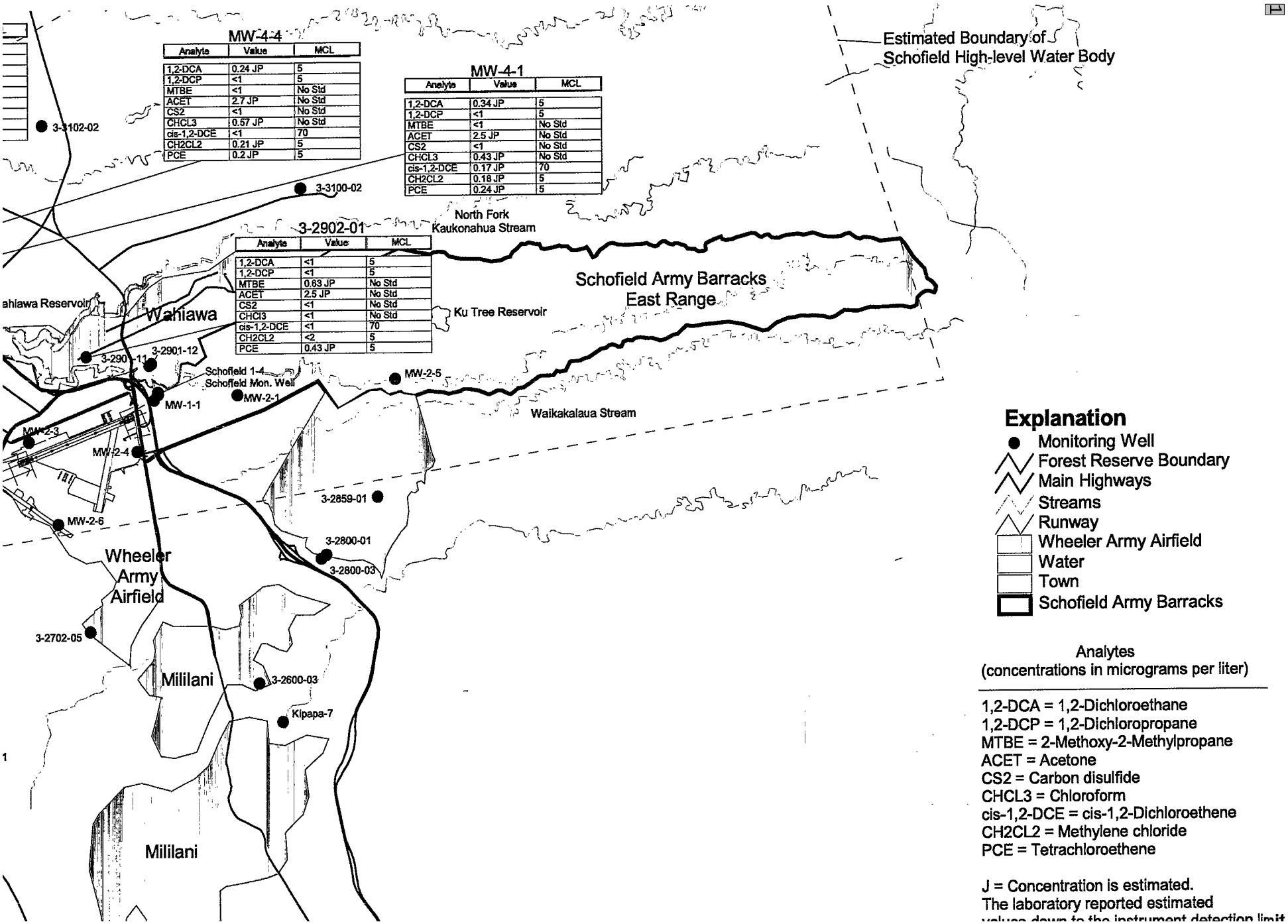
- The site name and location
- The lead agency conducting the review

- A brief description of the selected remedy
- A summary of contamination addressed by the selected remedy
- A brief summary of the results of the five-year review
- The protectiveness statements
- A brief summary of data and information that provided the basis for determining protectiveness, issues, recommendations, and follow-up actions directly related to the protectiveness of the remedy
- How the community can contribute (public comment period)
- Locations where a copy of the five-year review report can be obtained or viewed
- A contact point and phone number for further information
- Dates of both the completion of the review and the next five-year review

In addition to the public notice documents, there will also be a public comment period to allow members of the community to get involved.

Table 6.1: Wells in the Long-term Groundwater Monitoring Program, Well Use, and Monitoring Frequency

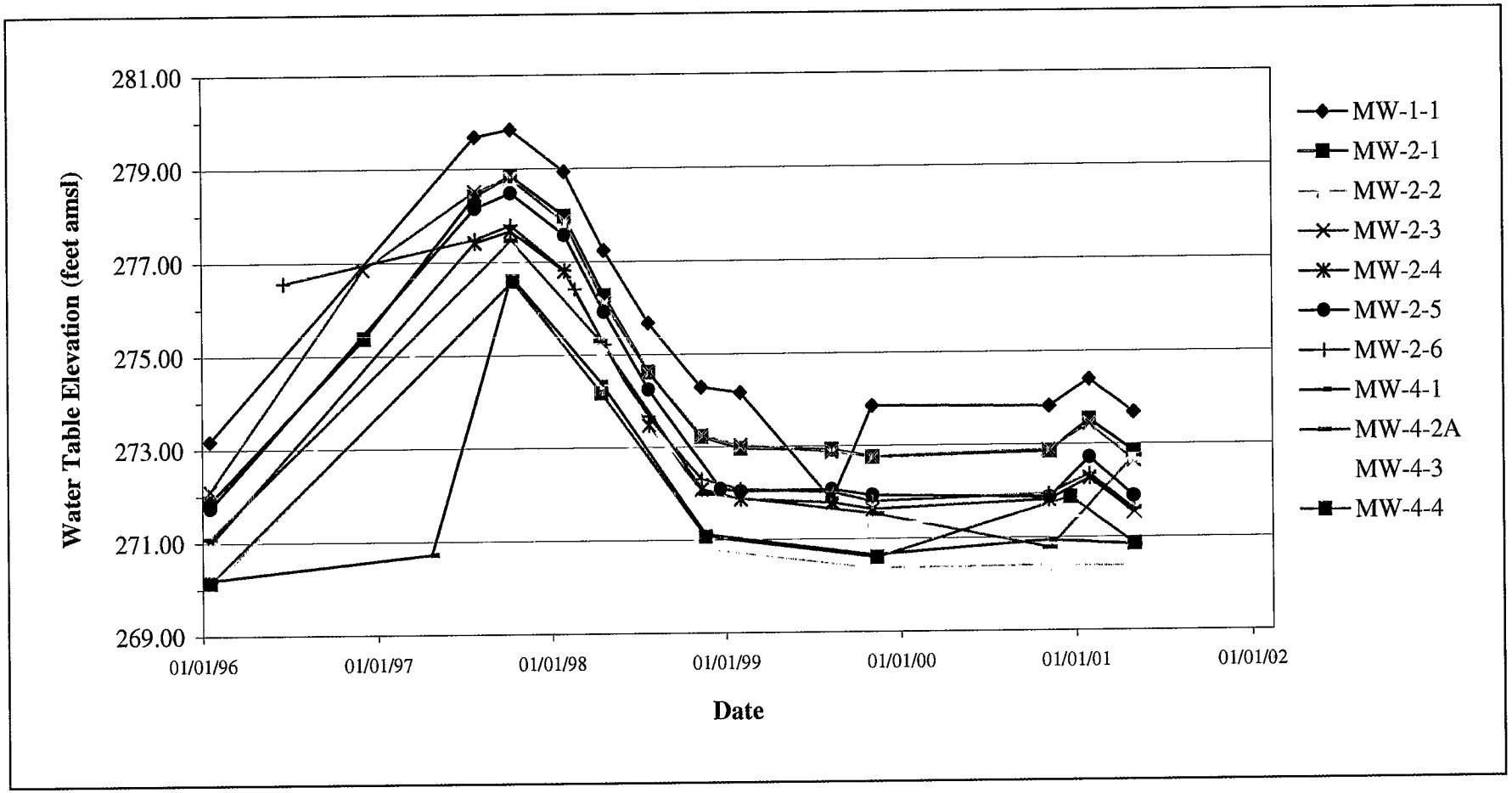
Well	Well Use	Monitoring Frequency
3-2600-03	Domestic/Municipal Water Supply	Semiannually
3-2702-05 (Replaced 3-2702-04)	Monitoring	Semiannually
3-2703-02 (Replaced 3-2703-01)	Irrigation	Semiannually
3-2800-03	Domestic/Municipal Water Supply	Semiannually
3-2803-01	Domestic/Municipal Water Supply	Quarterly
3-2803-05	Irrigation/Municipal	Quarterly
3-2803-07	Irrigation/Municipal	Quarterly
3-2859-01	Domestic/Municipal Water Supply	Semiannually
3-2901-01(Shaft Monitoring Well)	Monitoring	Quarterly
3-2901-02 (Supply Well 1)	Domestic/Municipal Water Supply	Quarterly
3-2901-03 (Supply Well 2)	Domestic/Municipal Water Supply	Quarterly
3-2901-04 (Supply Well 3)	Domestic/Municipal Water Supply	Quarterly
3-2901-10 (Supply Well 4)	Domestic/Municipal Water Supply	Quarterly
3-2901-11 (Replaced 3-2901-08)	Domestic/Municipal Water Supply	Semiannually
3-2901-12	Domestic/Municipal Water Supply	Semiannually
3-2901-13 (MW 1-1)	Monitoring	Quarterly
3-2902-01	Domestic/Municipal Water Supply	Semiannually
3-3100-02	Domestic/Municipal Water Supply	Semiannually
3-3102-02	Irrigation	Semiannually
3-3103-01	Irrigation	Semiannually
3-3203-02	Irrigation	Semiannually
3-2900-02 (MW-2-1)	Monitoring	Quarterly
3-2903-01 (MW-2-2)	Monitoring	Semiannually
3-2902-03 (MW-2-3)	Monitoring	Quarterly
3-2801-02 (MW-2-4)	Monitoring	Quarterly
3-2959-01 (MW-2-5)	Monitoring	Quarterly
3-2802-01 (MW-2-6)	Monitoring	Quarterly
3-3004-01 (MW 4-1)	Monitoring	Semiannually
3-3004-05 (MW-4-2A)	Monitoring	Semiannually
3-3004-03 (MW 4-3)	Monitoring	Semiannually
3-3004-04 (MW-4-4)	Monitoring	Semiannually



Analytes
(concentrations in micrograms per liter)

1,2-DCA = 1,2-Dichloroethane
1,2-DCP = 1,2-Dichloropropane
MTBE = 2-Methoxy-2-Methylpropane
ACET = Acetone
CS2 = Carbon disulfide
CHCL3 = Chloroform
cis-1,2-DCE = cis-1,2-Dichloroethene
CH2CL2 = Methylene chloride
PCE = Tetrachloroethene

J = Concentration is estimated.
The laboratory reported estimated values down to the instrument detection limit



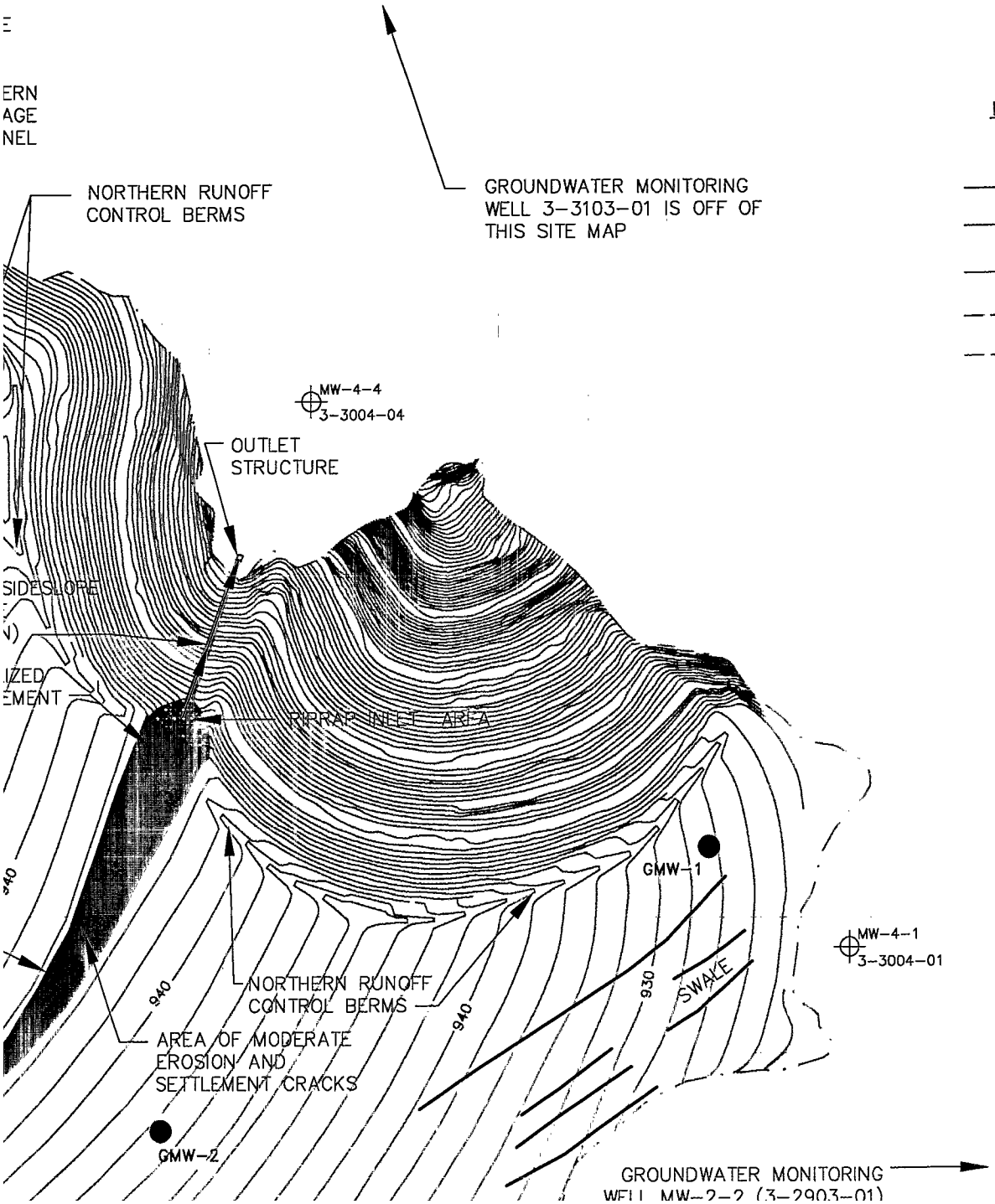
Harding ESE
A MACTEC COMPANY

Historical Water Levels for Onsite Monitoring Wells

Schofield Army Barracks

FIGURE **6.2**

JOB NUMBER	DATE	DRAWN
53744.06.01	11/27/01	EAH



LEGEND:

- APPROXIMATE LANDFILL SITE BOUNDARY
- CONTOUR WITHIN SITE BOUNDARY
- CONTOUR OUTSIDE SITE BOUNDARY
- SECURITY FENCE
- ROAD
- GMW-1 — GAS MONITORING/VENTING WELL
- SURVEY MONUMENT
- PERIMETER GAS MONITORING WELL
- MW-4-2A / 3-3103-01 — GROUNDWATER MONITORING WELL (ARMY NUMBER) (STATE OF HAWAII NUMBER)
- SURFACE CRACK
- AREA OF MODERATE EROSION AND SETTLEMENT CRACKS

NOTES:

1. SURFACE CRACKS AND LOW SPOTS/SWALES OBSERVED AS SHOWN (LOCATIONS ARE APPROXIMATE).
2. NO EROSION OBSERVED EXCEPT MODERATE AMOUNT IN CENTER DRAINAGE CHANNEL.
3. OVERALL VEGETATION OBSERVED IS POOR TO MODERATE.

N

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7.0 TECHNICAL ASSESSMENT

In accordance with the Comprehensive Five-Year Review Guidance, three questions are presented and answered in the following subsections by OU to evaluate and assess the effectiveness and protectiveness of the remedy.

7.1 Operable Unit 2 Remedy Evaluation

This subsection presents answers to the three remedy and protectiveness evaluation questions for OU 2.

7.1.1 Evaluation of the Remedy for Operable Unit 2

Question A: Is the remedy functioning as intended by the decision documents?

Based on the information gathered during the five-year review process, the remedy is functioning as intended by the OU 2 ROD (HLA, 1996d) and OU 2 O&M Plan (HLA, 1996e). The Schofield Barracks Supply Wells and Del Monte Well 3-2803-05 have operating wellhead treatment systems that incorporate air stripping to remove TCE and CCl_4 from groundwater, and both systems are regularly maintained. The long-term groundwater monitoring program is being implemented as stated in the OU 2 ROD and OU 2 O&M Plan. However, the groundwater remediation goals, which are MCLs for TCE and CCl_4, have not yet been achieved in subsurface groundwater. Because extracted groundwater does not meet MCLs, treatment, monitoring, and five-year reviews will continue until extracted groundwater does meet MCLs for TCE and CCl_4.

Issues regarding the implementation of institutional controls include the designated use of Well 3-2803-01, which is registered as a domestic/municipal use well with the Hawaii Department of Natural Resources, Division of Water and Land Development (DOWALD). This registered use does not agree with the actual use and should be changed to reflect the actual use, as discussed further in Section 7.1.3. The OU 2 remedy was discussed in Section 4.1.3, with O&M costs presented in Table 4.1.

7.1.2 Evaluation of Previous Assumptions for Operable Unit 2

Question B: *Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?*

No changes to the exposure assumptions, toxicity data, cleanup levels or remedial action objectives were found during the review process.

7.1.3 Evaluation of Effectiveness/Protectiveness of Operable Unit 2

Question C: *Has any other information come to light that could call into question the protectiveness of the remedy?*

One issue was identified that may impact the interpretation of protectiveness for the OU 2 remedy. Analytical data from Well (3-2803-01) indicates that TCE concentrations have exceeded the action level of 2.5 µg/l in groundwater. This well is currently classified as a domestic/municipal use well; however, Jon Fukuda of DPW reported that this well is actually not used as a domestic water well, but rather is a process water source for the cooling towers for the Kunia Tunnel. Mr. Fukuda reports that Del Monte recently signed an agreement with the U.S. Department of the Navy (Navy), who operates the tunnel, to allow the Navy to use some of Del Monte's water if the Kunia tunnel water supply from Schofield Barracks is ever interrupted. Thus, there would be no domestic use of Well 3-2803-01 water even for emergency purposes. Therefore, the listed classification does not match the actual use, and the listed classification should be changed with DOWALD.

No other information has come to light that would call into question the protectiveness of the OU 2 remedy.

7.2 Operable Unit 4 Remedy Evaluation

This subsection presents answers to the three remedy and protectiveness evaluation questions for OU 4.

7.2.1 Evaluation of the Remedy for Operable Unit 4

Question A: Is the remedy functioning as intended by the decision documents?

Review of the documents, ARARs, risk assumptions, quarterly data, and the five-year review site inspection indicates that the OU 4 remedy will continue to improve conditions and function as intended provided that continued maintenance and repair are performed on the landfill cover. Routine maintenance and repair are necessary in helping to prevent surface water from infiltrating into the waste layer, thereby reducing mobility of the contaminants.

The repairs performed thus far have been effective in resolving the issue of cracking of the landfill cover, but continued repair is necessary. Jon Fukuda of DPW reported that, as of November 28, 2001, no new cracks had reappeared in the previously repaired area in the northeast corner of the Former Landfill. Another issue is maintenance of the vegetative cover. Maintaining a healthy vegetative cover is dependent upon the amount of rainfall at Schofield Barracks, and therefore is difficult to maintain. However, even in poorly vegetated areas there have been no signs of erosion, except for some signs of slight to moderate erosion in the Center Drainage Channel. The application of herbicide to the reinvading Guinea grass has also been effective.

The operations and maintenance required to maintain the integrity and functionality of the landfill cover include continued routine inspections, periodic repair of the cracks, landscaping, regrading due to settlement, and revegetation of regraded areas. Continued landfill gas monitoring would also be required to ensure that methane concentrations do not exceed the LEL.

The average annual O&M cost over the last five years is approximately $360,000. This average annual cost includes landfill gas monitoring, landfill landscaping, and crack repair. It is likely that at least this amount, and possibly more, would be required on an annual basis to maintain the integrity and

functionality of the existing remedy. Additional future costs may include repair and maintenance of the drainage system.

The existing institutional controls include prohibitions on the use or disturbance of groundwater, prohibitions on excavation activities, disturbance of the landfill cover, and any other activities that might interfere with the implemented remedy. No vandalism or other activities were observed that would have violated these institutional controls. The fence around the site is intact and in good condition, with the exception of a fence post that needs to be re-set.

7.2.2 Evaluation of Previous Assumptions for Operable Unit 4

Question B: *Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?*

Exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of remedy implementation are still valid.

Changes in Standards and To Be Considered

During construction and since completion of the remedial action, the action-specific ARARs cited in the OU 4 ROD (HLA, 1996c) have been met. However, some of the ARARs do not apply to current activity at the Former Landfill. These ARARs include requirement of a NPDES permit, compliance with fugitive dust emission limitations, placement of a notation on the landfill property indicating it was used as a landfill, compliance to emissions of ozone and elemental lead, and monitoring and measurement of VOC emissions if emissions are greater than 1 ton per year for each pollutant. Additional construction activity or changes in site conditions may have an effect on the applicability of the ARARs (i.e., additional construction activity would require another NPDES permit and compliance to fugitive dust emission limitations); however, all of the ARARs are currently being met. Very minor changes in ARARs have occurred, as presented in Appendix C. However, no changes have been made to ARARs or To Be Considereds (TBCs) that affect the protectiveness of the remedy.

Changes in Exposure Pathways, Toxicity, and Other Contaminant Characteristics

Since implementation of the remedy, there have been no changes in land use, no new contaminants or contaminant sources, no changes in toxicity and other contaminant characteristics, no remedy byproducts, and no changes in exposure pathways. Therefore, the risk assessment should not be any different than when the remedy was first implemented. The media of interest for the OU 4 baseline risk assessment (see Appendix I of the FS) were surface soil, surface water, and sediment. Exposure to these media has not been affected by the cracks or the lack of vegetation on the landfill cover.

7.2.3 Evaluation of Effectiveness/Protectiveness of Operable Unit 4

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No ecological targets were identified in the baseline risk assessment and none were identified during the five-year review. Therefore, monitoring of ecological targets is not necessary. No weather related events have affected the protectiveness of the remedy other than what was previously identified (lack of rainfall).

According to the documents reviewed, the site inspections, and the landfill gas monitoring data, the remedy is functioning as intended by the OU 4 ROD with continued maintenance and repair. The OU 4 ARARs cited in the OU 4 ROD have been met. There have been no changes in land use, no new contaminants or contaminant sources, no changes in toxicity and other contaminant characteristics, no remedy byproducts, and no changes in exposure pathways. Based on these unchanged conditions, the risk assessment does not require re-evaluation. There is no other information that calls into question the protectiveness of the remedy.

8.0 ISSUES REGARDING REMEDIAL MEASURES

Issues or items that need to be addressed or resolved to maintain the effectiveness and protectiveness of the remedies are discussed in this section. Issues for OU 2 and OU 4 are presented separately and are summarized in Table 8.1.

8.1 Issues Regarding Operable Unit 2

Issues regarding the continued effectiveness and protectiveness of the OU 2 remedy are the following:

- The protective surface housings for ten of the eleven onpost monitoring wells are corroded and some are no longer secure.
- The registered use classification for Del Monte Well 3-2803-01 is currently for domestic/municipal use. This does not match the current and planned use of the well and suggests that domestic use could occur. This may not be protective of human health, as the TCE concentration in groundwater from this well has been near drinking water MCL in recent years.
- The concentrations and distribution of TCE and CCl_4 contamination in the Schofield High-Level Aquifer have changed very little in the past five years. Trends in concentrations indicate slight, gradual changes or no change. The relative stability of the concentrations over time suggest that lower monitoring frequencies may be sufficient to assure protectiveness of the remedy.

These issues are presented in Table 8.1.

8.2 Issues Regarding Operable Unit 4

Issues regarding the continued effectiveness and protectiveness of the OU 4 remedy are the following:

- There is cracking of the cover due to settlement in the northwest, west, and northeast sections of the landfill.
- There is slight to moderate erosion evident in the Center Drainage Channel of the landfill. This is a less urgent issue than the cracking; nonetheless, it is an issue to be addressed.
- The protective surface housings for the four onpost monitoring wells at the landfill are corroded and some are no longer secure.

These issues are presented in Table 8.1.

Table 8.1: Issues Regarding Remedies for Operable Unit 2 and Operable Unit 4 at Schofield Barracks

Issue	Affects Current Protectiveness?	Affects Future Protectiveness?
Operable Unit 2		
Well 3-2803-01 is classified for domestic/ municipal use, which does not match actual use	Yes	Yes
Groundwater monitoring well casings showing signs of corrosion	No	No
Concentrations and distribution of TCE and CCl_4 in monitoring network have changed little in the past five years. Lower monitoring frequencies may be sufficient to assure protectiveness of remedy.	No	No
Operable Unit 4		
Cracking of the landfill cover	Yes	Yes
Barren spots and dead grass due to lack of rainfall	No	Yes
Groundwater monitoring well casings showing signs of corrosion	No	No

9.0 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

During the five-year review process for OUs 2 and 4, issues have been identified for each OU that must be addressed for the respective remedies to be protective of human health and the environment. Recommendations and follow-up actions for addressing these concerns are presented below.

9.1 Recommendations and Follow-up Actions for Operable Unit 2

Issues regarding the effectiveness and protectiveness of the OU 2 remedy, as implemented, are identified in Section 8.1. Measures to address these issues include the following:

- Repair or replace the protective surface housings for ten of the eleven onpost monitoring wells. These repairs do not affect the protectiveness of the remedy, but should be performed to maintain the integrity and security of the wells. A contract has been awarded to conduct the repairs, which are planned for completion in April 2002.

- Change the use classification for Del Monte Well 3-2803-01 to ensure the groundwater from the well is not used as a domestic water source. The Army will submit a letter to DOWALD requesting that the change be made in the State's records. A use restriction will also be filed with the Navy, the owner of the well, to prevent the Navy from implementing any changes to the well that would allow it to be connected to the drinking water system at the Kunia Tunnel without first treating the water to drinking water standards.

- Decrease the frequency of the long-term groundwater monitoring. Because the concentrations and distribution of TCE and CCl_4 contamination in the Schofield High-Level Aquifer have changed very little in the past five years, a lower frequency of monitoring should be considered. Therefore, the Army proposes that the monitoring well network be reviewed to identify those wells with concentrations that are not changing or are decreasing in concentration, and decrease their sampling frequency to half their current frequency. For those wells that have shown increasing trends or are near the threshold value, the monitoring frequency should stay at the current level (i.e., quarterly) for a two-year period and then be re-evaluated. In the case of the Schofield Barracks supply wells, the Army proposes to retain Schofield Well 4 (highest TCE concentration) on a quarterly sampling schedule and reduce the other three Schofield supply wells (1, 2, and 3) and the Schofield shaft monitoring well to an annual or semiannual sampling frequency.

These recommendations and follow-up actions are presented in Table 9.1. Proposed changes to the long-term groundwater monitoring program are presented in Table 9.2.

9.2 Recommendations and Follow-up Actions for Operable Unit 4

Issues regarding the effectiveness and protectiveness of the OU 4 remedy, as implemented, are identified in Section 8.2. Routine maintenance and repair of remedy components must be continued in order to achieve maximum performance of the OU 4 remedy. Measures to address these issues are the following:

- Repair the cracking of the cover due to settlement in the northwest, west, and northeast sections of the landfill. A contract has been awarded to conduct the repairs, which are planned for March to May 2002.
- Take measures to address the slight to moderate erosion evident in the Center Drainage Channel of the landfill. This is a less urgent issue than the cracking; nonetheless, action should be taken in the near future to prevent additional erosion. Recommendations include doing one of the following: (1) regrading/revegetating, (2) installment of permanent erosion matting, or (3) placement of riprap along affected areas.
- Repair or replace the corroded protective surface housings on the four groundwater monitoring wells at the landfill, as mentioned above for OU 2.

These recommendations and follow-up actions are presented in Table 9.1.

Table 9.1: Recommendations and Follow-up Actions for Operable Unit 2 and Operable Unit 4 at Schofield Barracks

Deficiency	Recommendations/ Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness? Current	Affects Protectiveness? Future
Operable Unit 2						
Well 3-2803-01 is classified for domestic/municipal use, which does not match actual use	Change listed classification with Hawaii Department of Natural Resources, Division of Water and Land Development	Army	State/EPA	Classification is planned for change by May 2002	Yes	Yes
Groundwater monitoring well casings showing signs of corrosion	Repair or replace protective casings, possibly using a more durable material.	Army	State/EPA	Repair is scheduled for completion during April 2002	No	No
Concentrations and distribution of TCE and CCl_4 in monitoring network have changed little in the past five years. Lower monitoring frequencies may be sufficient to assure protectiveness of remedy.	Identify wells where concentrations are constant or decreasing, and reduce frequency by half. For other wells, keep current frequency for two years and re-evaluate. For Schofield supply wells, reduce frequency for Wells 1, 2, 3, and the shaft monitoring well to annually.	Army	State/EPA	Plan to adopt revised frequencies by May 2002 sampling event	No	No
Operable Unit 4						
Cracking of the landfill cover	Continue to perform crack repair on a routine basis	Army	State/EPA	May to March 2002 for crack repair in NW, W, & NE areas	Yes	Yes
Barren spots and dead grass due to lack of rainfall	Three solutions: 1) regrade/revegetate; 2) install permanent erosion matting; 3) place riprap in affected areas	Army	State/EPA		No	Yes
Groundwater monitoring well casings showing signs of corrosion	Replace protective casings	Army	State/EPA	Repair is scheduled for completion during April 2002	No	No

Table 9.2: Proposed Changes to the Long-term Groundwater Monitoring Program

Well	Well Use	Current Monitoring Frequency*	Proposed Monitoring Frequency
3-2600-03	Domestic/Municipal Water Supply	Semiannually	Annually
3-2603-01	Domestic/Municipal Water Supply	Semiannually	Annually
3-2702-05 (Replaced 3-2702-04)	Monitoring	Semiannually	Annually
3-2703-02 (Replaced 3-2703-01)	Irrigation	Semiannually	Annually
3-2800-03	Domestic/Municipal Water Supply	Semiannually	Annually
3-2803-01	Industrial#	***Quarterly***	Quarterly
3-2803-05	Irrigation/Municipal	***Quarterly***	Quarterly
3-2803-07	Irrigation/Municipal	Quarterly	Semiannually
3-2859-01	Domestic/Municipal Water Supply	Semiannually	Annually
3-2901-01(Shaft Monitoring Well)	Monitoring	Quarterly	Annually
3-2901-02 (Supply Well 1)	Domestic/Municipal Water Supply	***Quarterly***	Semiannually
3-2901-03 (Supply Well 2)	Domestic/Municipal Water Supply	***Quarterly***	Semiannually
3-2901-04 (Supply Well 3)	Domestic/Municipal Water Supply	***Quarterly***	Semiannually
3-2901-10 (Supply Well 4)	Domestic/Municipal Water Supply	***Quarterly***	Quarterly
3-2901-11 (Replaced 3-2901-08)	Domestic/Municipal Water Supply	Semiannually	Annually
3-2901-12	Domestic/Municipal Water Supply	Semiannually	Annually
3-2901-13 (MW 1-1)	Monitoring	*Quarterly*	Semiannually
3-2902-01	Domestic/Municipal Water Supply	Semiannually	Annually
3-3100-02	Domestic/Municipal Water Supply	Semiannually	Annually
3-3102-02	Irrigation	Semiannually	Annually
3-3103-01	Irrigation	Semiannually	Annually
3-3203-02	Irrigation	Semiannually	Annually
3-2900-02 (MW-2-1)	Monitoring	***Quarterly***	Quarterly
3-2903-01 (MW-2-2)	Monitoring	Semiannually	Annually
3-2902-03 (MW-2-3)	Monitoring	***Quarterly***	Quarterly
3-2801-02 (MW-2-4)	Monitoring	***Quarterly***	Quarterly
3-2959-01 (MW-2-5)	Monitoring	Quarterly	Semiannually
3-2802-01 (MW-2-6)	Monitoring	*Quarterly*	Semiannually
3-3004-01 (MW 4-1)	Monitoring	***Semiannually***	Semiannually
3-3004-05 (MW-4-2A)	Monitoring	*Semiannually*	Annually
3-3004-03 (MW 4-3)	Monitoring	***Semiannually***	Semiannually
3-3004-04 (MW-4-4)	Monitoring	***Semiannually***	Semiannually

* Italic type indicates that groundwater from the well has shown detections of trichloroethene (TCE) or carbon tetrachloride (CCl_4) greater than 2.5 micrograms per liter (ug/l) during the period from 1996 to 2001. Bold italic type indicates that TCE or CCl_4 detections greater than 2.5 ug/l have occurred during the period from 1999 to 2001.

\# Well use for Well 3-2803-01 should be changed from the current Domestic/Municipal Water Supply to Industrial.

10.0 PROTECTIVENESS STATEMENTS

Based on the findings of the five-year review process, the remedies for OU 2 and OU 4 have been evaluated and recommendations and follow-up actions have been identified. Based on the implementation of these measures, protectiveness statements are made below for each OU.

10.1 Effectiveness of Current Measures for Operable Unit 2

The primary RAO for the OU 2 implemented remedy was to protect human health and the environment by limiting contact with groundwater exceeding the MCLs. Human health is protected by the air strippers installed on wells with contaminated groundwater (the four Schofield Barracks Supply Wells and Del Monte Well 3-2803-05). The treatment systems are fully operational and functional and treat groundwater to remove contaminants to levels an order of magnitude below MCLs. Results from the monitoring well network show that the plume is not migrating downgradient and should not impact additional wells. The Army will continue to maintain and operate the treatment systems and the monitoring well network until TCE and CCl_4 MCLs are achieved in groundwater, and will respond to any unforeseen increases in TCE levels downgradient of Schofield Barracks. Therefore, the remedy is effective and protective.

10.2 Effectiveness of Current Measures for Operable Unit 4

The primary RAO of the implemented remedy was to protect human health and the environment by limiting direct contact with the Former Landfill contents and by restricting surface-water infiltration through the landfill. Construction and implementation of the landfill cover met the first half of the RAO by limiting direct contact with the Former Landfill contents. Continued repair and maintenance of the OU 4 remedy will continue to comply with the second half of the RAO by restricting surface-water infiltration through the landfill. Therefore, the remedy is effective and protective.

11.0 NEXT REVIEW

The next review for Schofield Barracks OU 2 Groundwater and OU 4 Former Landfill is scheduled to take place in five years, by March 2007.

12.0 ACRONYMS AND ABBREVIATIONS

µg/l	Micrograms per liter
ARARs	Applicable or Relevant and Appropriate Requirements
Army	U.S. Department of the Army
ASTS	Air Stripper Treatment System
bgs	Below ground surface
CCl_4	Carbon tetrachloride
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	Code of Federal Regulations
COC	Contaminant of Concern
CRM	Cement Rubble Masonry
CWA	Clean Water Act
DERP	Defense Environmental Restoration Program
DOD	U.S. Department of Defense
DOH	Department of Health
DOWALD	Hawaii Department of Natural Resources, Division of Water and Land Development
DPW	U.S. Army Directorate of Public Works
EPA	United States Environmental Protection Agency
FFA	Federal Facility Agreement
FS	Feasibility Study
HAR	Hawaii Administrative Rules
Harding ESE	Harding ESE, Inc.
HC	Hawaii Code
HLA	Harding Lawson Associates

HRS	Hawaii Revised Statutes
IRP	Installation Restoration Program
LEL	Lower Explosive Limit
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goals
mm	Millimeter
msl	Mean sea level
MSWLF	Municipal Solid Waste Landfill
MTBE	Methyl Tert Butyl Ether
Navy	U.S. Department of the Navy
NCP	National Contingency Plan
NPDES	National Polluant Discharge Elimination System
NPL	National Priorities List
O&M	Operations and Maintenance
OE	Ordnance explosives
OU	Operable Unit
PA	Preliminary Assessment
PCE	Tetrachloroethene
ppb	Parts per billion
RAO	Remedial Action Objective
RI	Remedial Investigation
ROD	Record of Decision
Schofield Barracks	Schofield Army Barracks, Island of Oahu, Hawaii
SDWA	Safe Drinking Water Act
SI	Site Investigation
SVE	Soil Vapor Extraction

SVOC	Semivolatile Organic Compound
TBC	To Be Considered
TAMC	Tripler Army Medical Center
TCE	Trichloroethene
USAEC	United States Army Environmental Center
USATHAMA	U.S. Army Toxic and Hazardous Materials Agency
USC	United States Code
UXO	Unexploded Ordnance
VOC	Volatile Organic Compound
WTP	Water treatment plant

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Appendix A

OPERABLE UNIT 2 SCHOFIELD BARRACKS WATER TREATMENT SYSTEM DESCRIPTION

A. SYSTEM DESCRIPTIONS

This section describes the overall treatment plant and its subsystems with respect to design parameters, operations, and maintenance.

The general plant description considers the overall water treatment plant, its major design considerations, and systems.

More detailed descriptions of the component systems follow.

1. GENERAL PLANT DESCRIPTION

The Schofield Barracks Water Treatment Plant (WTP) is designed to remove trichloroethylene (TCE) and minor amounts of tetrachloroethylene (PCE) from the well water by air-stripping (A/S) treatment. Facilities exist to chlorinate the well water before treatment and chlorine and fluoride are added to the water after treatment. A clear well (CW) provides chlorine contact time, and clear-well pumps deliver the treated water to the distribution mains.

Major plant design criteria are as follows:

Design flowrate	8 mgd (5,556 gpm)
Maximum flowrate	10 mgd (6,945 gpm)
Number of A/S towers	Five (one is standby)
TCE removal efficiency with four towers operating at the design flowrate	97.2 percent
Design influent TCE concentration	35 ppb
Calculated effluent TCE concentration	0.98 ppb
Tower height	29 feet (top to be less than H-2 freeway adjacent to the site)
Clear-well capacity	200,000 gallons
Number of CW pumps	Five
Total capacity--CW pumps	10 mgd
CW pump head	210 feet

Deep-Well Pumps

Number installed	Four
Number operational	Three
Number on standby	One
Rated flow/unit	2,000 gpm
Approximate head (as modified for the WTP)	640 feet (277 psi)
Motor horsepower	400 bhp

Chlorination System

150-lb gas cylinders	Two
Feed rate at 10 mgd	42 lb/day
Chlorine residual range	0.2 to 0.5 ppm

The existing chlorine system is retained to chlorinate the well water before A/S treatment.

Fluoridation System

Chemical form	Sodium fluoride
Feed rate at 10 mgd	84 lb/day
Fluoride range	0.6 to 0.8 ppm

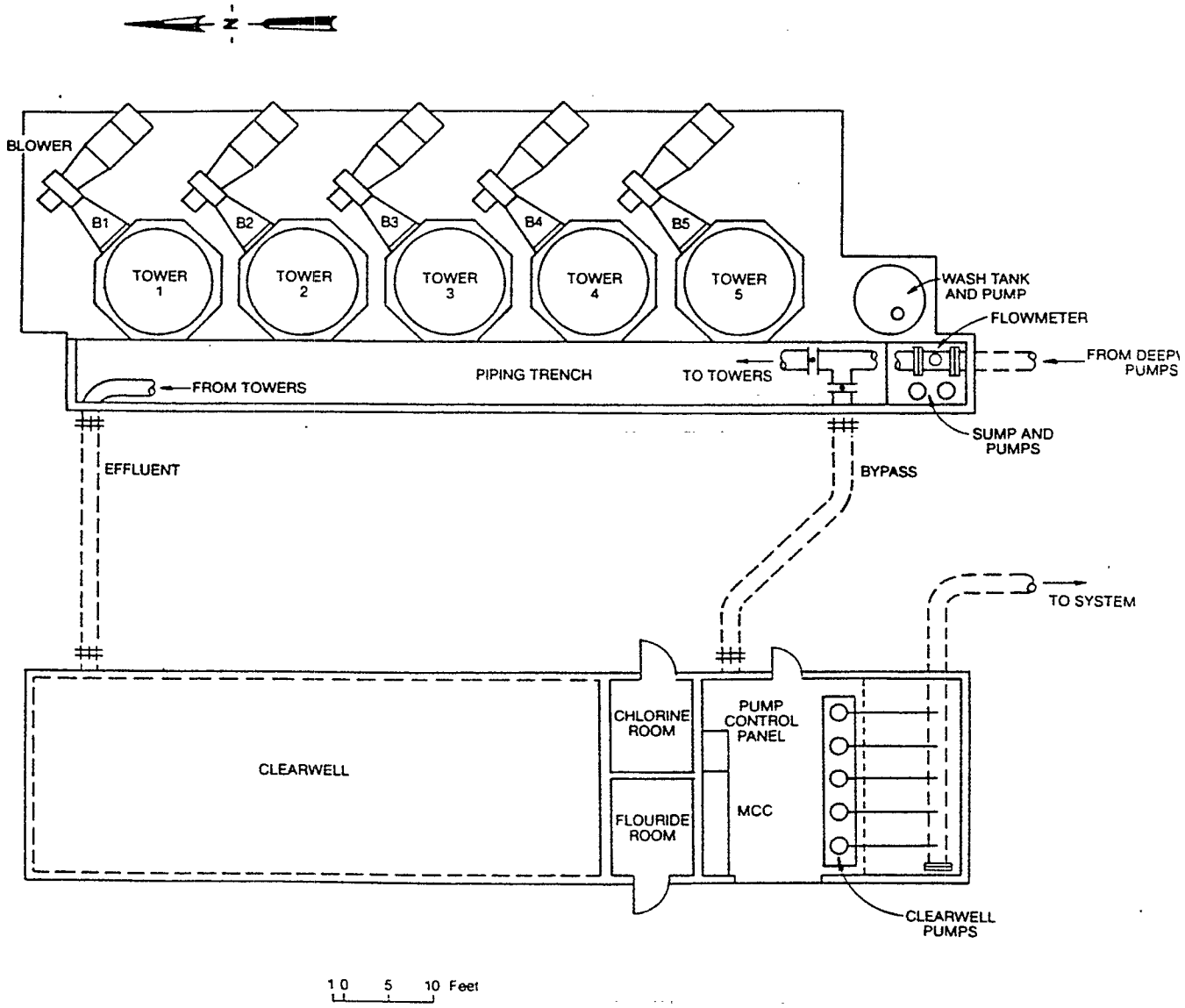
Figure A-1 is a treatment area plan showing the arrangement of major components and Figure A-2 is a plant operations flow diagram identifying pumps, piping, valves, the towers, and other treatment system components. The legend lists the identification and description of the plant components shown in this figure.

2. PLANT SYSTEMS

The treatment plant consists of several major systems as described in this section.

a. Deep-Well Pumps and Header

The four deep-well pumps are located in two underground galleries approximately 565 feet below, and 1,000 feet east of, the treatment site. Access to the deep-well galleries is by a cable-operated railcar through an inclined tunnel with its upper portal in the deep-well house.



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WATER TREATMENT PLANT
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FIGURE A-1
TREATMENT AREA PLAN

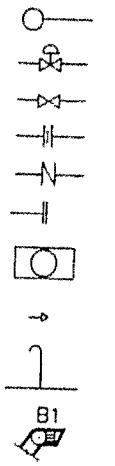
Tag Number	Description/Location
VPD2-1	Deep-well Pump 2 control valve Gallery
VPD2-2	Deep-well Pump 2 shutoff valve Gallery
VPD3-1	Deep-well Pump 3 control valve Gallery
VPD3-2	Deep-well Pump 3 shutoff valve Gallery
VPD4-1	Deep-well Pump 4 control valve Gallery
VPD4-2	Deep-well Pump 3 shutoff valve Gallery
VH	Deep-well header shutoff Wellhouse
VF, VG	Header bypass valves Yard valving area
VE	Deep-well header shutoff Yard valving area
VB	Treatment bypass Pipe trench
VA	Treatment header Pipe trench
V1-1 to V5-1	Tower riser Tower riser piping
V1-2 to V5-2	Tower effluent Tower effluent piping
V1-3 to V5-3	Tower recirculation drain Tower effluent piping
V1-4 to V5-4	Tower recirculation supply Tower riser piping
VRS	Wash tank supply Wash tank
VR-1	Recirculation supply header shutoff Pipe trench--wash tank end
VR-2	Recirculation return header shutoff Pipe trench--wash tank
VR-3	Wash tank drain

Tag Number	Description/Location
VS-1	Sump Pump 1 shutoff
VS-2	Sump Pump 2 shutoff
VID	Influent header drain
VP1-2 to VP5-2	Clear-well pump discharge shutoff
VP1-1 to VP5-1	Clear-well pump bypass control
VX-VY	Future treatment
VC-VD VK-VJ	Distribution shutoff valves Valve yard
VC-I	Inlet header check valve Well house
VC-W	Washdown system check valve
SA-I	Inlet header sample valve Wash tank piping
SA-O	Effluent header sample valve Effluent header-north end
SA-1 through SA-5	Tower 1 through 5 sample valves
	Pumps
PD-1 through PD-4	Deep-well Pumps 1 to 4 Gallery
PW	Wash pump Wash tank
PS1 and PS2	Piping trench sump pumps Sump
PC-1 through PC-5	Clear-well Pumps 1 to 5 CW Buildings
	Other
B1 through B5	Tower 1 through 5 Blowers--blower pad
PT-1 through PT-5	Packed towers 1 through 5 Tower pad

Tag Number	Description/Location
FM	Flowmeter Piping trench--south
F	Fluoride injection Piping trench--north
CL	Chlorine injection Piping trench-north

LEGEND

SYMBOLS



PUMP

AUTOMATIC VALVE

GLOBE OR GATE VALVE

BUTTERFLY VALVE

CHECK VALVE

BLIND FLANGE

FLOW METER

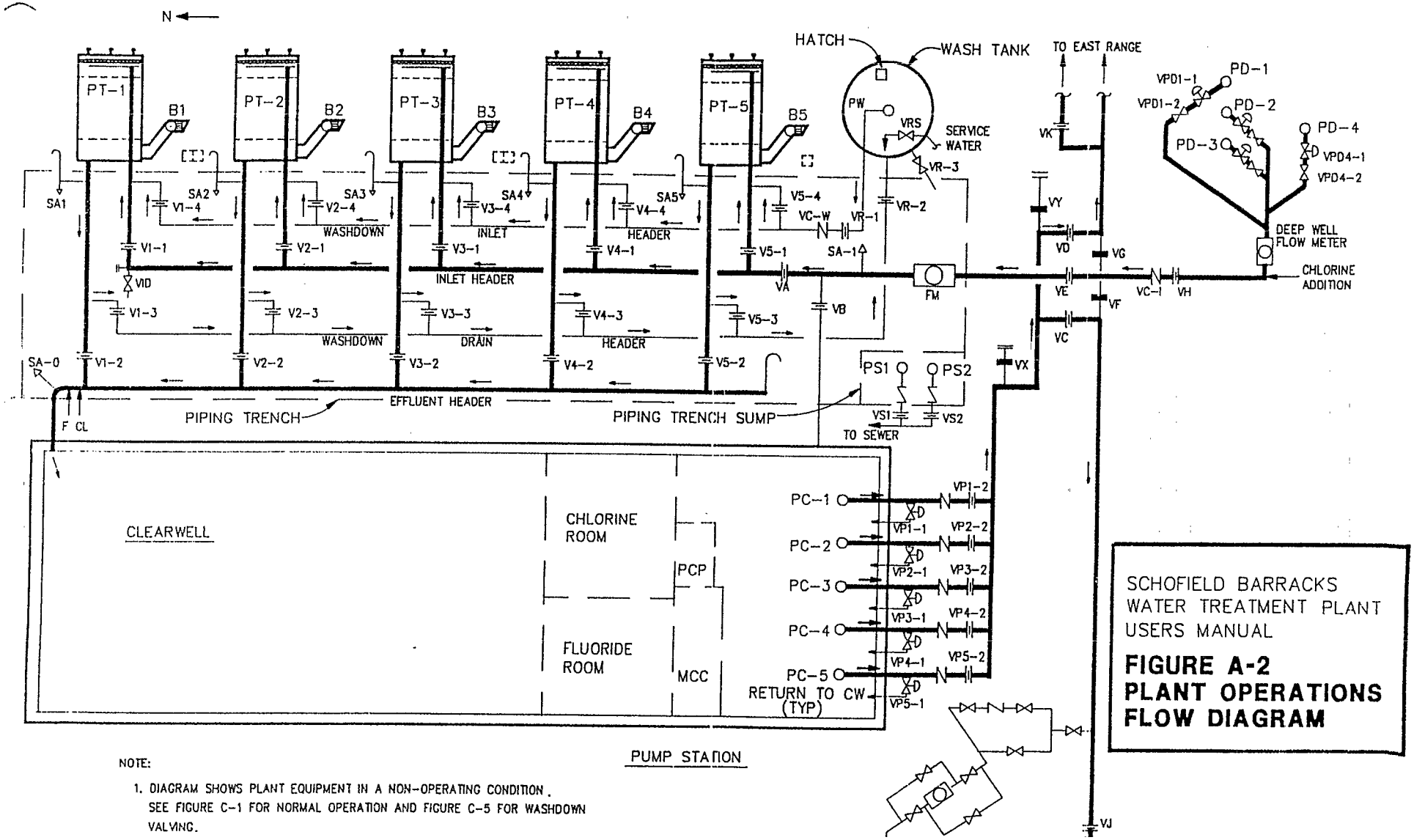
SAMPLE VALVE

VENT

BLOWER AND SILENCER

RISER, FLOW METER, & BLOWER CONTROL PANELS

VALVE CLOSED



SCHOFIELD BARRACKS
WATER TREATMENT PLANT
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FIGURE A-2
PLANT OPERATIONS FLOW DIAGRAM

NOTE:

1. DIAGRAM SHOWS PLANT EQUIPMENT IN A NON-OPERATING CONDITION. SEE FIGURE C-1 FOR NORMAL OPERATION AND FIGURE C-5 FOR WASHDOWN VALVING.

Three of the existing pumps (No. 2, 3, and 4) were replaced with new vertical turbine pumps during the treatment plant project. (Pump No. 1 is scheduled for replacement on a separate project.) The new pumps have a lower discharge pressure than the original units because they pump water only to the top of the towers and not into the pressurized distribution mains. The existing piping and valving and the 500-hp motors and controls were reused. The Byron Jackson O&M manual for the new units contains details on the pump construction, installation, operation, servicing, maintenance, and performance. Pump curves are included in the vendor's manual. Design point performance characteristics are:

Design flow	2,000 gpm
Design head	640 feet
Efficiency at design point	81 percent
Shutoff head	1,100 feet--approx.
Brake hp at design point	400 bhp

Groundwater elevation is approximately 15 feet below the gallery floor level, and the pump suction screens are at about 33 to 35 feet below the pump mounting plates.

Each pump delivers its output through a control valve, shut-off valve, and header into the main deep-well header that brings the water to the ground surface. An orifice flow-meter, chlorine addition point, shutoff valve, and check valve were retained in the existing deep-well header piping.

Operation of the deep-well pumps remains essentially un-changed with the addition of the WTP. The operator starts and stops pumps manually. A deep-well pump shutdown circuit was added on the WTP project and will sequentially stop deep-well pumps by a manual control or automatically in the event of a malfunction at the WTP that might jeopardize treated water quality or be leading to a clear-well over-flow. This automatic shutdown feature is described more fully under the plant instrumentation and control system (A.2.j).

b. Yard Piping and Valving

This system consists of the main line and buried piping and valves that interconnect the deep-well pump header to the treatment plant and the treated water mains to the east range and base distribution headers. Valved stubouts are provided for future additional treatment facilities, if needed.

The valves in the yard system and their functions and normal positions are shown in Table A-1.

During the startup of the WTP and before changeover of the last deep-well pump, this yard valving provided the flexibility to deliver water to the new WTP and distribution system at the same time. With the lower pressure now available at the ground surface, water can be delivered only to the treatment system or directly to the clear well. Pumping into the higher pressure distribution mains is now accomplished by the clear-well pumps.

Table A-1
YARD VALVING

Valve	Function	Normal Operation
V C	Treated water shutoff to base	Open
V D	Treated water shutoff to east range	Open
V E	Deep-well header shutoff	Open
V F	Deep-well header/base cross-connect	Closed
V G	Deep-well header/east range cross-connect	Closed
V H	Deep-well header shutoff	Open
V J	Base shutoff	Open
V K	East range--12-inch shutoff	Open
V X	Future treatment stubout	Closed
V Y	Future treatment stubout	Closed

c. Treatment Piping, Valving, and Fans

This system consists of the tower inlet and outlet headers in the pipe trench; plant flowmeter; the tower riser valve and flowmeter; the tower effluent piping and valve; the washdown piping and valving at each tower; sample taps on the inlet header, outlet header, and outlet of each tower; and the air supply blower to each tower and its controls.

The WTP flowmeter (FM) is a 24-inch in-line Sparling flowmeter with a direct reading integrator and transmitter into instrument and control (I/C) loop 100--plant influent flow (see Section A.2.J, Plant Instrumentation and Controls, for I/C details).

The influent header valve (VA) is used to shut off all flow to the influent header such as when maintenance is required on the influent header or when bypass flow to the clear well is required. VA should remain open at all other times.

The tower riser valves (V1-1 through V5-1) control the flow of well water into the respective towers and are to be adjusted so that approximately equal flows are delivered to each operating tower.

It is important to avoid zero flow on the deep-well pumps by always having a flow path for operating deep-well pumps. For example, the valving sequence for establishing bypass flow to the clear well through VB requires that VB be opened first, then the tower riser valves or header shutoff valve closed to maintain the pump flow during the diversion.

The tower effluent valves (V1-2 through V5-2) are used to isolate the tower from the effluent header during packing washdown. These valves should remain open except when using the packing washdown procedure.

The tower effluent piping includes a P-trap to prevent air loss from the tower air plenum into the discharge header. An overflow is also provided to prevent water from rising into the blower ducting in the event of a higher-than-normal tower water flowrate or restricted effluent flow path. Overflow water is directed to the pipe trench and sump, from which it is pumped to the sewer.

Valves V1-3 through V5-3 and V1-4 through V5-4 are the tower washdown outlet and inlet valves, respectively, to be opened on one tower at a time when that tower is being treated by the washdown system.

Sample valves SA-1 through SA-5 and SA-I and SA-O provide water samples from each tower's output, the well water input, and the combined treated output before the clear well.

Air is supplied to each tower by an individual blower-silencer unit located on the pad, on the east side of the towers. The silencer unit reduces the noise generated by the blower. Each blower unit is designed to the following criteria:

Motor horsepower	10 hp
Air flowrate	11,000 scfm
Total pressure	4-inch water column

Each blower has a pedestal-mounted safety switch on the south side of the unit used for maintenance lockout purposes and an ON-OFF pushbutton control station located in a pedestal-mounted control box near the pipe trench. These control boxes also house the flowmeters for the tower risers.

Blower pushbutton controls and riser flowmeters for the towers are located on the pedestal-mounted boxes as follows:

Tower	Control Box Location
PT1 and PT2	Between PT1 and PT2
PT3 and PT4	Between PT3 and PT4
PT5	South of PT5

The tower riser valves (V1-1 through V5-1) are used to distribute the well water flow approximately equally to the operating towers as indicated by the riser flowmeters. The riser flowmeters should therefore be calibrated to indicate about the same readings for the same actual flowrate. An adjustment procedure is included in Section C, Operating Instructions.

d. Packed Towers

Five air stripping towers are provided. Each tower shell is constructed of fiberglass reinforced plastic (FRP), 12 feet in diameter and 29 feet in overall height.

The towers and their packing are designed to provide a large area of contact between the well water and the flow of air through the plastic packing. Well water is delivered by the external riser to near the top of the tower and is distributed evenly over the top surface of the packing by a main header and several laterals with multiple orifices. As the water falls by gravity to the base of the tower, it is broken by the packing into many small drops and streams with a large surface area.

Air is forced upward through the packing bed by the blower. The action of the airflow past the large surface area of water removes the volatile TCE and PCE from the water and discharges the contaminants into the atmosphere through the stacks on top of the tower. A low-range pressure switch is actuated by the plenum air pressure and signals the loss of air to the process control computer.

The concentration of PCE in the well water was measured to be below the action level in the early tests. The WTP will

remove the PCE with very nearly the same efficiency as for TCE, thereby reducing the resulting PCE to very low levels in the treated water. TCE is therefore considered the primary contaminant of concern in this manual.

At the design conditions of 35-ppb TCE in the well water, an 8-mgd flowrate, and complete stripping, the air emission would contain approximately 2.3 pounds of TCE a day.

The State of Hawaii Department of Health found that "Levels of TCE to be emitted by the stripping towers are within the existing ambient air levels for urban areas in the United States... and no air permits shall be required" (Appendix 1).

The removal efficiency (ratio of volatile compound removed to that in the incoming well water) depends primarily on the packing selection, depth of packing, and the water and air flowrates.

The packing material is Jaeger TriPacks--3-1/2 inches. The packing depth is 17-1/2 feet.

Other design criteria for the A/S system are as follows:

Design system flowrate	8 mgd, four towers
Maximum system flowrate	10 mgd, five towers
Minimum system flowrate	2 mgd
Design water temperature	55°F
TCE removal at design flow	97.2 percent
Hydraulic loading rate/tower	12.4 gpm/sf
Air flowrate/tower	11,000 scfm
Design influent TCE	35 ppb

Figure A-3 shows the design point and estimates of actual removal efficiency per tower over a flow range bracketing the design water flowrate at 11,000-scfm airflow. During startup tests, the well water TCE was measured to be in the range of 29.5 to 47.4 ppb. The treated water TCE concentration was less than 0.5 ppb, the analytical detection limit. This is equivalent to TCE removal efficiencies greater than 98.4 to 98.9 percent over the five towers. A removal efficiency of 98.6 percent is used in this manual to illustrate expected performance. Additional laboratory data on water samples can be used to adjust this estimate as they are obtained.

The maximum individual tower flow should be controlled to be below the rate at which overflow occurs to avoid potential flooding of the fan ducting. This flowrate can be determined by field tests.

The minimum flow to a tower should be controlled to be not less than about 350 gpm. This flowrate represents a

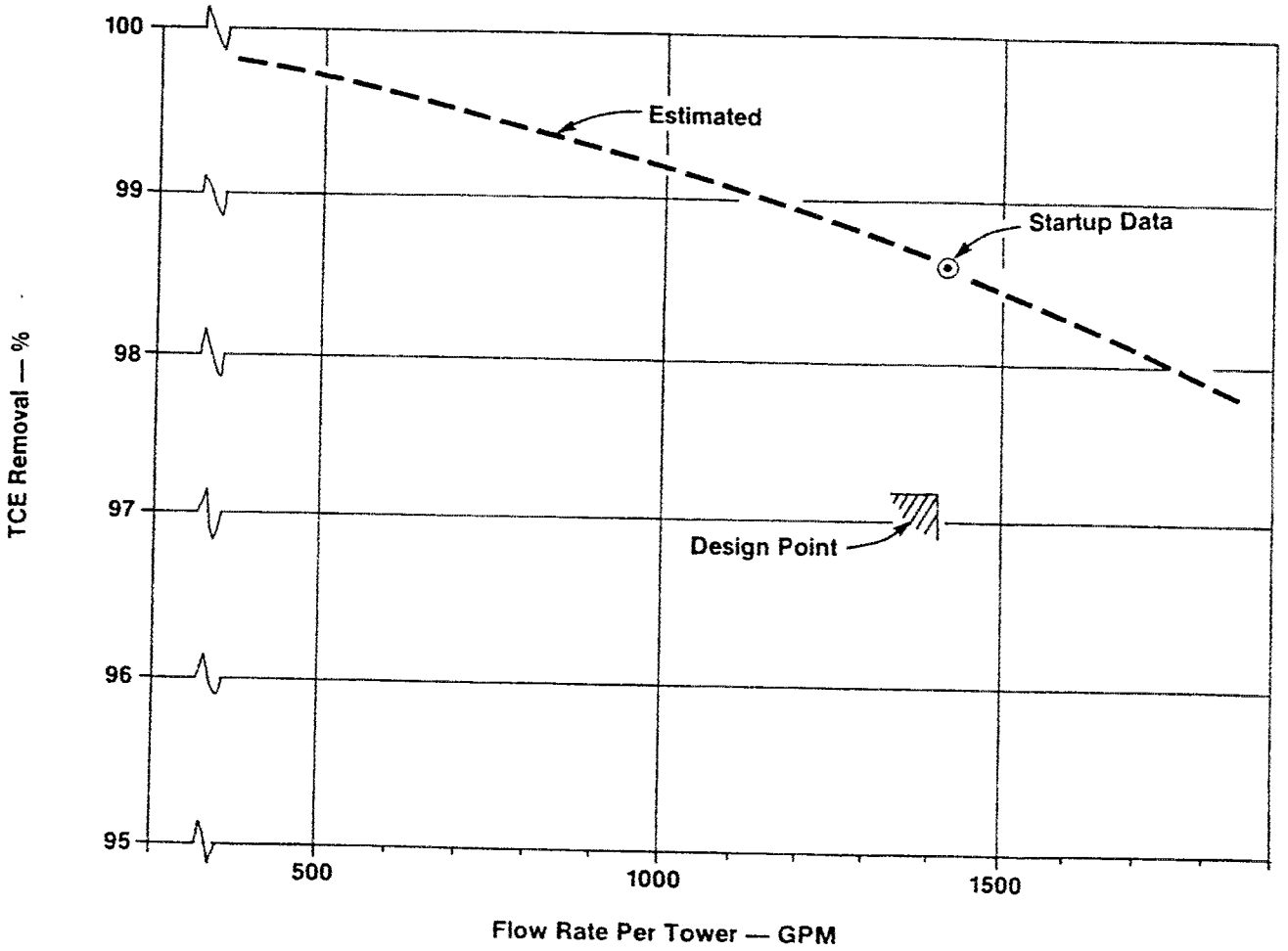


FIGURE A-3
Schofield Barracks WTP
Users Manual
TCE Removal vs Tower Water Flow

reasonably well-balanced flow between five towers operating with one deep-well pump and results in near-optimum treatment efficiency.

Estimated tower performance as a function of airflow is shown in Figure A-4. This figure shows that the stripping efficiency is relatively insensitive to airflow changes near the design point. A reduction in airflow would reduce fan horsepower requirements and energy costs, but should be considered only after analyses of the well water over several months show that the contamination level is not likely to increase.

Reduced air flow should not be below about 6,000 scfm to maintain an adequate air-to-water ratio in the tower. This change would probably require changing blower sheaves, belts, and the plenum pressure switches and would provide the maximum energy cost saving.

e. Treatment Bypass

Valves VB and VA located in the piping trench provide the ability to direct the well water into the clear well, bypassing the A/S treatment system.

To establish well water flow through the bypass, it is important that operating deep-well pump flow not go to zero. Valving should therefore open the bypass valve (VB) first, then close the individual tower riser valves or VA, if needed, to isolate the tower influent header.

Strict administrative controls should be used over the operation of VA and VB. WE RECOMMEND LOCKING VA OPEN AND LOCKING VB CLOSED. Also, a tag should be placed on both VA and VB stating the following:

"1. When valving from treatment operation to bypass operation, OPEN the Bypass Valve VB first and then close the treatment riser valves, V1-1 through V5-1 or VA.

2. When valving from bypass operation to treatment operation, OPEN the treatment riser valves V1-1 through V5-1, the tower effluent valves V1-2 through V5-2 AND VA first, then close the Bypass Valve, VB."

f. Piping Trench and Sump Pumps

The piping trench along the towers houses the A/S system piping and serves to collect washdown water, minor piping leakage, tower overflows, and drainage from the wash tank. The floor of the trench slopes to a sump at its south end where two vertical centrifugal 1.5-hp, 100-gpm sump pumps deliver collected wastewater to a sewer manhole about

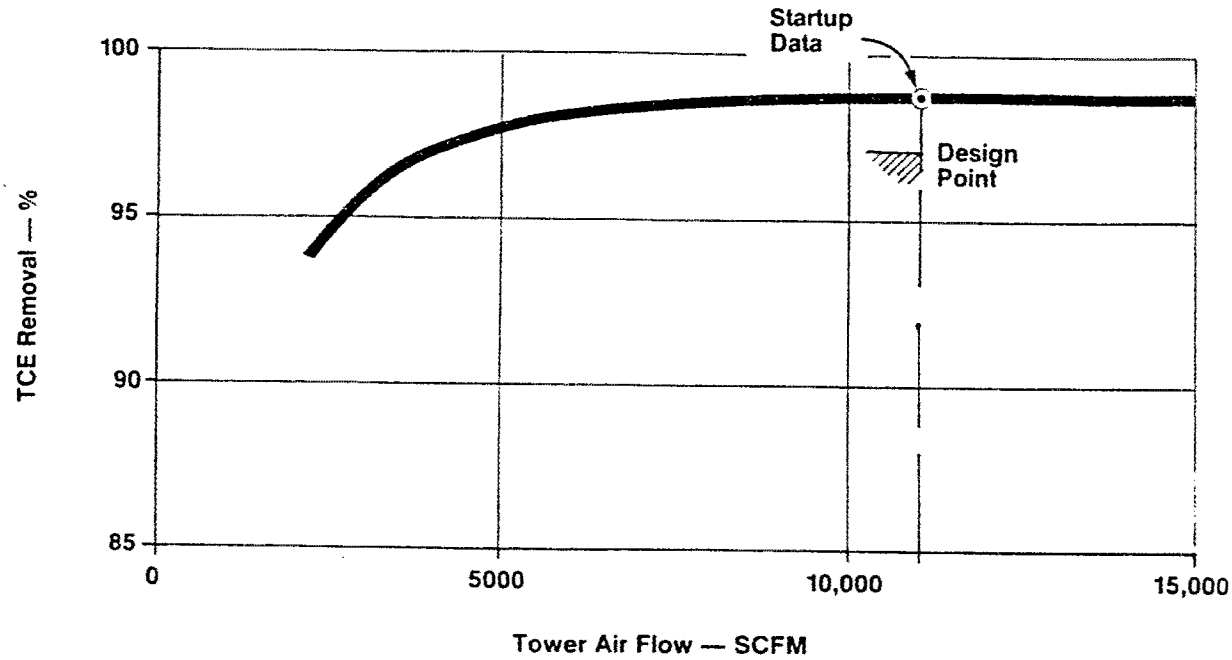


FIGURE A-4
Estimated TCE Removal vs
Tower Air Flow

90 feet north of the northern edge of the tower base. The sewer system then conveys the wastewater to a treatment plant on Wheeler AFB.

Controls monitor the sump water level and pump status, display pump status, and alarms at the PCP if a high water level is reached in the sump.

g. Clear Well and Clear-Well Pumps

The in-ground concrete clear well provides approximately 200,000-gallon capacity at a water level of 13-1/3 feet. It is designed for plug flow to give chlorine contact time of about 1/2 hour or greater and serves as a wet well or sump for the five clear-well discharge pumps (PC-1 through PC-5).

Each of the vertical turbine clear-well pumps is driven by a 100-hp motor and is designed to produce 1,400 gpm at a total head of 210 feet of water. (Performance curves are in the Byron Jackson vendor's manual.)

Clear-well water level is monitored by a low-level displacement switch (LSLL-300) set to shut down all operating clear-well pumps before a decreasing water level would uncover the pump suction strainers and possibly cause damage to the pumps.

Clear-well water level is also monitored by a level element and transmitter with an indicator on the PCP and with several set points for CW pump control and level alarms through the PCC.

Figure A-5 shows the set points for pump ON signals as the water level rises and pump OFF signals as the water level falls.

For example, consider that the clear-well pumps are off and are set up properly for automatic operation as controlled by clear-well level, that all deep-well pumps are initially off, and that the clear-well level is below the 8-foot level. A deep-well pump is then started by an operator to meet system demands. It delivers approximately 1,900 gpm to the A/S towers, which flow into the clear well. With no clear-well pumps operating and this inflow rate, the water level will rise at about 1.5 inches per minute (about 8 minutes per foot). When the "on" level for the lead pump is reached (9.25 feet), the lead pump will start and deliver approximately 1,400 gpm from the clear well into the distribution system. (The actual flowrate may vary from this nominal value because of the back pressure in the distribution header.) At a 1,400-gpm outflow rate, the clear-well level will continue to rise at a slower rate with a net inflow rate of about 500 gpm (1,900 - 1,400 = 500 gpm). The time

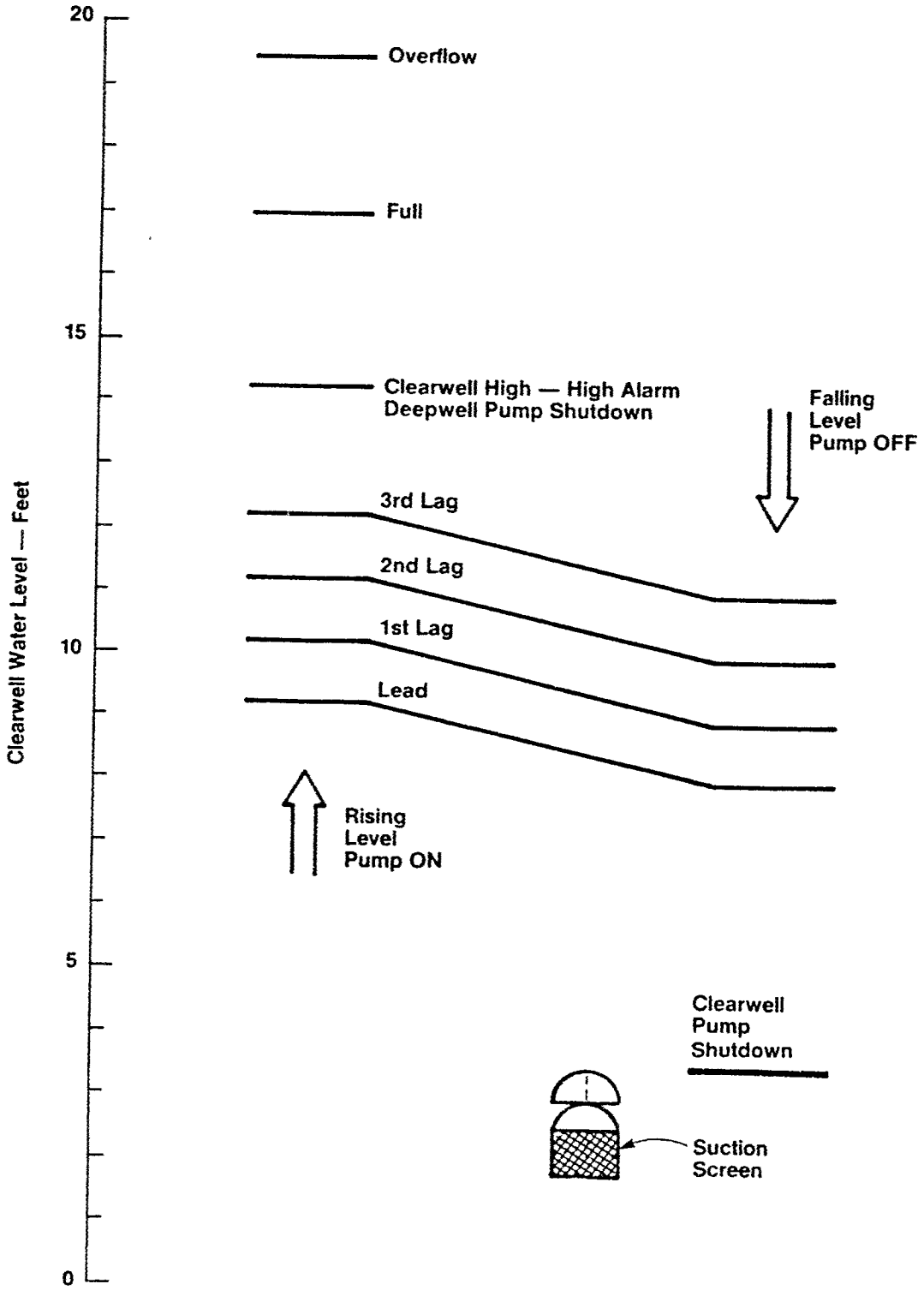


FIGURE A-5
Clearwell Level Set Points

for a 1-foot rise will be about 30 minutes at this rate, and the "on" level of 10-1/4 feet for the first lag pump will be reached in about 30 minutes. With the second clear-well pump operating at approximately 1,400 gpm, the total outflow will be about 2,800 gpm--900 gpm more than the inflow. The clear-well level will therefore decrease. At the net outflow of 900 gpm, the first lag pump will operate until the level decreases to 9 feet. For the 1-1/4-foot decrease from its "on" level of 10-1/4 feet to the "off" level of 9 feet, at a net outflow of 900 gpm, the first lag pump will operate for about 21 minutes. As long as a single deep-well pump is ON and delivering 1,900 gpm, the lead clear-well pump will operate continuously, and the first lag pump will cycle ON and OFF at about 38 minutes off and 21 minutes on.

The actual times will vary from these because actual inflow and outflow rates will be different from the values used in this example. These estimates are based on 1 foot of clear-well water level containing 15,035 gallons and the calculation:

$$\text{Minutes for a 1-foot change} = \frac{15{,}035 \text{ gallons/ft}}{\text{(net flow) gallons/min}}$$

For two or more deep-well pumps operating, the clear-well level will rise, and more clear-well pumps will operate continuously. The pump that cycles will therefore have higher level set points--that is, be the second or third lag pump.

The clear-well pump sequence selector switch on the PCP sets up different lead, lag, and standby pumps for each position as follows:

Switch Position	Lead Pump Lead	First Lag Pump	Second Lag Pump	Third Lag Pump	Standby Pump
1	1	2	3	4	5
2	2	3	4	5	1
3	3	4	5	1	2
4	4	5	1	2	3
5	5	1	2	3	4

The "standby" pump does NOT start automatically as a fourth lag pump. Its purpose is to take over for a "failed" unit when that occurs.

The clear-well level instrumentation also provides a clear-well high level alarm on the PCP and a high-high level shut-

down signal to the deep-well pumps to avoid an impending clear-well overflow.

In the event, however, that clear-well water does continue to rise above the deep-well pump shutdown level, overflow will occur at a level of about 19-1/2 feet through the four overflow pipes located at the north end of the clear well and may also occur elsewhere, such as around the two hatch covers. Overflow water drains to the runoff collection ditch north of the treatment plant and is conducted to a storm drainage ditch and storm sewer manhole outside the site fence and west of the site entrance road.

Each clear-well pump discharges into the distribution header through a check valve and manually operated shutoff valve. The shutoff valve, which is normally open, provides for maintenance work on the discharge piping of a pump without shutting down the distribution header. The check valve prevents backflow when a pump is not running. A pump bypass control valve (see ClaVal manual) is connected to the side outlet of a tee between the pump discharge and the check valve. Its discharge is directed back to the clear well when the valve is open.

The purpose of the pump bypass control valve is to reduce hydraulic surges on the distribution system when a clear-well pump is started or stopped. The operation of the pump bypass control valve system is controlled by electrical circuitry in each pump's starter section in the MCC and by a limit switch on the bypass valve. Operation may be by either the manual switch on the MCC or by the water level in the clear well. The description that follows assumes that the pump is set up to operate as described by the vendor, clear-well water level is above the low-low shutdown level and power is on to the MCC starter.

The pump-control valve operating cycle in AUTO is as follows:

- With the pump "OFF," the check valve will be closed with distribution system pressure on the header side and atmospheric pressure on the pump side. The pump bypass control valve will be fully open.

- When the clear-well level rises to the ON level, the pump will start through its reduced-voltage and then full-voltage cycles. The initial pump flow will be through the bypass control valve back into the clear well.

- The bypass control valve will then close slowly, gradually increasing the pressure on the pump side of the check valve.

- When the pressure on the pump side of the check valve is slightly greater than the distribution system pressure, the check valve will open--at about zero flowrate, resulting in essentially no surge on the discharge line.

- As the bypass control valve continues to close, flow is established into the distribution header and stopped through the bypass valve.

The operating condition of the pump control valve components is therefore:

Pump	On
Bypass control valve	Closed
Check valve	Open
Flow	To system

This condition continues until an "OFF" signal is received.

- Upon receipt of a pump "OFF" signal, the pump continues to operate, and the bypass control valve begins to open, slowly directing an increasing flow back to the clear well.

- When the flow through the check valve is essentially zero (or very slightly in the reverse direction), the check valve will close, stopping flow to the system and resulting in essentially no surge on the discharge line.

- When the bypass control valve is fully open, its limit switch signals the pump to stop, completing the start-stop cycle and returning the control components to their original condition, ready for the next START signal.

Two alarms are built into this circuitry.

- A pump failure alarm will occur on startup in the event that the pump's "run" contactor is not closed within a preset time delay.

- A valve failure alarm will occur on startup in the event that the bypass valve has not started its travel to close within a preset time period.

When either of these events occurs, the corresponding alarm on the PCP will sound, and the pump will be locked out. The

standby pump will be automatically switched into the "failed" pump's position and will start.

h. Chlorine and Fluoride Addition

These systems provide the facilities to feed these chemicals into the treated water before the clear well. The chemical injection ports are on the top of the north end of the A/S effluent header just before it turns to go to the clear well. The chemical feed rooms are on the north side of the clear-well control building.

Chlorine. A gaseous chlorine system is provided with two 150-pound cylinders on scales with an automatic changeover valve. Chlorine feed rate is set on the PCP and is automatically paced with the deep-well pump flow. Chlorine addition is stopped completely when no deep-well pumps are on. A low-chlorine pressure signal will sound an alarm, which is considered a major malfunction because this condition could result in unchlorinated water reaching the distribution system. This condition will sound an alarm on the PCP and the "major" alarm light comes on at the operator's console in the wellhouse.

The chlorine feed room is isolated from other operating areas and is equipped with a chlorine leak detector, motorized damper, and exhaust fans.

The chlorinator vendor's manual contains additional details and safety precautions to guide operations.

The ability to chlorinate well water during "Bypass" operation and to prechlorinate well water before treatment in the towers was retained through the chlorine system adjacent to the operations building.

Fluoride. The fluoride addition system provides the facilities for preparing a saturated fluoride solution from dry, granular sodium fluoride and injecting it into the treated water with a positive displacement feed pump. The dose is set on the PCP, and the solution feed rate is flow paced with plant flow. The feeder is stopped when no deep-well pumps are on.

If the feed pump does not start within a preset time delay after receiving a start signal, an alarm sounds on the PCP, and the "minor" alarm light comes on at the operator's console in the wellhouse.

i. Tower Washdown

This system consists of a 1,900-gallon FRP wash tank, wash pump, controls, water level instrumentation, and piping and

valving for draining the tank and connecting it to the recirculation headers in the pipe trench.

The washdown system is provided so that a selected tower packing and internal parts can be shock chlorinated or treated with an acid solution when needed to control undesirable growths or deposits.

For chlorine treatment, the tower to be treated is shut down and isolated from the influent and effluent headers. The wash tank is filled with service water. Household bleach is then added to give a chlorine solution of 80 to 100 ppm. The system valving is lined out to recirculate the wash tank solution through the tower when the wash pump is started. Approximately 500 gpm will recirculate through the system as long as the pump is on. The solution will drain back to the wash tank when the pump is stopped. The wash tank is then drained to the sump and the chlorine solution pumped to the sewer. The tank is refilled and the tower rinsed down with clean water and drained to the wash tank, and the rinse, drain, pump-out cycle is repeated until the chlorine residual in the tower effluent is considered suitable for valving into the clear well (for example, a residual of 0.5 ppm or less).

The time interval between chlorine washdown treatments, the duration of the chlorine recirculation and the chlorine residual considered suitable for a return to normal service, can be determined only by trial including monitoring chlorine residuals and analyzing tower effluent for bacteria count.

Given the quality of the well water, mineral deposits on the packing are not considered likely. The materials of construction of the washdown system are designed for a mild hydrochloric acid (5 percent), however, so that an acid washdown could be performed, if needed. Note that disposal of a waste acid solution may require neutralization such as by the addition of soda ash in the wash tank or sump before pumping to the sewer.

j. Plant Instrumentation and Controls (I/C)

The WTP instrumentation and control system consists of a number of operator controls and process sensing devices located throughout the plant, a process control computer (PCC) located in the pump control panel (PCP) enclosure in the clear-well pump building, and status lights located on the operator's panel in the wellhouse.

This section of the manual describes the function and location of the I/C components used by a plant operator.

Details of the I/C design and PCC programming are contained in the plant drawings, specifications, and vendor's manual.

The plant I/C functions are identified as "loops" and are shown schematically on the process and instrumentation diagram of Figure A-6. The panel layout and parts identification for the PCP and tower controls are shown in Figure A-7.

In the following loop descriptions, the instrumentation device identification symbols, as shown on the process and instrumentation diagram (Figure A6) are referenced in parentheses.

See also Volume 6--Instruments and Controls for additional details of the I/C system.

100 Loop--Plant Flow. The WTP flowmeter (FT100) is located at the south end of the pipe trench in the influent header. It has a flow register that shows the total volume of water delivered to the treatment plant. The flowrate is transmitted to the recorder (FIR100) on the PCP in the clear-well pump building and is also used to flow-pace the chlorine and fluoride addition systems.

200 Series Loops--Tower Blower Controls. A blower safety switch is pedestal mounted just south of each blower unit (B1 through B5). This switch is used to isolate the motor from the electrical supply for maintenance purposes and must be in the ON position for the blower to operate.

The blower ON-OFF controls are pushbuttons (HS211 through HS215) mounted on the pedestal-mounted panels located near the pipe trench, as follows:

Tower 1	between tower 1 and 2--north side
Tower 2	between tower 1 and 2--south side
Tower 3	between tower 3 and 4--north side
Tower 4	between tower 3 and 4--south side
Tower 5	south of tower 5

When a blower is "ON," an indicator light (QL211 through QL215) on the PCP comes on.

A blower failure is sensed by a pressure switch (PSL211 through PSL215) connected to the tower air plenum. In normal operation this pressure will be slightly above atmospheric pressure to force the airflow through the packing and out of the tower. If the airflow stops for any reason, the plenum pressure decreases to atmospheric and the switch signals the control system to sound the fan failure annunciator (QA211 through QA215) (light the "major" alarm light on the operator's console) and to shut down the operating deep-well pumps in sequence. This shutdown action is taken

INSTRUMENT IDENTIFICATION

1. Instrumentation devices are shown on the Diagram (Figure A-6) by a circle with a number in the lower half and letters in the upper half.

2. The numbers refer to the instrument "Loop". The Loops are described in the text and are summarized as follows:

Loop	Function
100	Plant Flow
200	Tower Blower Controls
300	Clear Well Level and Pump Controls
400	Chlorine System
500	Fluoride System
600	Tower Washdown System
700	Pipe Trench Sump Pumps
800	Annunciators and Plant Alarms
900	Deep Well Pump Shutdown

3. The letters describe the process variable and function of the device. Letter symbols and their meaning are as follows:

Loop	Function
OA	Indicator Alarm Light
OL	Indicator Light
HS	Hand Switch
LAH	Level Alarm — High
LSH	Level Switch — High
LAL	Level Alarm — Low
LSL	Level Switch — Low
LAHH	Level Alarm — High-High
LSHH	Level Switch — High-High
LSM	Level Switch — Medium
FT	Flow Transmitter
FQI	Flow Integrator Indicator
FRI	Flow Indicator Recorder
FI	Flow Indicator
PSL	Pressure Switch — Low
LI	Level Indicator
LSLL	Level Switch — Low Low
LALL	Level Alarm — Low Low
LT	Level Transmitter
LE	Level Element
PI	Pressure Indicator
ZS	Position Switch
FCV	Flow Control Valve
FSL	Flow Switch — Low
FFC	Flow Pacing Control
PAL	Pressure Alarm — Low
AAH	Air Alarm — High (Chlorine)
AE	Air Sensor — (Chlorine)
FV	Flow Valve
SC	Speed Controller
PI	Pressure Indicator

LINE LEGEND

- PROCESS (CLOSED CONDUIT. DASHED LINE INDICATES ALTERNATE FLOW STREAM
- CONNECTING LINES
- ANALOG SIGNAL (4 TO 20 MADC ETC.)
- NON-CONNECTING LINES
- DISCRETE SIGNAL (ON/OFF ETC.)
- BUILDING OR FACILITY BOUNDARY

INTERFACE SYMBOLS

- INTERFACE TO OR FROM PROCESS EXTERNAL TO PROJECT

VALVE SYMBOLS

- GATE
- KNIFE GATE
- BUTTERFLY
- GLOBE
- BALL
- VEE-BALL
- PLUG
- SEAT PORT ECCENTRIC PLUG
- DIAPHRAGM
- PRESSURE RELIEF
- AIR AND/OR VACUUM RELEASE
- REGULATED SIDE PRESSURE CONTROL
- PINCH
- NEEDLE
- SWING CHECK
- BALL CHECK
- SAMPLE

MISCELLANEOUS SYMBOLS

- HORN
- HYDRAULIC ACTUATOR
- SOLENOID VALVE
- OR INTERLOCK. SE CONTROL DIAGRA
- TIME DELAY
- ELECTRIC MOTOR

PRIMARY ELEMENT SYMBOLS

- PROPELLER OR TURBINE METER
- LEVEL (FLOAT)

PUMP & COMPRESSOR SYMBOLS

- CENTRIFUGAL PUMP (DRY PIT)
- SUBMERSIBLE SUMP PUMP
- EDUCTOR
- COMPRESSOR (CENTRIFUGAL) OR BLOWER
- CHEMICAL FEED PUMP
- CENTRIFUGAL WET PIT PUMP OR TURBINE PUMP

ABBREVIATIONS & LETTER SYMBOLS

AC	ALTERNATING CURRENT
AM	AUTO-MANUAL
Cl_2 etc.	CHLORINE (TYPICAL: USE STANDARD CHEMICAL ELEMENT ABBREVATION)
CP	CONTROL PANEL
DC	DIRECT PANEL
LR	LOCAL-REMOTE
MA	MANUAL-AUTO
MCC	MOTOR CONTROL CENTER
OO	ON-OFF
OOA	ON-OFF-AUTO

SCHOFIELD BARRACKS WTP
USERS MANUAL

PROCESS AND INSTRUMENTATION DIAGRAM
LEGEND

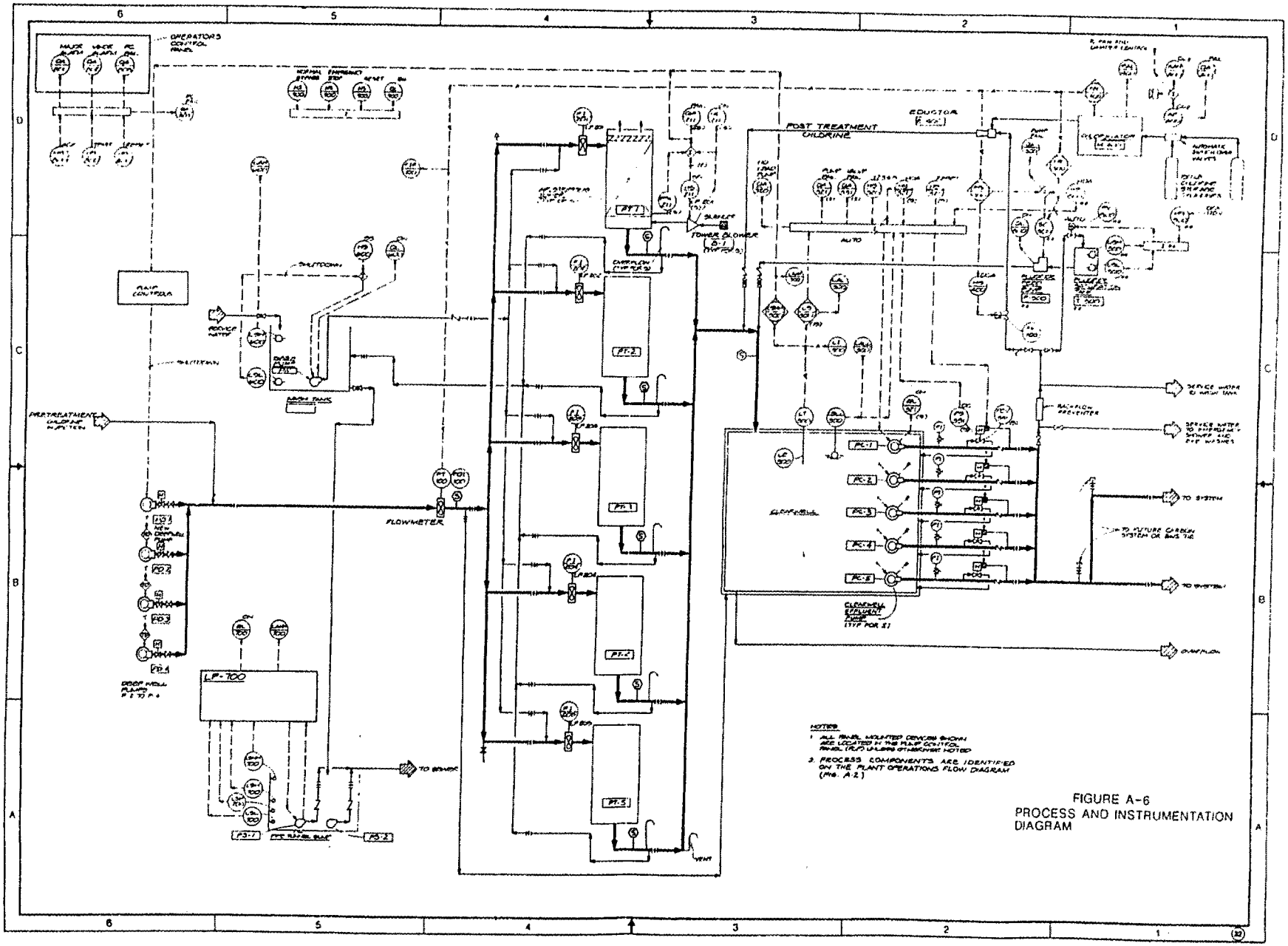
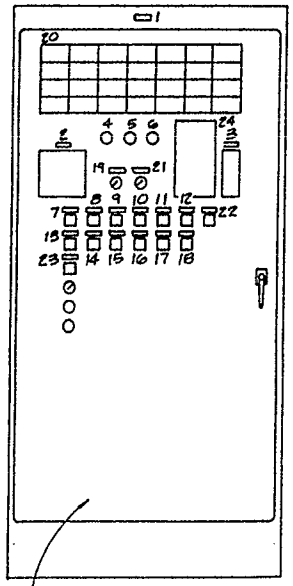


FIGURE A-6
PROCESS AND INSTRUMENTATION DIAGRAM

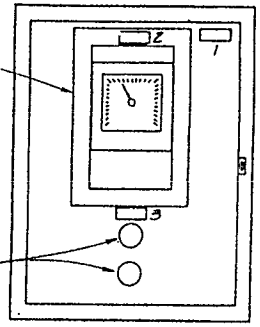
PANEL SCHEDULE		
ITEM NO.	TAG NO.	NAMEPLATE INSCRIPTION
1		PUMP CONTROL / PANEL (PCP)
2	FIR-100	PLANT INFLUENT / FLOW (RECORDER)
3	LI-300	CLEARWELL / LEVEL (INDICATOR)
4	HS-800	ACKNOWLEDGE
5	HS-800	TEST
6	HS-800	RESET
7	QL-211[ON]	TOWER FAN / NO.1
8	QL-212[ON]	TOWER FAN / NO.2
9	QL-213[ON]	TOWER FAN / NO.3
10	QL-214[ON]	TOWER FAN / NO.4
11	QL-215[ON]	TOWER FAN / NO.5
12	QL-700[ON]	PIPE TUNNEL / SUMP PUMP
13	QL-321[ON]	CLEARWELL / PUMP NO.1
14	QL-322[ON]	CLEARWELL / PUMP NO.2
15	QL-323[ON]	CLEARWELL / PUMP NO.3
16	QL-324[ON]	CLEARWELL / PUMP NO.4
17	QL-325[ON]	CLEARWELL / PUMP NO.5
18	QL-600[ON]	WASH PUMP
19	HS-320 [1-2-3-4-5]	CLEARWELL PUMP / SEQUENCE SELECT
20		(28 POINT ANNUNCIATOR - LIGHT CABINET)
21	HS-400[OCA]	CHLORINE / EJECTOR SUPPLY / VALVE
22	QL-500[ON]	FLUORIDE / FEED PUMP
23	QL-900 [ON] HS-900 [NORMAL-BYP] HS-900 [EMERG STOP] HS-900 [RESET]	DEEP WELL / PUMP SHUTDOWN
24		(TIMER/COUNTER ACCESS MODULE)

ANNUNCIATOR SCHEDULE	
WINDOW ROW-COL	WINDOW INSCRIPTION
1-1	TOWER FAN / NO.1 FAILURE
1-2	TOWER FAN / NO.2 FAILURE
1-3	TOWER FAN / NO.3 FAILURE
1-4	TOWER FAN / NO.4 FAILURE
1-5	TOWER FAN / NO.5 FAILURE
1-6	CLEARWELL / HIGH LEVEL
1-7	PROGRAMMABLE CONTROLLER FAILURE
2-1	CLEARWELL PUMP / NO.1 FAILURE
2-2	CLEARWELL PUMP / NO.2 FAILURE
2-3	CLEARWELL PUMP / NO.3 FAILURE
2-4	CLEARWELL PUMP / NO.4 FAILURE
2-5	CLEARWELL PUMP / NO.5 FAILURE
2-6	CLEARWELL / LOW LEVEL
2-7	(BLANK)
3-1	CLEARWELL / PUMP NO.1 / VALVE FAILURE
3-2	CLEARWELL / PUMP NO.2 / VALVE FAILURE
3-3	CLEARWELL / PUMP NO.3 / VALVE FAILURE
3-4	CLEARWELL / PUMP NO.4 / VALVE FAILURE
3-5	CLEARWELL / PUMP NO.5 / VALVE FAILURE
3-6	CLEARWELL / LOW-LOW LEVEL
3-7	(BLANK)
4-1	CHLORINATOR / LOW PRESSURE
4-2	FLUORIDE PUMP / FAILURE
4-3	WASH TANK / HIGH LEVEL
4-4	PIPE TUNNEL / SUMP / HIGH-HIGH LEVEL
4-5	NO LEAD / CLEARWELL PUMP / SELECTED
4-6	CHLORINE / LEAK
4-7	CHLORINE / LEAK DETECTOR / FAILURE



PROCESS CONTROL COMPUTER (PCC) IS INSIDE ENCLOSURE

PUMP CONTROL PANEL



NOTES:

1. X=1 FOR TOWER T-201
   X=2 FOR TOWER T-202
   X=3 FOR TOWER T-203
   X=4 FOR TOWER T-204
   X=5 FOR TOWER T-205

PANEL SCHEDULE		
ITEM NO.	TAG NO.	NAMEPLATE INSCRIPTION FIRST LINE / SECOND LINE / THIRD LINE
1		LP-20(X)
2	FI-20(X)	TOWER NO.(X) / INFLUENT FLOW
3	HS-21(X)(SS)	TOWER FAN / NO.(X)

TOWER RISER FLOWMETER AND BLOWER CONTROL PANEL

FIGURE A-7
SCHOFIELD BARRACKS WTP
USERS MANUAL
PCP AND TOWER CONTOL PANEL

to limit the delivery of untreated well water into the distribution system.

300 Series Loops--Clear-Well Level and Pump Controls. Two separate level sensors are used on the clear-well water level. They are located in the clear well behind the fluoride addition room.

One sensor provides the signal for the clear-well pump controls, the level indicator on the PCP (LI300), and the high level alarms (LAHH300). The transmitter (LT300) for this sensor displays the water level in percent of full scale (16 feet).

The other level sensor (LSLL300) is a switch separate from the PCP, used to shut down any operating clear-well pumps at its low level set point and thereby protect the pumps from possible damage if they were to run dry or cavitate.

The operation of the clear-well pumps under automatic control by the level signal is described under Section A.2.g, Clear Well and Clear-Well Pumps.

The pump control HAND-OFF-AUTO switches (HS321 through HS325) are located on the MCC. The sequence selector switch ON indicator lights (QL321 through QL325) and valve and pump failure annunciators (QA331 through QA335 and QA321 through QA325) are on the PCP.

400 Series Loops--Chlorine System. The chlorine system instrumentation is located in the chlorine room and provides for flow pacing (FFC400); a low-chlorine pressure switch (PAL400), which signals an annunciator on the PCP and shuts down the deep-well pumps; and chlorine leak detection (AAH400), which sounds an annunciator on the PCP (QA400), sounds a warning horn, and actuates exhaust blowers and a motor-operated damper on the north wall of the chlorine room.

A chlorine eductor control switch (HS400) (OPEN-CLOSE-AUTOMATIC) is located on the PCP and controls the solenoid valve (FV400) supplying service water to the chlorine eductor. The chlorine solution is delivered to the injection point on the treated water header at the north end of the pipe trench. In the AUTOMATIC position, the solenoid valve closes when plant flow is less than 1,000 gpm (no deep-well pumps on). Details of the chlorine equipment are in the vendors' manuals.

500 Series Loops--Fluoride System. The fluoride system plant instrumentation and controls provide for flow-paced (FFC500) injection of a fluoride solution, a feed pump control switch (HS500) on the PCP, and a pump failure

annunciator (QA500) on the PCP. Instruments and controls supplied with the vendor's equipment provide for automatic fluoride solution preparation and feed pump control. Refer to the Wallace and Tierman manuals for details.

600 Series Loops--Tower Washdown System. The I/C components for this system consist of the wash tank level switches (LSL600 and LSH600), which signal a high level on a PCP annunciator and a low level shutdown of the wash pump (PW). The pump ON-OFF control station is at the pump, and an indicator light (QL600) is lit on the PCP when the pump is running. The approximate flowrate being pumped is indicated by the tower riser flowmeter (FI201 through FI205) on the tower being treated.

700 Series Loop--Pipe Trench Sump Pumps. Level switches (LSL700, LSM700, LSH700 and LSHH700) in the sump at the south end of the pipe trench are designed to control the operation of the two sump pumps (PS-1 and PS-2) through a local control unit (LP700). An annunciator on the PCP sounds in the event of a high-high level in the sump, and an indicator light (QL700) on the PCP shows that a sump pump is running.

800 Series Loops--Annunciators and Plant Alarms (Figure A-7). Individual annunciators are described under the plant systems. The annunciator panel controls are located on the PCP and consist of TEST, RESET, and ACKNOWLEDGE pushbutton switches (HS800).

The TEST switch illuminates all of the visual indicators when it is pushed.

When a plant function exceeds its annunciator set point, the corresponding annunciator panel light flashes on and off and the alarm horn sounds. By pushing the ACKNOWLEDGE pushbutton, the horn is silenced, and the lighted panel changes to STEADY-ON. After the plant function returns to its normal range, pushing the RESET pushbutton will turn off the panel light. Operating the RESET button will not turn the light off if the alarm condition still exists.

Plant alarm conditions are classified into three groups as follows:

Major Alarms

- Tower Blower Failure--loss of tower airflow and therefore a loss of treatment on the affected tower
- Clear-Well High-High Level--impending overflow
- No Clear-Well Pump Selected--clear-well pumps not properly set to pump out of the clear well; impending overflow

Chlorine Leak--low or lost chlorine addition to treated water
Chlorinator Low Pressure--loss of chlorine addition to treated water

Occurrence of any of these alarms lights the major alarm indicator light on the operator's panel in the deep-well house and requires immediate attention.

PCC Failure Alarm

PCC failure is detected by the loss of a normally continuously energized output. This condition will shut down the entire deep-well and treatment system,is annunciated on the PCP, and lights the PCC failure alarm light at the operator's panel in the deep-well house.

Minor Alarms

All other annunciated conditions on the PCP are considered to be minor alarms and light the minor alarm light on the operator's panel in the deep-well house. These conditions require operator attention, but not necessarily as quickly as for the major and PCC failure alarms.

900 Series Loops--Deep-Well Pump Shutdown. The deep-well pump (PD-1 through PD-4) shutdown interlock is controlled through the NORMAL/BYPASS keylock selector switch (HS900) on the PCP. In the NORMAL mode, the programmable controller will initiate the deep-well pump shutdown. In the BYPASS mode, the programmable controller's automatic shutdown control is bypassed, allowing only manual shutdown of the deep-well pumps at the PCP or at existing manual control stations.

The BYPASS feature was included in the plant at the request of the operators to provide flexibility of operations and avoid a deep-well pump shutdown at their discretion.

Bypassing this feature could result in delivering untreated water to the distribution system or overflowing the clear well. Bypass operation should therefore be under strict administrative controls and the switch returned to NORMAL after any required BYPASS operation.

The interlock has an adjustable time delay so that the pump shutdowns are staggered. The adjustable time delay period is zero to 2 minutes for each pump. Once shut down, the deep-well pumps are not allowed to restart until the condition that initiated the shutdown is corrected. A light on the PCP (QL900) indicates deep-well pump shutdown.

When in the NORMAL mode, the deep-well pump shutdown interlock is initiated on any of the following conditions:

(1) Tower blower failure: If, under running conditions, a tower blower (TSF211 through TSF215) fails, the programmable controller will shut down the operating deep-well pumps through the deep-well pump shutdown interlock. When water flow through the system stops (FSL100), the programmable controller will close the chlorine dilution water valve (FV400), shut down the chlorinator (M400), and stop the fluoride feed pump (P500). The clear-well booster pumps (PC-1 through PC-5) continue to operate until the level in the clear well reaches the programmed clear-well pump shutdown levels. All other blowers in operation at the time of the failure continue to operate until they are manually stopped. The blower failure cannot be reset until the STOP pushbutton of the failed unit has been depressed.

A tower blower (B1 through B5) must be operating to cause a system shutdown on failure. If a blower fails when it is called to start, it will not activate the system shutdown interlock.

(2) Controller failure: If the programmable controller fails, the existing deep-well pumps (PD-1 through PD-4) will shut down through the deep-well pump shutdown interlock. The rest of the system will shut down automatically because of the failure of the programmable controller.

(3) No clear-well booster pump (PC-1 through PC-5) selected: If the programmable controller senses that there is no clear-well booster pump selected, the following sequences occur:

(a) If the system is not in operation, the programmable controller will inhibit the existing deep-well pumps from starting through the deep-well pump shutdown interlock until the condition is corrected.

(b) If the system is in operation, the programmable controller will shut down the existing deep-well pumps through the deep-well pump shutdown interlock. When water flow through the system stops, the programmable controller will shut down the rest of the system as described in the tower blower failure condition with the exception that the clear-well booster pumps are shut down and locked out by the PC

until the failure condition is corrected and the RESET pushbutton on the PCP has been depressed.

(4) Clear-well high-high level: If a clear-well high-high level (LSHH300) is detected (after an adjustable time delay), the programmable controller will shut down the existing deep-well pumps through the deep-well pump shutdown interlock. When water flow through the system stops, the programmable controller will shut down the rest of the system as described in the tower blower failure condition.

(5) No tower blowers on: If the programmable controller senses that there are no tower blowers (B1 through B5) running, the programmable controller will inhibit the deep-well pumps through the deep-well pump shutdown interlock.

(6) Manual emergency shutdown: The EMERGENCY STOP mushroom head pushbutton (HS900) on the PCP will initiate a deep-well pump shutdown when depressed. The manual shutdown operates in both NORMAL and BYPASS deep-well pump shutdown modes. When initiated, the deep-well pumps will be shut down through the deep-well pump shutdown interlock. Once the deep-well pump shutdown interlock has been initiated, the programmable controller will shut down the rest of the system as described in the tower blower failure condition. The deep-well pumps will not be allowed to restart until the emergency shutdown RESET pushbutton (HS900) has been depressed.

Timer Counter Access Module. The timer counter access module allows the operator to monitor the status of all counters and timers in the PCC program. The unit also allows the operator to change the preset values for timers and counters.

Along with timers and counters the unit provides the operator the ability to monitor and change PCC register values.

k. Electrical System

Electrical power for the WTP is supplied by a primary 7,200-volt, three-phase overhead line at the plant substation and is delivered through underground conduit to the 750-kVA, 7,200-480/277V pad-mounted transformer east of the clear-well pump building. The secondary of the transformer is connected to the main breaker and metering section (A) of the MCC in the clear-well pump building (refer to vendor's

data in Section 4). Voltage, current, demand, and kWh meters are mounted on the metering panel (refer to Volume 4--Electrical for vendor's data and to plant as-built drawings).

MCC Sections B, C, D, E, and F house the electrical controls for the tower blowers and clear-well pumps; blower No. 1 and clear-well pump No. 1 starters are in Section B, blower No. 2 and clear-well pump starters in Section C, etc. Reduced voltage starters and power factor correcting capacitors are used on the clear-well pump circuits. The clear-well pump HAND-OFF-AUTO selector switch, RESET pushbutton, and ON indicator light are on the face of the MCC panel.

The control relays for the pump bypass control valve circuits are inside each starter enclosure.

Sections G and H of the MCC house the starters for the wash pump and vent fans, the circuit breaker feeding the sump pump control panel, and the service transformer and circuit breaker panel.

1. Corrosion Protection System

The corrosion protection system is designed to protect the buried fabricated steel clear-well discharge header from potentially destructive corrosion. The system consists of three vertical graphite anodes spaced along the header's length and buried beside the clear-well building's north sidewalk. The anodes are connected together, and the common anode lead conductor is connected to the cathodic protection rectifier mounted on the inside wall of the pump station. The rectifier connection to the header pipe is made at a flanged pipe connection on the discharge piping of one of the clear-well pumps.

In operation, the rectifier impresses a direct current on the anode-header system, which protects the header.

A test station is also provided in the design with lead wires connected on both sides of the flexible pipe coupling joining the steel header and ductile iron pipe. These leads terminate on a terminal block in a flush housing located in the asphalt paving near the southwest corner of the clear-well building. The test station will be used by a corrosion specialist to obtain electrical data on the buried piping, which is needed to adjust the rectifier properly.

Other than maintaining power to the rectifier and routinely recording its output, there are no operating or maintenance requirements for the WTP staff. An experienced corrosion control specialist with highly specialized test equipment should adjust the system initially and check its performance periodically. A contracted service is suggested.

Appendix B

LIST OF DOCUMENTS REVIEWED FOR FIVE-YEAR REVIEW PROCESS

APPENDIX B

List of Documents Reviewed—Operable Units 2 and 4

Operable Unit 2 Documents

Draft Final Operable Unit 2 Remedial Investigation Report, Schofield Army Barracks. April 2, 1996. HLA.

Final Feasibility Study Report for Operable Unit 2, Schofield Army Barracks, Island of Oahu, Hawaii. February 1996. HLA.

Final Record of Decision for Operable Unit 2, Schofield Army Barracks, Island of Oahu, Hawaii. August 12, 1996. HLA.

Final Operation and Maintenance and Long-Term Groundwater Monitoring Plan for Operable Unit 2, Schofield Army Barracks, Island of Oahu, Hawaii. September 13, 1996.

Long-Term Groundwater Monitoring Report for Operable Unit 2 – August 2000, Schofield Army Barracks, Island of Oahu, Hawaii. November. HLA.

Final Long-Term Groundwater Monitoring Report for Operable Unit 2 – January to March 2001, Schofield Army Barracks, Island of Oahu, Hawaii. May. HLA.

Long-Term Groundwater Monitoring Report for Operable Unit 2 – July to September 2001, Schofield Army Barracks, Island of Oahu, Hawaii. November. HLA.

Long-Term Groundwater Monitoring Report for Operable Unit 2, July and August 1998, Schofield Army Barracks, Island of Oahu, Hawaii. December. HLA.

Long-Term Groundwater Monitoring Report for Operable Unit 2, February 1999, Schofield Army Barracks, Island of Oahu, Hawaii. May. HLA.

Long-Term Groundwater Monitoring Report for Operable Unit 2, August 1999, Schofield Army Barracks, Island of Oahu, Hawaii. December. HLA.

Long-Term Groundwater Monitoring Report for Operable Unit 2, January to March 2000, Schofield Army Barracks, Island of Oahu, Hawaii. July. HLA.

Operable Unit 4 Documents

Final Sampling and Analysis Plan for Operable Unit 4 Phase II Remedial Investigation and Feasibility Study Field Program, Schofield Army Barracks, Island of Oahu, Hawaii, March 16, 1995. HLA.

Final Feasibility Study Report for Operable Unit 4, Schofield Army Barracks, Island of Oahu, Hawaii. December 26, 1995. HLA.

Final Record of Decision for Operable Unit 4, Schofield Army Barracks, Island of Oahu, Hawaii. July 12, 1996. HLA.

Final Operation and Maintenance and Long-Term Groundwater Monitoring Plan for Operable Unit 4, Schofield Army Barracks, Island of Oahu, Hawaii. September 13, 1996. HLA.

Presumptive Remedy for CERCLA Municipal Landfill Sites. 1993. U.S. Environmental Protection Agency (EPA).

Synopsis Completion of Work Plan for FY00 OMA Package A-103, Repair Landfill Cover, Schofield Barracks, Oahu, Hawaii, May 18, 2001. Aylward Enterprises, Inc.

Remedial Action Report for Operable Unit 4, Former Landfill, Schofield Barracks, Island of Oahu, Hawaii, August 21, 1998. HLA.

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Operable Unit 4, Former Landfill Post-Closure Inspection Report, Schofield Barracks, Island of Oahu, Hawaii, April 27, 1999. DPW.

Operable Unit 4, Former Landfill Post-Closure Inspection Report, Schofield Barracks, Island of Oahu, Hawaii, July 21, 1999. DPW.

Operable Unit 4, Former Landfill Post-Closure Inspection Report, Schofield Barracks, Island of Oahu, Hawaii, November 15, 1999. DPW.

Operable Unit 4, Former Landfill Post-Closure Inspection Report, Schofield Barracks, Island of Oahu, Hawaii, March 13, 2000. DPW.

Operable Unit 4, Former Landfill Post-Closure Inspection Report, Schofield Barracks, Island of Oahu, Hawaii, June 28, 2000. DPW.

Operable Unit 4, Former Landfill Post-Closure Inspection Report, Schofield Barracks, Island of Oahu, Hawaii, August 26, 2000. DPW.

Operable Unit 4, Former Landfill Post-Closure Inspection Report, Schofield Barracks, Island of Oahu, Hawaii, October 31, 2000. DPW.

Operable Unit 4, Former Landfill Post-Closure Inspection Report, Schofield Barracks, Island of Oahu, Hawaii, February 21, 2001. DPW.

Operable Unit 4, Former Landfill Post-Closure Inspection Report, Schofield Barracks, Island of Oahu, Hawaii, June 27, 2001. DPW.

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Long-Term Groundwater Monitoring Report for Operable Units 2 and 4 – May to July 2000, Schofield Army Barracks, Island of Oahu, Hawaii. October. HLA.

Long-Term Groundwater Monitoring Report for Operable Units 2 and 4 – November and December 2000, Schofield Army Barracks, Island of Oahu, Hawaii. February. HLA.

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Final Long-Term Groundwater Monitoring Report for Operable Unit 2 and Operable Unit 4, April and May 1998, Schofield Army Barracks, Island of Oahu, Hawaii. November. HLA.

Long-Term Groundwater Monitoring Report for Operable Unit 2 and Operable Unit 4, November and December 1998, Schofield Army Barracks, Island of Oahu, Hawaii. March 1999. HLA.

Long-Term Groundwater Monitoring Report for Operable Unit 2 and Operable Unit 4, May and June 1999, Schofield Army Barracks, Island of Oahu, Hawaii. September. HLA.

Long-Term Groundwater Monitoring Report for Operable Unit 2 and Operable Unit 4, November 1999, Schofield Army Barracks, Island of Oahu, Hawaii. February 2000. HLA.

Appendix C

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Table C.1: Location-specific Applicable or Relevant and Appropriate Requirements for Operable Unit 2 at Schofield Barracks

Location Characteristic(s)	Prerequisite(s)	Requirement(s)	HAR Citation(s)
Wilderness areas, wildlife resources, wildlife refuges, or scenic rivers			
· Within area affecting stream or river -**and** - presence of fish or wildlife resources	· Presence of fish or wildlife resources; action by federal agency that results in the control or structural modification of a natural stream or body of water · Offsite response action	· The effects of water-related projects on fish and wildlife resources must be considered. · Action must be taken to prevent, mitigate, or compensate for project-related damages or losses to fish and wildlife resources. · Offsite actions that alter a resource require consultation with the FWS, NMFS, and/or the appropriate state agency. · Consultation with the responsible agency is also strongly recommended for onsite actions.	· Fish and Wildlife Coordination Act (16 USC 661 *et seq.*), §§662 and 663 – **applicable** · 40 CFR §6.302(g) (applies to federal agencies only) - **TBC**
· Location encompassing aquatic ecosystem with dependent fish, wildlife, other aquatic life, or habitat	· Action(s) involving the discharge of dredge or fill material into aquatic ecosystem	· Degradation or destruction of aquatic ecosystems must be avoided to the extent possible. Discharges that cause or contribute to significant degradation of the water of such ecosystems are prohibited.	· Clean Water Act §404 - **applicable** · 40 CFR §230 – **applicable** · 33 CFR §320-330 - **applicable**
· Presence of wild birds or their nests		· The intentional, knowing, or reckless taking, catching, injuring, killing, destroying, or keeping in captivity or possession of wild birds is prohibited. · Damaging or destroying the nests of wild birds is prohibited.	· HRS §183D-61 *et seq.* – **applicable**

Table C.1 (continued)

Location Characteristic(s)	Prerequisite(s)	Requirement(s)	HAR Citation(s)
Endangered, threatened, or rare species			
· Presence of endangered or threatened species or critical habitat (see above citation) of same within an aquatic ecosystem as defined in 40 CFR §230.3(c)	· Action involving discharge of dredge or fill material into aquatic ecosystem	· Dredge or fill material shall not be discharged into an aquatic ecosystem if it would jeopardize such species or would likely result in the destruction or adverse modification of a critical habitat of the species.	· Clean Water Act §404 – **applicable** · 40 CFR §230.10(b) – **applicable**
· Presence of federal or state endangered or threatened species		· The taking of any threatened or endangered species within the state is prohibited.	· HRS §195D-4 – **applicable**
· Presence of endangered or threatened species -**or**- critical habitat of such species as designated in 50 CFR §17, 50 CFR §226	· Action that is likely to jeopardize species or destroy or adversely modify critical habitat	· Actions that jeopardize species/habitat must be avoided or appropriate mitigation measures taken. · Offsite actions that affect species/habitat require consultation with DOI, FWS, NMFS, and/or state agencies, as appropriate, to ensure that proposed actions do not jeopardize the continued existence of the species or adversely modify or destroy critical habitat. · Consultation with the responsible agency is also strongly recommended for onsite actions.	· Endangered Species Act of 1973 (16 USC 1531 *et seq.*) - **applicable** · 50 CFR §402 - **applicable** · 40 CFR §6.302(h) - **TBC** · Fish and Wildlife Coordination Act (16 USC 661 *et seq.*) - **applicable**

Source: United States Army Environmental Center

CFR Code of Federal Regulations
DOI Department of Interior
FWS U.S. Fish and Wildlife Service
HAR Hawaii Administrative Rule
HRS Hawaii Revised Statutes
NMFS National Marine Fisheries Service
TBC To be considered
USC United States Code

Table C.2: Action-specific Applicable or Relevant and Appropriate Requirements for Operable Unit 2 at Schofield Army Barracks, Hawaii

Actions	Requirements	Prerequisites	Federal Citation	HAR Citation
Alternative 1 No Action				
Institutional controls	Institutional controls such as water use and deed restrictions to supplement engineering controls as appropriate for short- and long-term management to prevent or limit exposure to hazardous substances, pollutants, or contaminants.	Presence of hazardous substances, pollutants, or contaminants.	40 CFR § 300.430(a)(1)(iii)(D) to be considered.	
Alternative 2 Air Stripping				
Fugitive dust emissions	Visible fugitive dust emissions must not be discharged beyond the property lot line on which the fugitive dust originates. Reasonable precautions must be used to prevent fugitive dust emissions.	Fugitive emissions from excavation of contaminated soil and construction of pads.		§11-60.1-33(a)(1) through (7) and (b) **applicable**
Air emissions from the air stripper	Administrative and substantive requirements of permit if exemption listed at §11-60.1-62(d)(1) cannot be met. Requirements include the installation of devices for the measurement or analysis of source emissions or ambient concentrations of air pollutants; monitoring; and requirements concerning the use, maintenance, and installation of monitoring equipment.	Exemption under §11-60.1-62(d)(1) cannot be met.		§11-60.1-68 **applicable**
Discharge of treated groundwater	Comply with MCLs. See Section 3 of the OU 2 FS Report for a discussion of MCLs.	Discharge of treated groundwater into water distribution system.		

Table C.2 (continued)

Actions	Requirements	Prerequisites	Federal Citation	HAR Citation
Alternative 4 Peroxide/Ozone Oxidation				
Fugitive dust emissions	See Alternative 2			
Discharge of treated groundwater	See Alternative 2			

CFR Code of Federal Regulations
HAR Hawaii Administrative Rule
MCL Maximum contaminant level
RCRA Resource Conservation and Recovery Act
UV Ultraviolet

Table C.3: Action-specific Applicable or Relevant and Appropriate Requirements for Operable Unit 4 at Schofield Army Barracks, Hawaii

Actions	Requirements	Prerequisites	Federal Citation	HAR Citation(s)
Fugitive Dust Emissions	Visible fugitive dust emissions must not be discharged beyond the property lot line on which the fugitive dust originates. Reasonable precautions must be used to prevent fugitive dust emissions.	Fugitive emissions from excavation of contaminated soil and construction of pads.		§11-60.1-33(a)(1) through (7) and (b) **applicable**
Surface-Water Control	NPDES permit required for offsite discharges and discharges to a POTW. NPDES permit is not required for onsite discharges, but the substantive requirements of the permit must be complied with for onsite discharges, offsite discharges, and discharges to a POTW.	Storm-water runoff associated with construction activity, including clearing, grading and excavation, except operations that result in the disturbance of less than five acres of total land area, which are not part of a larger common plan of development or sale.		*§11-55-34.02, (b) (2) Appendix C* **applicable**
	Monitoring required to ensure compliance with applicable state water quality standards.	Storm-water runoff from construction activity.		*§11-55-34.04 (b), Appendix A* **applicable**
Institutional Controls	Following closure of all municipal solid waste landfill (MSWLF) units, the owner or operator must record a notation on the deed to the landfill facility property, or some other instrument that is normally examined during title search, and notify the Director of Health that the notation has been recorded and a copy has been placed in the operating record.			§11-58.1-17(a)(9)(A) **relevant and appropriate**
	The notation on the deed must in perpetuity notify any potential purchaser of the property that the land has been used as a landfill facility and its use is restricted under § 11-58.1-17(b)(3)(C) of the Hawaii Administrative Rules.			§11-58.1-17(a)(9)(B) **relevant and appropriate**
Long-term Groundwater Monitoring and Maintenance of the Landfill Cover	Groundwater monitoring must be conducted throughout the postclosure care period for the MSWLF unit, unless a demonstration is made showing that *a reduced period is sufficient to protect human health and the environment and this demonstration is approved by the Director [11-58.1-17(b)(2)(A)]174*	A MSWLF unit.		§11-58.1-16(a)(5) **relevant and appropriate**

Table C.3 (continued)

Actions	Requirements	Prerequisites	Federal Citation	HAR Citation(s)
	A groundwater monitoring system that consists of a sufficient number of wells, installed at appropriate locations and depths, to yield groundwater samples from the uppermost aquifer that represent the quality of background water that has not been affected by leakage from the unit and the quality of groundwater passing the relevant point of compliance specified by the Director of Health.			§11-58.1-16(b)(1) **relevant and appropriate**
	Monitoring wells must be cased in a manner that maintains the integrity of the monitoring well borehole.			§11-58.1-16(b)(3) **relevant and appropriate**
	Owner or operator must establish background groundwater quality in a hydraulically upgradient or background well(s) for each monitoring parameters or constituents required in the particular groundwater monitoring that applies to the MSWLF unit, as determined under § 11-58.1-16(d)(1) or (e)(1).			§11-58.1-16(c)(5) **relevant and appropriate**
	Detection monitoring must be performed. The minimum of detection monitoring allowed is for the constituents listed in Appendix I to 40 CFR Part 258. If there is a statistically significant increase over background for one or more of the constituents listed in Appendix I to 40 CFR Part 258 at any monitoring well at the boundary, then an assessment monitoring program must be established, unless it can be demonstrated that a source other than the landfill caused the contamination or that the statistically significant increase resulted from error in sampling, analysis, statistical evaluation, or natural variation in the groundwater quality.			§11-58.1-16(d)(3) **relevant and appropriate**
	If assessment monitoring is triggered, then the groundwater must be sampled and analyzed for all constituents listed in Appendix II to 40 CFR Part 258. If one or more of the constituents listed in this appendix are detected at statistically significant levels above the groundwater protection standard established under § 11-58.1-16(e)(8) or (9) in any sampling event, then at least one additional monitoring well at the facility boundary in the direction of contaminant migration must be installed and an assessment of corrective measures must be initiated pursuant to § 11-58.1-16(f).			§11-58.1-16(e)(2) **relevant and appropriate**

Table C.3 (continued)

Actions	Requirements	Prerequisites	Federal Citation	HAR Citation(s)
	Postclosure care must be conducted for 30 years, unless this time period is decreased by the Director of Health when it is demonstrated that the reduced period is sufficient to protect human health and the environment or increased by the Director if the Director determines that the lengthened period is necessary to protect human health and the environment.			§11-58.1-17(b) **relevant and appropriate**
	The integrity and effectiveness of the final cover must be maintained.			§11-58.1-17(b) **relevant and appropriate**
	The groundwater must be monitored in accordance with § 11-58.1-16 and the groundwater monitoring system must be maintained.			§11-58.1-17(b) **relevant and appropriate**
Air Emissions from the Passive Landfill Gas Collection System and Active Vapor Extraction System	In the ambient air, the average concentration of ozone measured by a reference method during any one hour period shall not exceed 100 micrograms per cubic meter of air and the average concentration of lead measured as elemental lead by a reference method during any calendar quarter shall not exceed 1.5 micrograms per cubic meter of air.	Air emissions of *ozone* or lead.		§11-59-4(f) and (h) – **applicable**
Air Emissions from the Passive Landfill Gas Collection System and Active Vapor Extraction System	In the ambient air, methane concentrations at the perimeter of the landfill shall not exceed the lower explosive limit (5 percent).	Air emissions of methane.		§11-58.1-17 **relevant and appropriate**

Table C.3 (continued)

Actions	Requirements	Prerequisites	Federal Citation	HAR Citation(s)
	Substantive requirements of permit if exemption listed at §11-60.1-62(d)(1) cannot be met. Substantive requirements include the installation of devices for the measurement or analysis of source emissions or ambient concentrations of air pollutants; monitoring; and requirements concerning the use, maintenance, and installation of monitoring equipment.	Exemption under §11-60.1-62(d)(1) cannot be met.		§11-60.1-68 **applicable**
Gas Treatment System	Obtain a manifest and comply with packaging, labeling, marking, and placarding requirements.	Use of granular carbon filter system and the carbon filters meet the definition of a RCRA hazardous waste.	40 CFR 262 and 40 CFR 263 **applicable**	

CFR Code of Federal Regulations
HAR Hawaii Administrative Rule
MSWLF Unit Municipal solid waste landfill unit
NPDES National Pollutant Discharge Elimination System
POTW Publicly owned treatment works
RCRA Resource Conservation and Recovery Act
VOC Volatile organic compound

Table C.4: Location-specific Applicable or Relevant and Appropriate Requirements for Operable Unit 4 at Schofield Army Barracks, Hawaii

Location Characteristic(s)	Operating Condition(s)	Requirement(s)	HAR Citation(s)
Wilderness areas, wildlife resources, wildlife refuges, or scenic rivers			
• Within area affecting stream or river **-and** - presence of fish or wildlife resources	• Action that results in the control or structural modification of a natural stream or body of water	• The effects of water-related projects on fish and wildlife resources must be considered. • Action must be taken to prevent, mitigate, or compensate for project-related damages or losses to fish and wildlife resources. • Offsite actions that alter a resource require consultation with the FWSa, NMFSb, and/or the appropriate state agency. • Consultation with the responsible agency is also strongly recommended for onsite actions.	• Fish and Wildlife Coordination Act (16 USC 661 et seq.) • 40 CFR 6.302(g) (applies to federal agencies only)
• Location encompassing aquatic ecosystem with dependent fish, wildlife, other aquatic life, or habitat	• Action(s) involving the discharge of dredge or fill material into aquatic ecosystem	• Degradation or destruction of aquatic ecosystems must be avoided to the extent possible. Discharges that cause or contribute to significant degradation of the water of such ecosystem are prohibited.	• Clean Water Act 404 • 40 CFR 230 • 33 CFR 320-330
• Presence of wild birds or their nests		• The intentional, knowing, or reckless taking, catching, injuring, killing, destroying, or keeping in captivity or possession of wild birds is prohibited. • Damaging or destroying the nests of wild birds is prohibited.	• *HRS* 183D-61 et seq.
Endangered, threatened, or rare species			
• Presence of endangered or threatened species or critical habitat (see above citation) of same within an aquatic ecosystem as defined in 40 CFR, 230.3(c)	• Action involving discharge of dredge or fill material into aquatic ecosystem	• Dredge or fill material shall not be discharged into an aquatic ecosystem if it would jeopardize such species or would likely result in the destruction or adverse modification of a critical habitat of the species.	• Clean Water Act 404 • 40 CFR 230.10(b)
Endangered, threatened, or rare species (continued)			
• Presence of federal or state endangered or threatened species		• The taking of any threatened or endangered species within the state is prohibited.	• *HRS* 195D-4

Table C.4 (continued)

Location Characteristic(s)	Operating Condition(s)	Requirement(s)	HAR Citation(s)
• Presence of endangered or threatened species –or- critical habitat of such species as designated in 50 CFR 17, 50 CFR 226, or 50 CFR 227	• Action that is likely to jeopardize species or destroy or adversely modify critical habitat	• Actions that jeopardize species/habitat must be avoided or appropriate mitigation measures taken. • Offsite actions that affect species/habitat require consultation with DOId, FWS, NMFS, and/or state agencies, as appropriate, to ensure that proposed actions do not jeopardize the continued existence of the species or adversely modify or destroy critical habitat. • Consultation with the responsible agency is also strongly recommended for onsite actions.	• Endangered Species Act of 1973 (16 USC 1531 et seq.) • 50 CFR 402 • 40 CFR 6.302(h) • Fish and Wildlife Coordination Act (16 USC 661 et seq.)

CFR Code of Federal Regulations
DOI Department of Interior
FWS U. S. Fish and Wildlife Service
HAR Hawaii Administrative Rule
HRS *Hawaii Revised Statutes*
NMFS National Marine Fisheries Service
USC United States Code

Appendix D

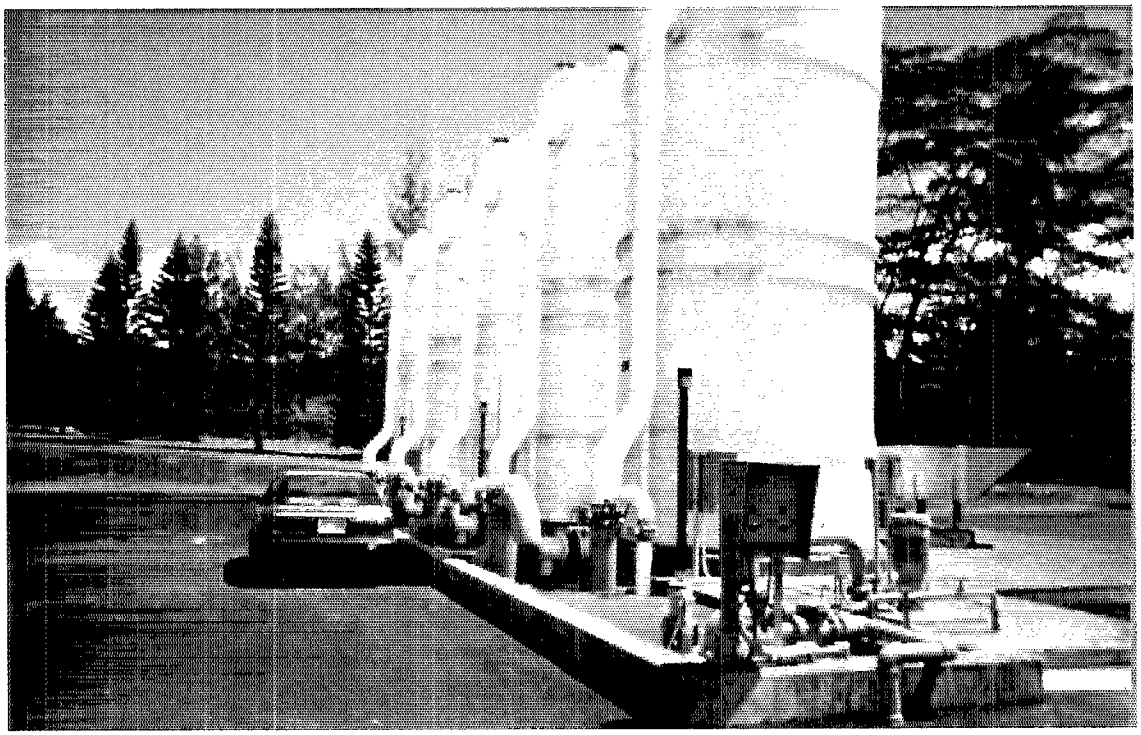
OPERABLE UNIT 2 SITE INSPECTION CHECKLIST FOR ONPOST MONITORING WELLS, NOVEMBER 2001

Table D.1: Site Inspection Checklist for Onsite Monitoring Wells

Well	Properly Secured/ Locked	Functioning	Routinely Sampled	Good Condition	Needs Maintenance	Remarks
MW-1-1	Yes	Yes	Yes	Yes	No	
MW-2-1	Yes	Yes	Yes	No	Yes, paint is badly deteriorated	Water-level measuring point should be re-surveyed
MW-2-2	Yes	Yes	Yes	No	Yes, paint is badly deteriorated	
MW-2-3	Yes	Yes	Yes	No	Yes, paint is badly deteriorated	
MW-2-4	No	Yes	Yes	No	Yes, paint is badly deteriorated	Hinge broken on cover
MW-2-5	No	No	Yes	No	Yes, paint is badly deteriorated	A waiting pump motor replacement, hinge broken on cover, water-level measuring point should be re-surveyed
MW-2-6	Yes	No	Yes	No	Yes, paint is badly deteriorated	A waiting pump motor replacement, hinge broken on cover, water-level measuring point should be re-surveyed
MW-4-1	Yes	Yes	Yes	No	Yes, paint is badly deteriorated	
MW-4-2A	Yes	No	Yes	No	Yes, paint is badly deteriorated	A waiting pump motor replacement, water-level measuring point should be re-surveyed
MW-4-3	Yes	Yes	Yes	No	Yes, paint is badly deteriorated	
MW-4-4	Yes	Yes	Yes	No	Yes, paint is badly deteriorated	Water-level measuring point should be re-surveyed

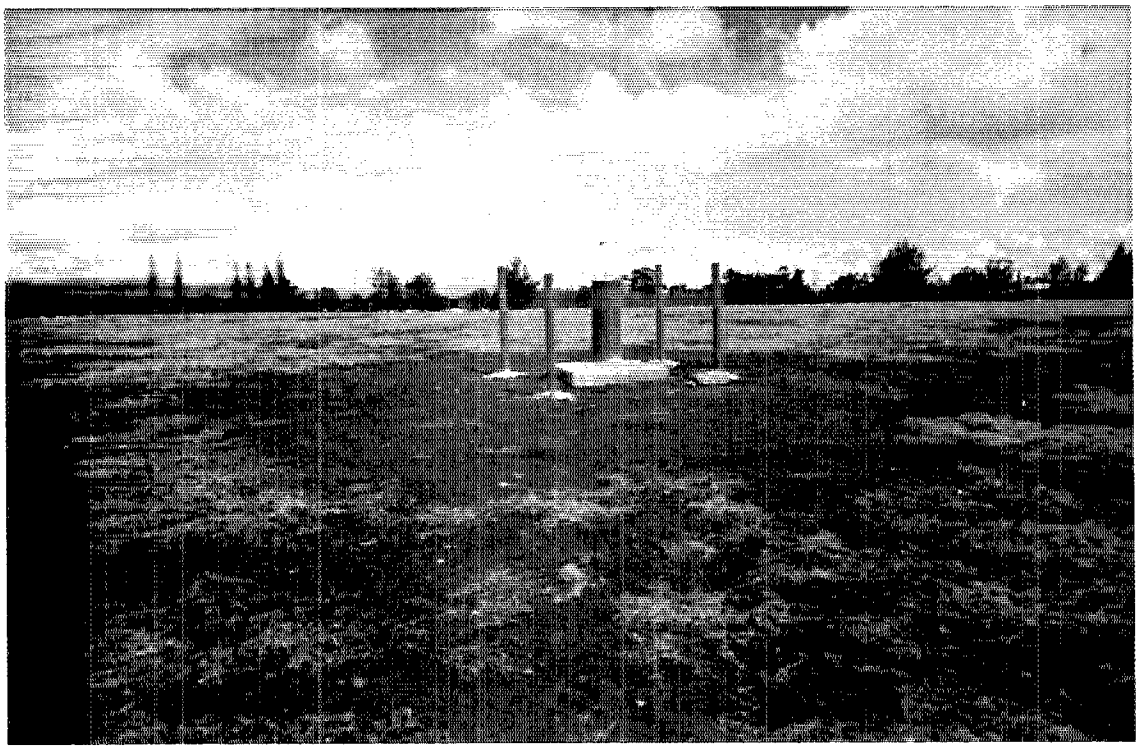
Appendix E

OPERABLE UNIT 2 AND 4 FIVE YEAR SITE INSPECTION PHOTOGRAPHS



Air Stripper Towers for Schofield Barracks Water Treatment System

Air Stripper for Del Monte Water Treatment System



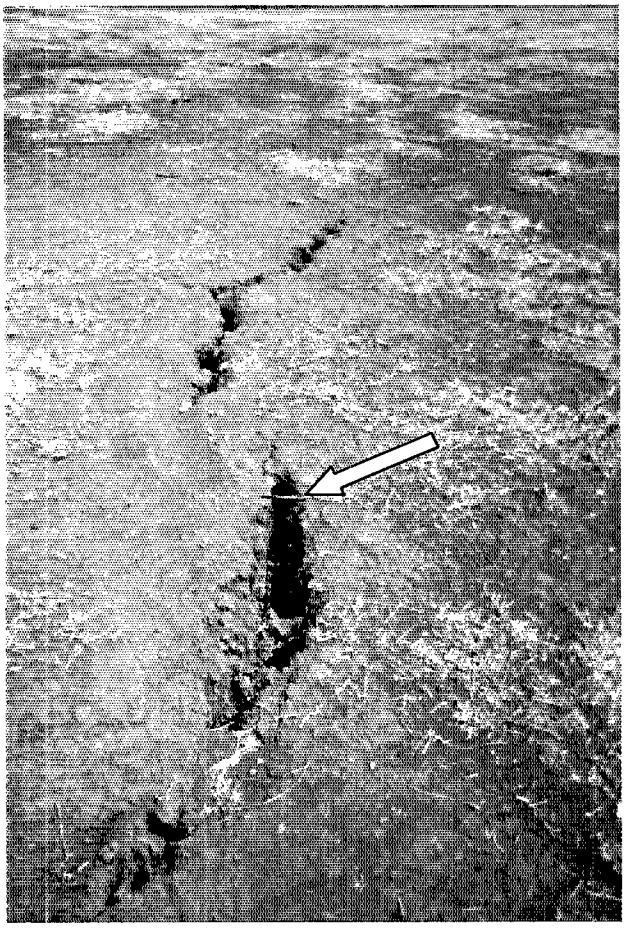
Looking at one of the landfill gas monitoring venting wells – Note sparse vegetation

Groundwater Monitoring Well MW-4-2 – Note corrosion on casing

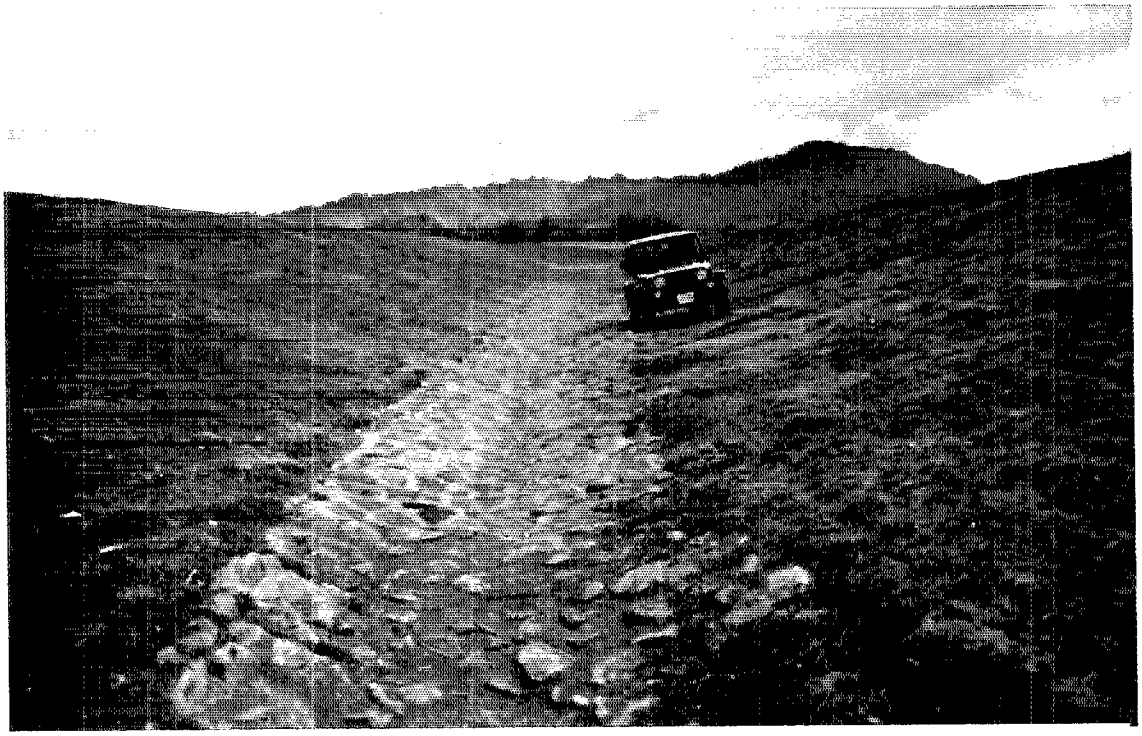
Posted sign on security fence around Operable Unit 4

North central sideslope drainage chute near outlet structure

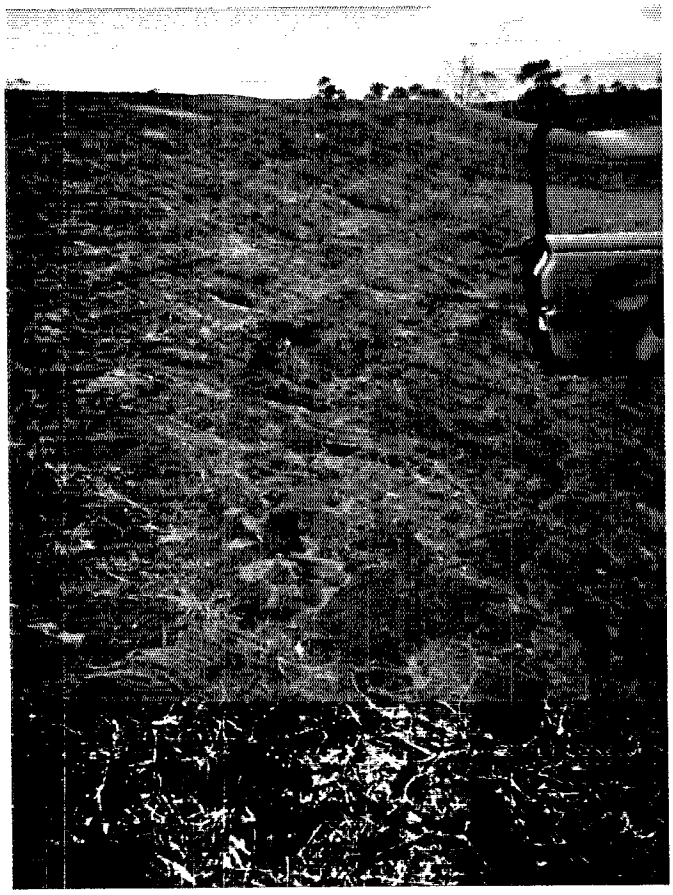
Sparse vegetation on landfill cover – view is from south end of landfill looking north



Looking at some of the cracks on the landfill cover –
Note pen at crack for scale



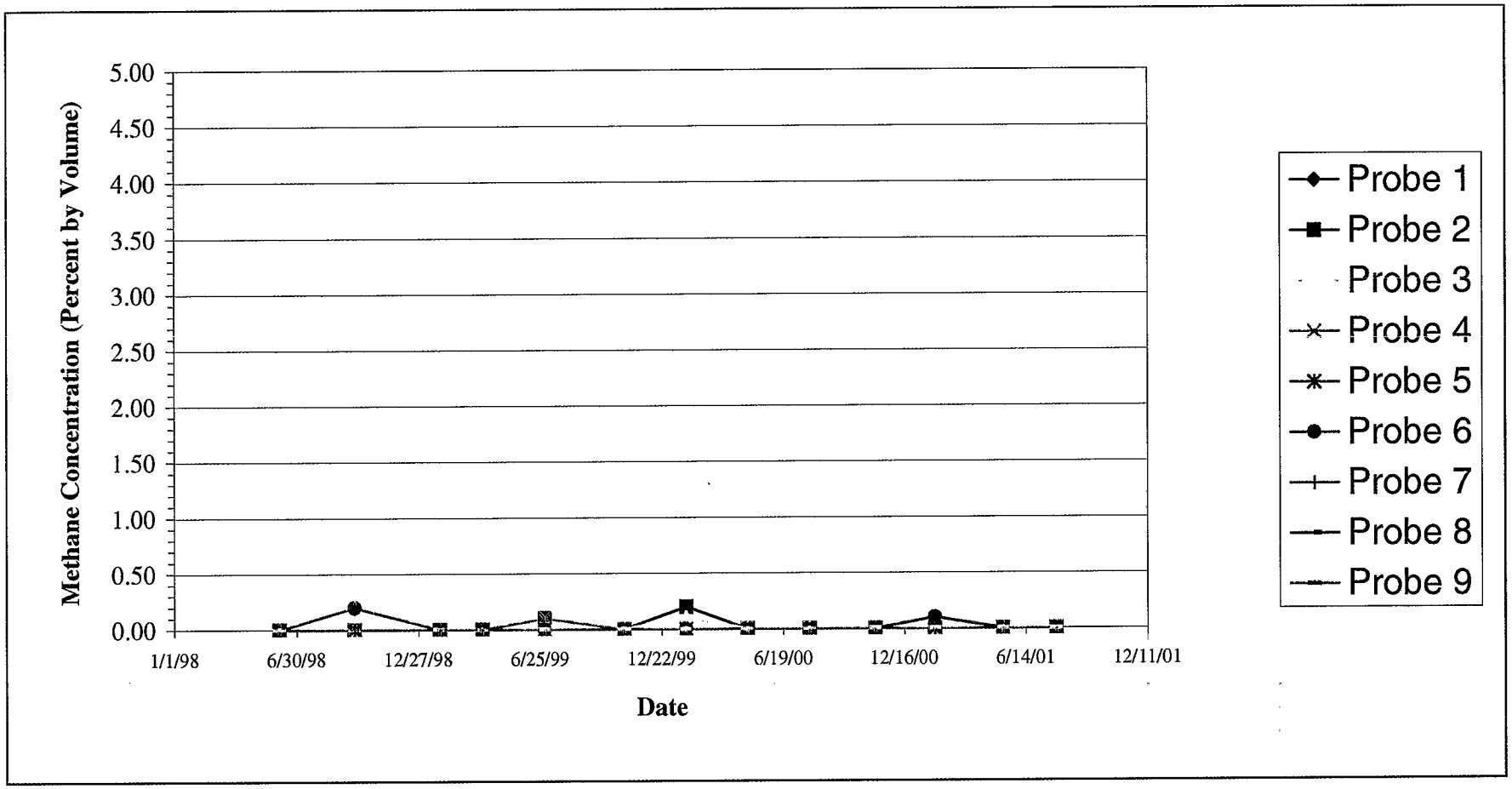
Center Drainage Channel – view is to the south



Some erosion and cracking on sideslope of Center Drainage Channel

Appendix F

OPERABLE UNIT 4 PLOTS OF LANDFILL GAS DATA FROM QUARTERLY LANDFILL GAS MONITORING REPORTS, 1998-2001



Harding ESE
A MACTEC COMPANY

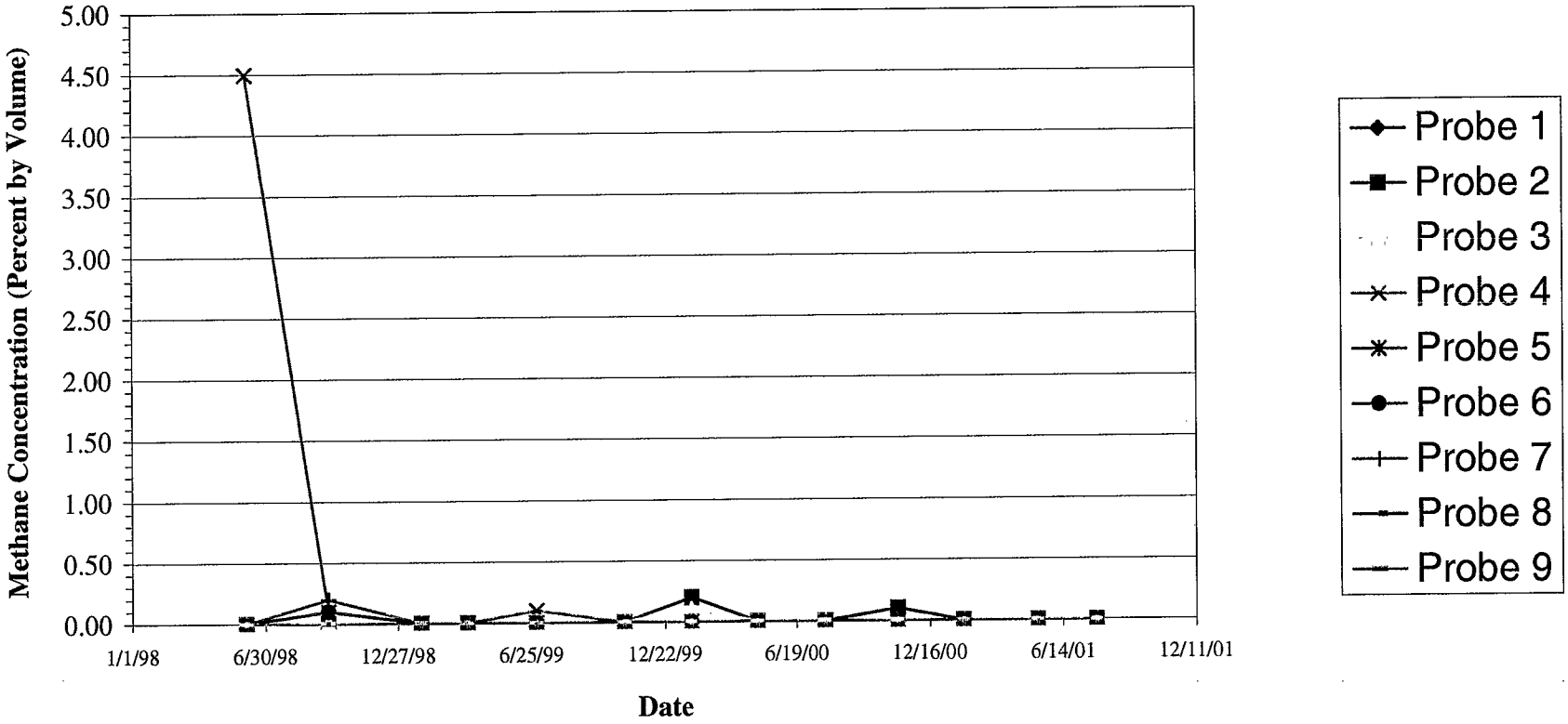
Historical Methane Concentrations for Landfill Gas Monitoring Probes (11 Feet Below Ground Surface)

Schofield Army Barracks

JOB NUMBER	DATE	DRAWN
53744.06.01	11/30/01	MJC

FIGURE

F.1



Harding ESE
A MACTEC COMPANY

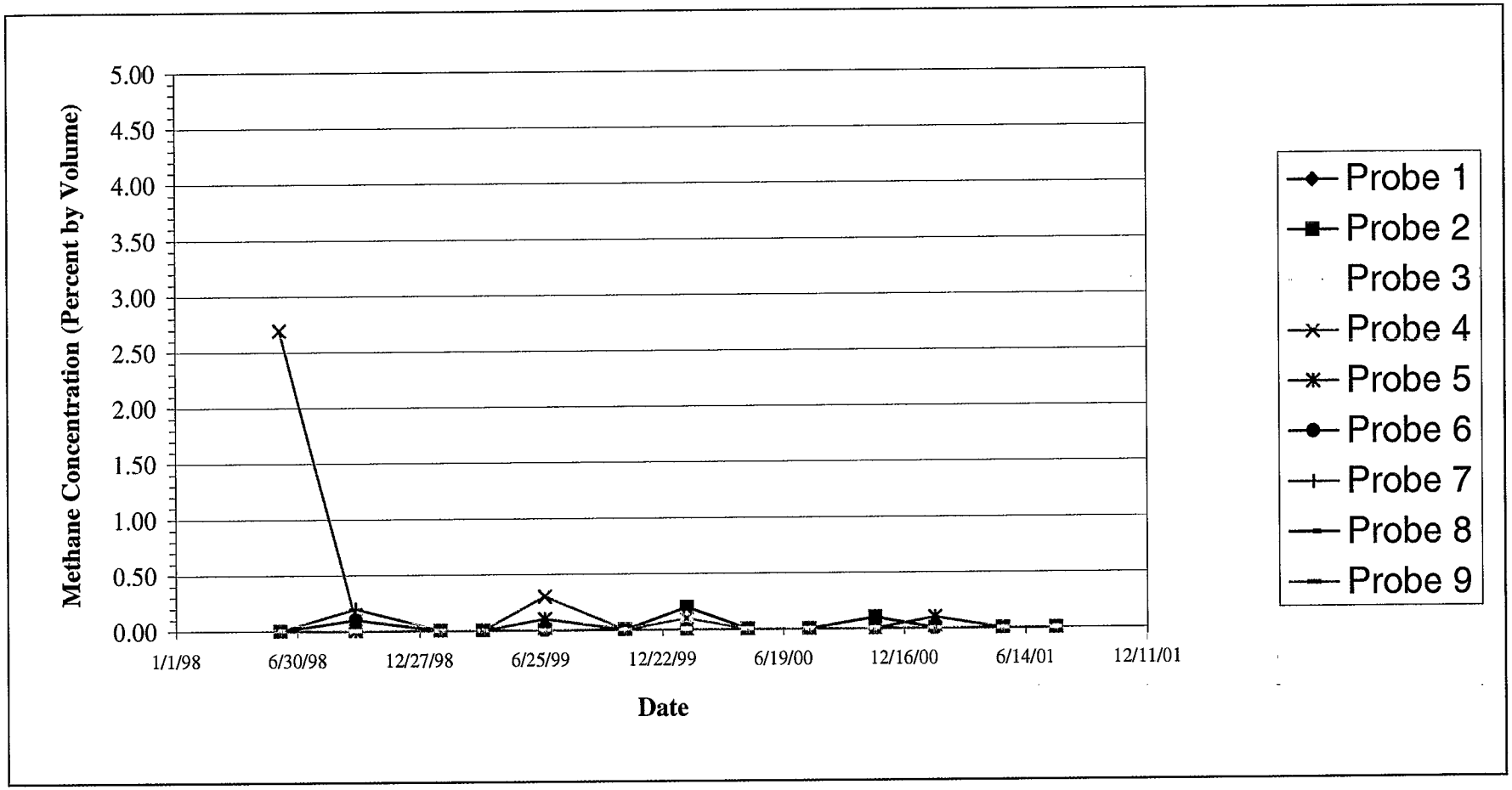
Historical Methane Concentrations for Landfill Gas Monitoring Probes (24 Feet Below Ground Surface)

Schofield Army Barracks

JOB NUMBER	DATE	DRAWN
53744.06.01	11/30/01	MJC

FIGURE

F.2



Harding ESE
A MACTEC COMPANY

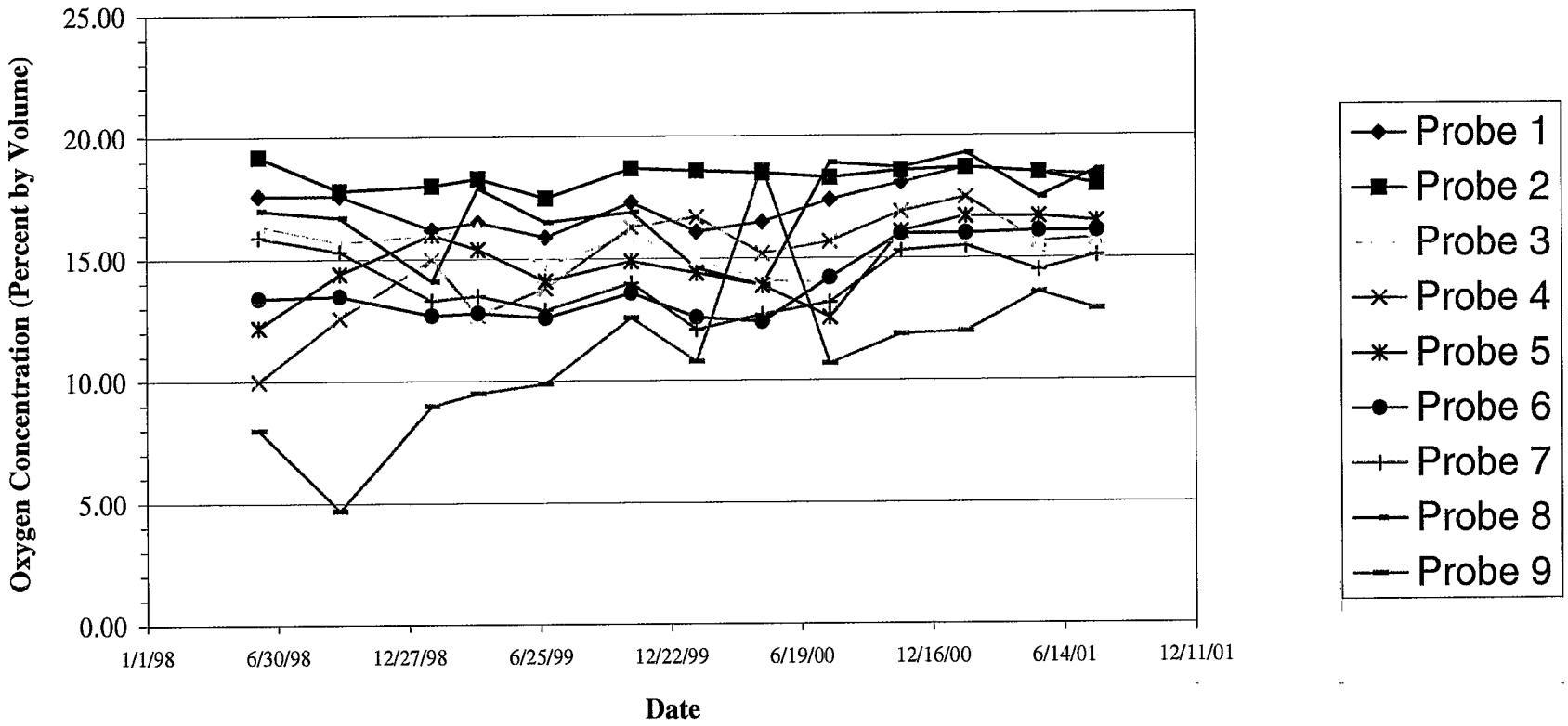
Historical Methane Concentrations for Landfill Gas Monitoring Probes (37 Feet Below Ground Surface)

Schofield Army Barracks

JOB NUMBER	DATE	DRAWN
53744.06.01	11/30/01	MJC

FIGURE

F.3



Harding ESE
A MACTEC COMPANY

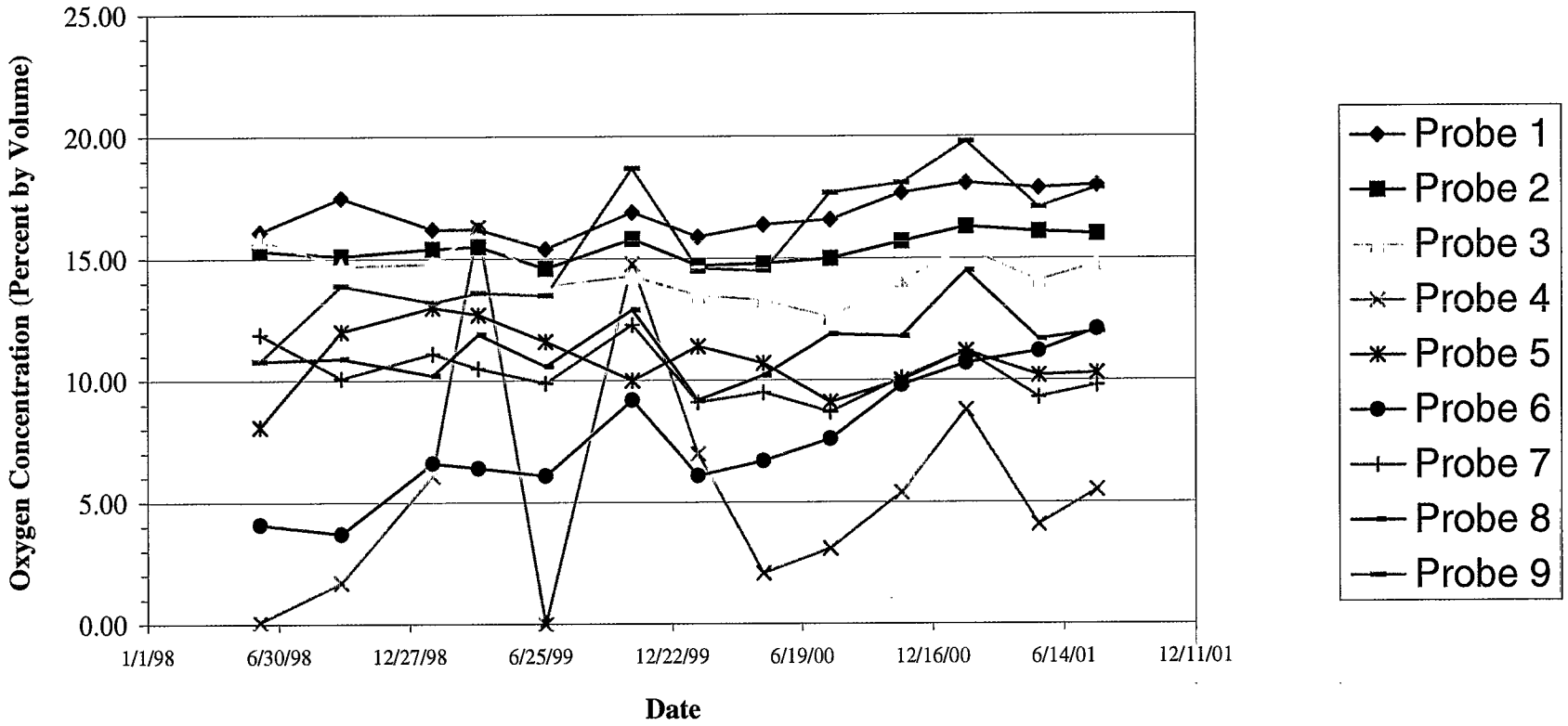
Historical Oxygen Concentrations for Landfill Gas Monitoring Probes (11 Feet Below Ground Surface)

Schofield Army Barracks

JOB NUMBER	DATE	DRAWN
53744.06.01	11/30/01	MJC

FIGURE

F.4



Harding ESE
A MACTEC COMPANY

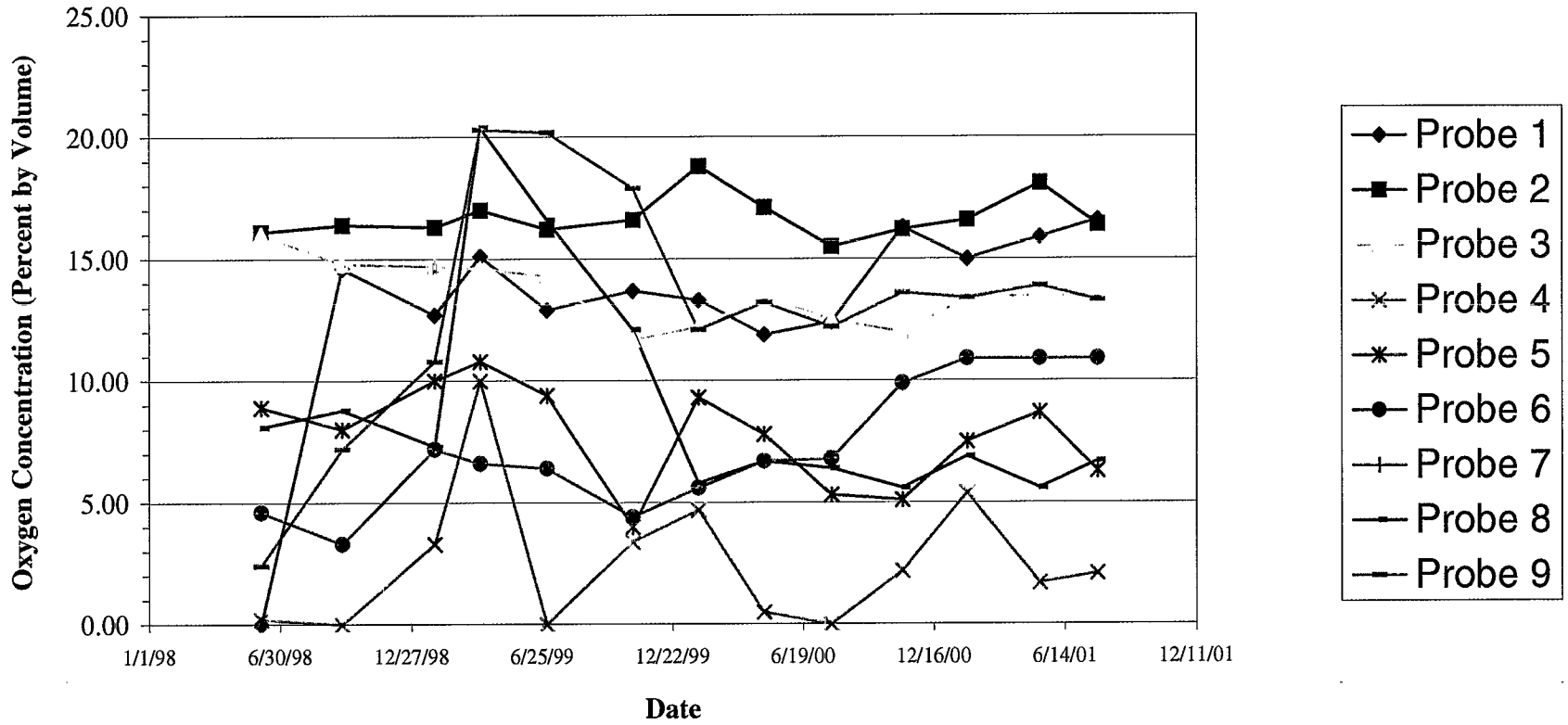
Historical Oxygen Concentrations for Landfill Gas Monitoring Probes (24 Feet Below Ground Surface)

Schofield Army Barracks

JOB NUMBER	DATE	DRAWN
53744.06.01	11/30/01	MJC

FIGURE

F.5



Harding ESE
A MACTEC COMPANY

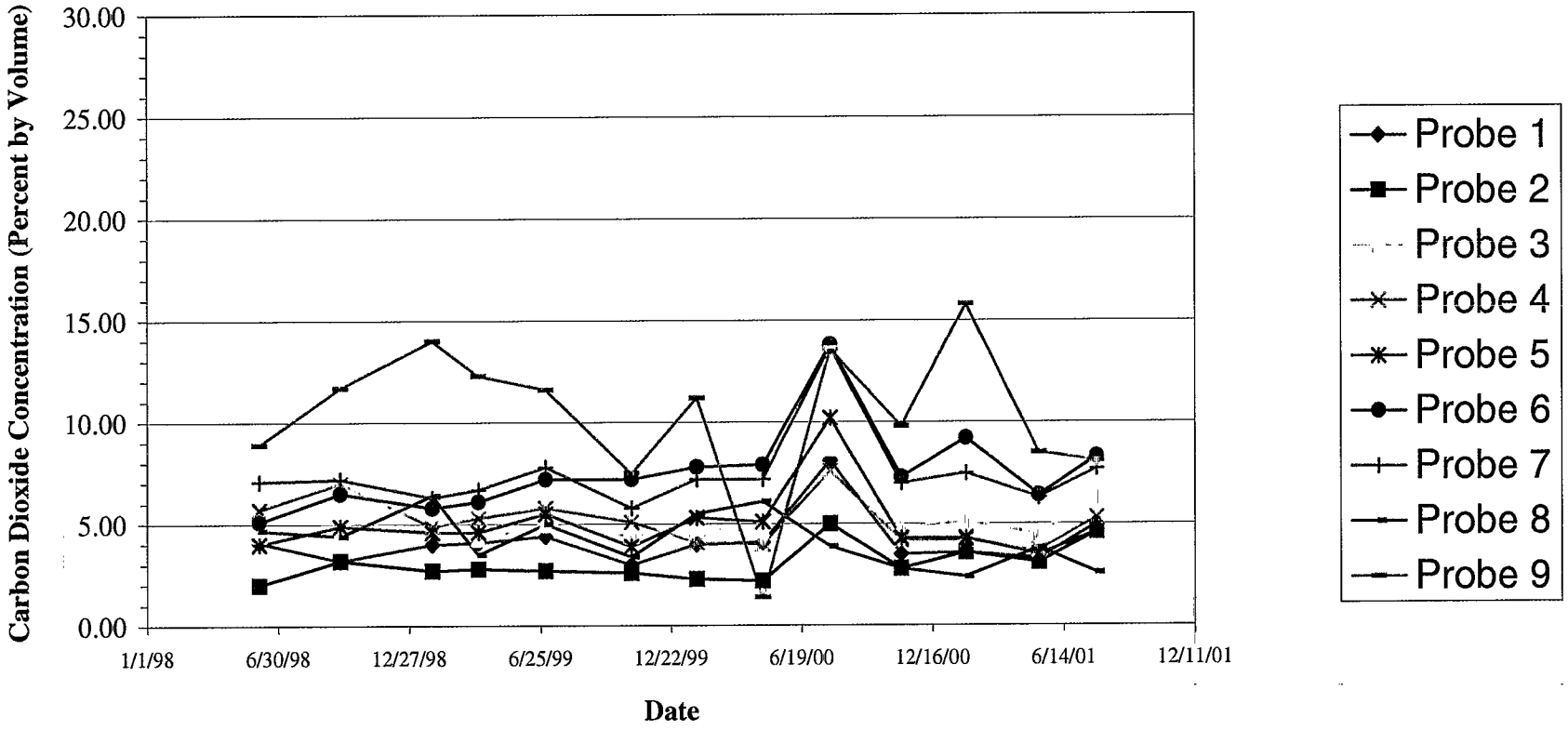
Historical Oxygen Concentrations for Landfill Gas Monitoring Probes (37 Feet Below Ground Surface)

Schofield Army Barracks

JOB NUMBER	DATE	DRAWN
53744.06.01	11/30/01	MJC

FIGURE

F.6



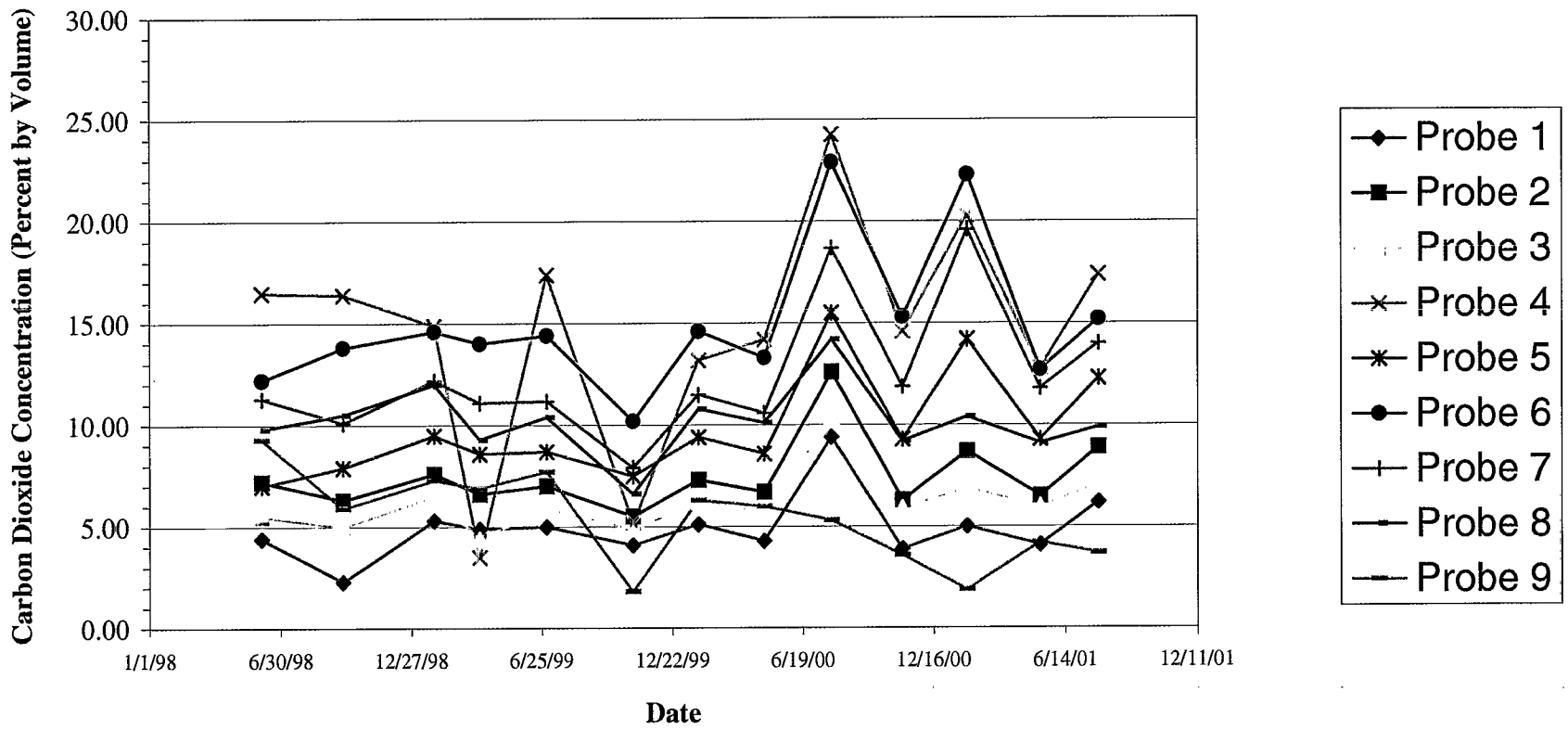
Harding ESE
A MACTEC COMPANY

Historical Carbon Dioxide Concentrations for Landfill Gas Monitoring Probes (11 Feet Below Ground Surface)

Schofield Army Barracks

FIGURE **F.7**

JOB NUMBER	DATE	DRAWN
53744.06.01	11/30/01	MJC



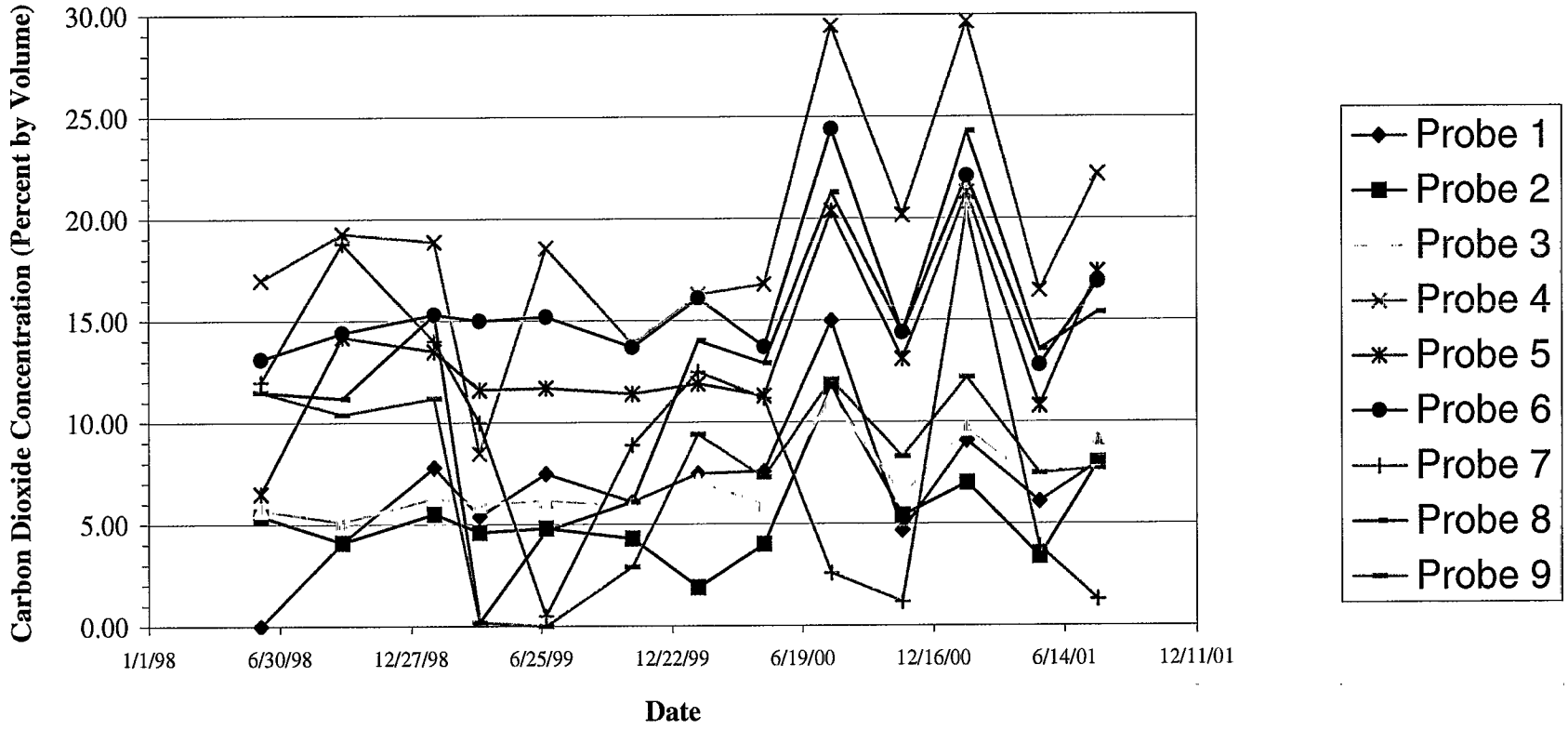
Harding ESE
A MACTEC COMPANY

Historical Carbon Dioxide Concentrations for Landfill Gas Monitoring Probes (24 Feet Below Ground Surface)

Schofield Army Barracks

FIGURE **F.8**

JOB NUMBER	DATE	DRAWN
53744.06.01	11/30/01	MJC



Harding ESE
A MACTEC COMPANY

Historical Carbon Dioxide Concentrations for Landfill Gas Monitoring Probes (37 Feet Below Ground Surface)

Schofield Army Barracks

JOB NUMBER	DATE	DRAWN
53744.06.01	11/30/01	MJC

FIGURE

F.9

Appendix G

OPERABLE UNIT 4 QUARTERLY LANDFILL INSPECTION REPORTS

Qtrly Insp

DEPARTMENT OF THE ARMY
HEADQUARTERS, UNITED STATES ARMY GARRISON, HAWAII
SCHOFIELD BARRACKS, HAWAII 96857-5000

REPLY TO
ATTENTION OF

APVG-GWV (200-1a)

22 DEC 1998

MEMORANDUM FOR

Commander, U.S. Army Environmental Center, ATTN: SFIM-AEC-RPO (Mr. James Daniel), Aberdeen Proving Ground, Maryland 21010-5401

Commander, U.S. Army, Pacific, ATTN: APEN-E (Mr. Gene Kubecka), Fort Shafter, Hawaii 96858-5100

SUBJECT: Landfill Inspection, Operable Unit 4, Schofield Barracks

1. The Record of Decision for Operable Unit 4, Former Landfill, Schofield Barracks, Island of Oahu, Hawaii, includes the long-term maintenance of the landfill cover in the selected remedy for the site. Quarterly post-closure inspections of the cover are an integral part of this long-term maintenance action. Personnel from the U.S. Army Garrison, Hawaii conducted such an inspection on October 26, 1998. The inspection report is at enclosure 1.

2. Generally, there has been little to no rain at the former landfill site over the last three months which has created concern over the survival of the recently installed vegetative cover. Control of guinea grass is and will continue to be a major concern. Herbicide use will be continued to combat this unwanted grass.

3. The next inspection is scheduled for January 1999. We will continue to monitor the site for any adverse changes. If you have any questions, please feel free to contact Mr. Jon Fukuda, Directorate of Public Works, Environmental Division, (808) 656-2878, extension 1055.

encl

BARRY M. TOTTEN
Colonel, EN
Director of Public Works

DEPARTMENT OF THE ARMY
HEADQUARTERS, UNITED STATES ARMY GARRISON, HAWAII
SCHOFIELD BARRACKS, HAWAII 96857-5000

DEC 2 1998

REPLY TO
ATTENTION OF

Directorate of Public Works

Mr. Mark Ripperda
Remedial Project Manager, H-9-4
U.S. Environmental Protection Agency
Region 9
75 Hawthorne Street
San Francisco, CA 94105-3901

Dear Mr. Ripperda:

The Record of Decision for Operable Unit 4, Former Landfill, Schofield Barracks, Island of Oahu, Hawaii, includes the long-term maintenance of the landfill cover in the selected remedy for the site. Quarterly post-closure inspections of the cover are an integral part of this long-term maintenance action. Personnel from the U.S. Army Garrison, Hawaii conducted such an inspection on October 26, 1998. The inspection report is at enclosure 1. Generally, there has been little to no rain at the former landfill site over the last three months which has created concern over the survival of the recently installed vegetative cover. Control of guinea grass is and will continue to be a major concern. Herbicide use will be continued to combat this unwanted grass.

The next inspection is scheduled for January 1999. We will continue to monitor the site for any adverse changes. If you have any questions, please feel free to contact Mr. Jon Fukuda, Directorate of Public Works, Environmental Division, (808) 656-2878, extension 1055.

Sincerely,

Barry N. Totten
Colonel, U.S. Army
Director of Public Works

Enclosure

DEPARTMENT OF THE ARMY
HEADQUARTERS, UNITED STATES ARMY GARRISON, HAWAII
SCHOFIELD BARRACKS, HAWAII 96857-5000

DEC 2 2 1998

REPLY TO
ATTENTION OF

Directorate of Public Works

Mr. Miles Nirei
Remedial Project Manager
Department of Health
Hazard Evaluation and Emergency
Response Office
919 Ala Moana Boulevard, Room 206
Honolulu, Hawaii 96814

Dear Mr. Nirei:

The Record of Decision for Operable Unit 4, Former Landfill, Schofield Barracks, Island of Oahu, Hawaii, includes the long-term maintenance of the landfill cover in the selected remedy for the site. Quarterly post-closure inspections of the cover are an integral part of this long-term maintenance action. Personnel from the U.S. Army Garrison, Hawaii conducted such an inspection on October 26, 1998. The inspection report is at enclosure 1. Generally, there has been little to no rain at the former landfill site over the last three months which has created concern over the survival of the recently installed vegetative cover. Control of guinea grass is and will continue to be a major concern. Herbicide use will be continued to combat this unwanted grass.

The next inspection is scheduled for January 1999. We will continue to monitor the site for any adverse changes. If you have any questions, please feel free to contact Mr. Jon Fukuda, Directorate of Public Works, Environmental Division, (808) 656-2878, extension 1055.

Sincerely,

Barry N. Totten
Colonel, U.S. Army
Director of Public Works

Enclosure

Operable Unit 4, Former Landfill
Post-Closure Inspection Report
Schofield Barracks, Island of Oahu, Hawaii
October 26, 1998.

Post-closure maintenance and operation of the Former Landfill at Schofield is conducted in accordance with the "Final Operation and Maintenance and Long-Term Monitoring Plan for Operable Unit 4, Schofield Barracks, Island of Oahu, Hawaii." Post-closure Applicable Relevant and Appropriate Requirements (ARARs) identified in Hawaii Administrative Rules (HAR) 11-58.1-17(b) requires that the integrity and effectiveness of any final cover be maintained. Routine inspections are performed as part of the post-closure program to routinely evaluate the integrity of the cover.

This inspection took place on October 26, 1998, by the undersigned. Systems inspected include the landfill cover, the passive gas collection/monitoring system, groundwater monitoring well network, security fence, access roads and survey monuments. The field inspection form is at enclosure 1. The inspections are described below.

1. Landfill Cover.

The landfill cover is inspected on a quarterly basis. This is the first inspection since the completion of construction of landfill cover and drainage system repairs. The Army, the Environmental Protection Agency, and the Hawaii Department of Health conducted the final inspection for the construction activity on July 21, 1998. The landfill cover was inspected for evidence of damage due to erosion, settlement, slumping, drought, fire, pestilence, debris accumulation, animal burrows an any other adverse conditions. Special attention was paid to the vegetative cover, the sideslopes, and the drainage systems. Generally, the landfill is very dry. Dessication cracks are prevalent throughout the landfill cover due to the lack of moisture. Much of the grass is in a distressed state. The inspection process for each of these areas is described below.

- Vegetative Cover - The vegetative cover was inspected to confirm appropriate vegetative species are established on the cover and to identify any barren areas or areas of tree and shrub growth. The rye and buffalo grass planted after construction activities appeared very dry. Their color was brown to gray and appeared in dire need of water. Much of the grass is dry and appears to be dying. It should be noted during the past six months there has been very little to no rain in the vicinity. Irrigation in the near future may be required, if. Subsequently the landfill does not currently require mowing. Guinea grass is beginning to establish itself in the area to the northeast of the central drainage swale. Barren patches appear in the north east corner of the landfill.

- Sideslopes - Sideslopes appear stable, no signs of cracking, slumping or erosion. Integrity of slopes remain intact.

- Drainage System - The drainage system appear to be intact with no apparent damage, however it should be noted that there has been a lack of rainfall since the completion of construction. There are no obstructions present that would impede surface runoff flow. All structures are intact. Drainage swale on western edge of the landfill alongside Kahoolawe Street is developing a crack approximately 2"-3" wide and running approximately 100ft. parallel to the swale on its eastern slope.

2. Existing Landfill Passive Gas Wells - The existing passive gas wells are intact. A hairline crack exists in the concrete base of GMW-4, but do not appear to affect the structural integrity of the well. All other passive gas wells appear intact.

3. Perimeter Landfill Gas Monitoring Wells - Perimeter gas wells are intact and fully functional. These wells are utilized on a quarterly basis to monitor landfill methane gas generation.

4. Groundwater Monitoring Well Network - All four groundwater monitoring wells in the vicinity of the landfill are intact and fully functional.

5. Security Fence - Security fence, locks, signs are intact and fully functional.

6. Access Roads - Access roads are intact with no potholes or obstructions preventing vehicular traffic.

7. Survey Monuments - No damage evident to survey monument.

Recommended corrective actions. Recommended landscaping contractor herbicide Guinea grass on the northeast side of the central swale to bring under control. Although crack in the western swale area is apparent, it does not appear to compromise the structural integrity of the cap at this point in time. Recommend keeping under observation for growth of crack during the next inspection. PVC pipe debris was cleared off the site by the undersigned at the time of the inspection. The crack running along the western swale does not appear to compromise the integrity of the cap at this time but should be monitored to ensure it does not grow.

Inspection completed by:

Jon Fukuda
Installation Restoration Program Manager

TABLE F.1
POST-CLOSURE INSPECTION REPORT FORM
OPERABLE UNIT 4
SCHOFIELD ARMY BARRACKS
ISLAND OF OAHU, HAWAII

Date of Inspection (M/D/Y) 10/26/98 Time 0930 (am/pm)

Inspector(s) Name/Title Jon Fukuda

Inspection of	Condition: Adequate/ Stable	Condition: Damaged/ Deteriorating	Action Required? yes	Action Required? no	Comments/Locations	Date of Corrective Action
1. Facility Access Control System						
A. Security Fence						
1. Gaps Beneath Fence	✓			✓		
2. Chain - Link Fabric	✓			✓		
3. Barbed Wire	N/A			✓	No barbed wire installed	
4. Fence Posts	✓			✓		
B. Site Access Gates						
1. Gate Locks	✓			✓		
2. Gate Operation	✓			✓		
C. Warning Signs	✓			✓		
D. Access Roads	✓			✓		

TABLE F.1
POST-CLOSURE INSPECTION REPORT FORM
OPERABLE UNIT 4
SCHOFIELD ARMY BARRACKS
ISLAND OF OAHU, HAWAII

Date of Inspection (M/D/Y) _____ Time _____ (am/pm)

Inspector(s) Name/Title _____

Inspection of	Condition: Adequate/ Stable	Condition: Damaged/ Deteriorating	Action Required? yes	Action Required? no	Comments/Locations	Date of Corrective Action
3. Final Cover System (Top and Side Slopes)						
A. Vegetation Establishment						
1. Barren Areas		✓		✓	barren northern corner	
2. Tree Growth	✓			✓	no new tree growth	
B. Slope Failure/Slumping						
C. Settlement	✓			✓		
D. Erosion Damage	✓			✓	No rain in several months	
E. Debris Accumulation	✓		✓		Removed several pieces of PVC	10/26
F. Animal Burrows	✓			✓		
G. Fire/Explosion Damage	✓			✓		

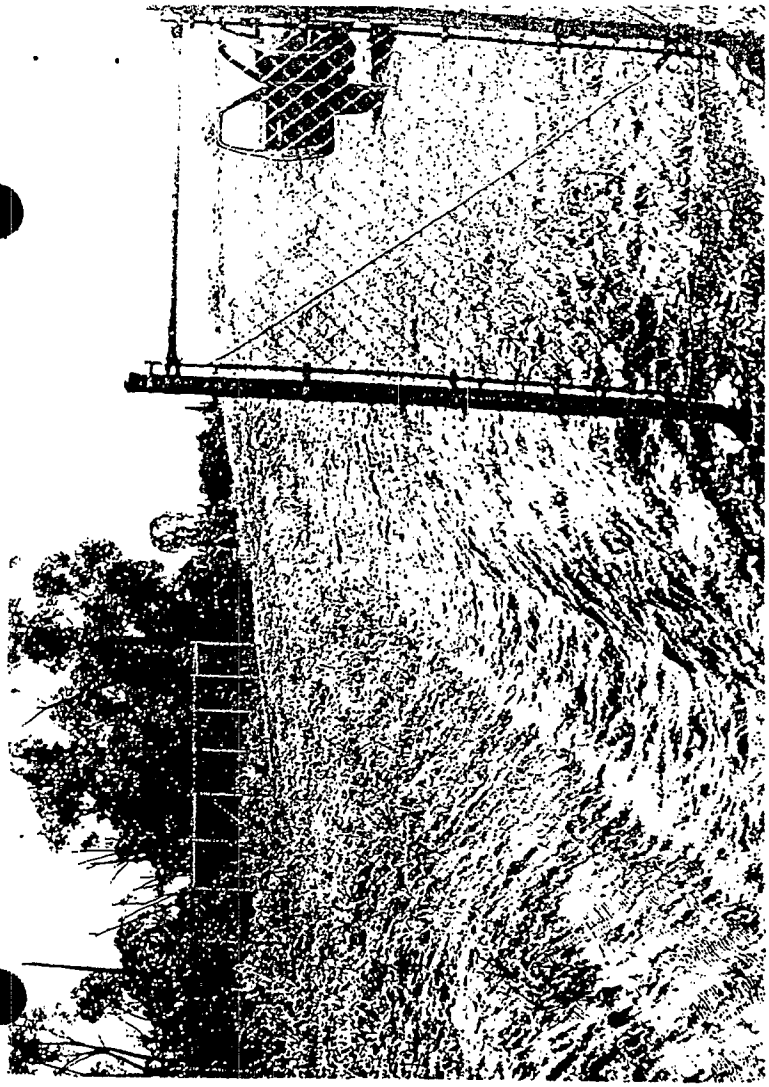
Much of ~~[illegible]~~ grass is very dry or dying
Need water soon

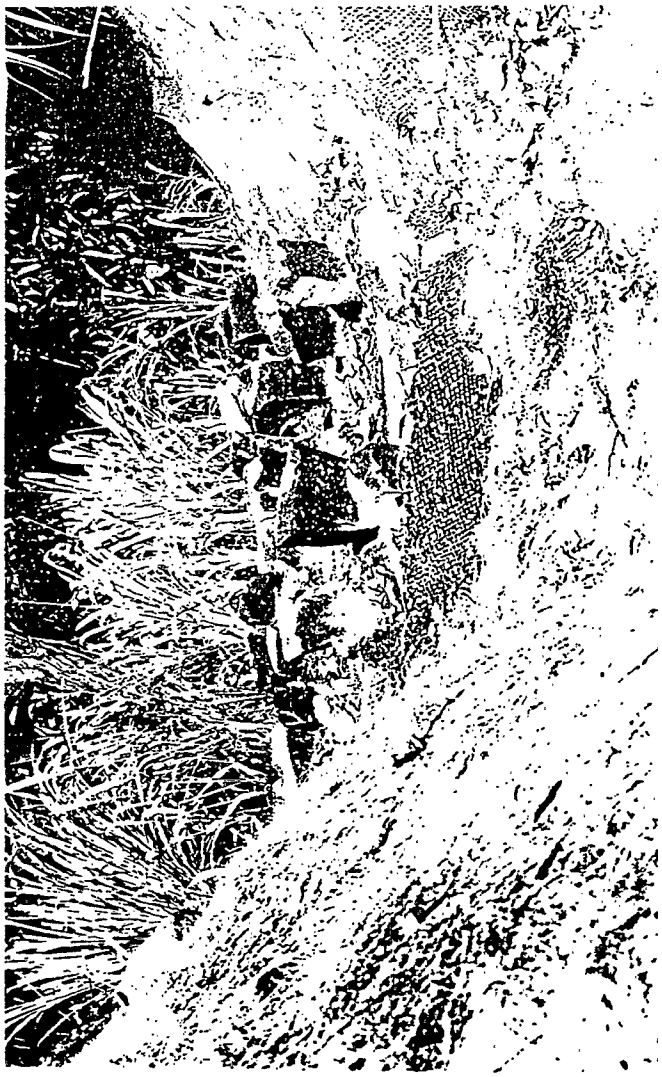
TABLE F.1
POST-CLOSURE INSPECTION REPORT FORM
OPERABLE UNIT 4
SCHOFIELD ARMY BARRACKS
ISLAND OF OAHU, HAWAII

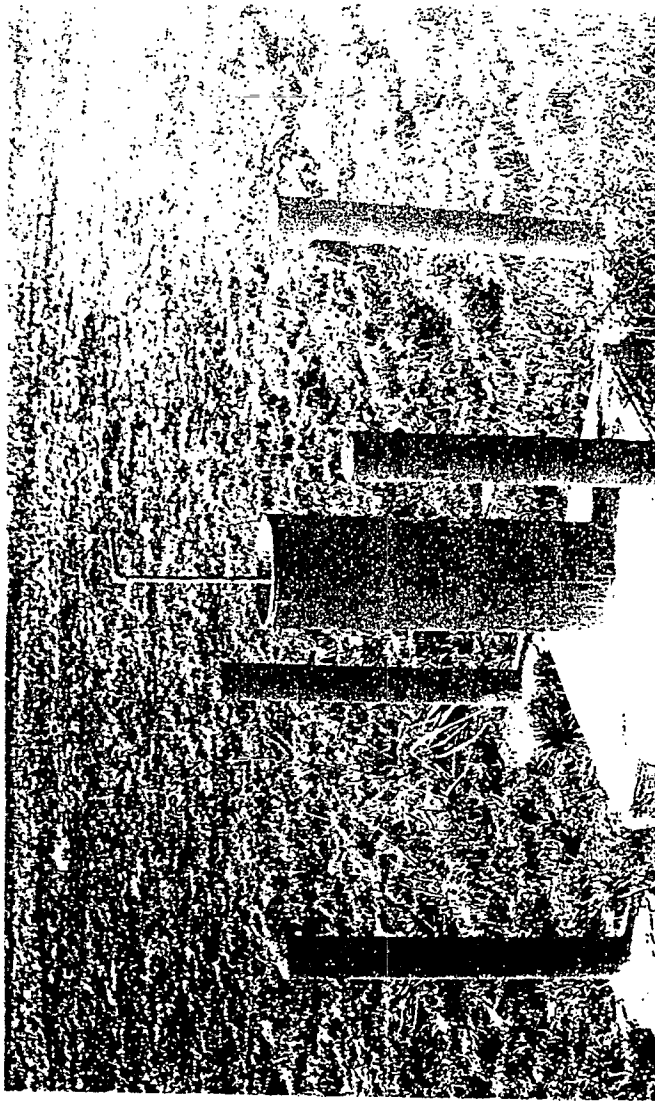
Date of Inspection (M/D/Y) 10/28/98 Time 0930 (am/pm)

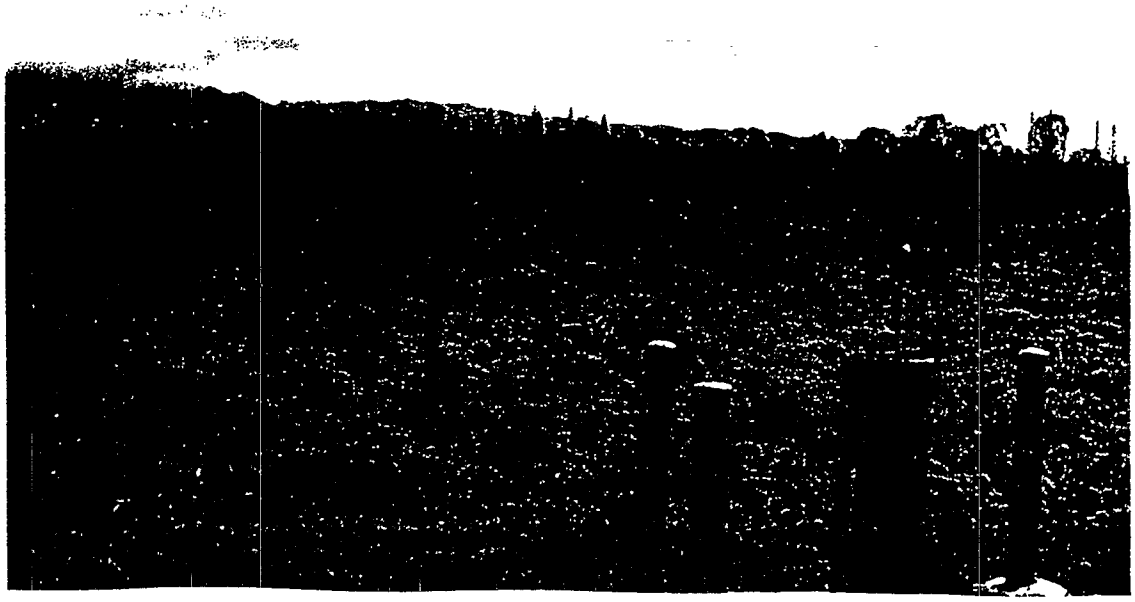
Inspector(s) Name/Title Jim Fikenda

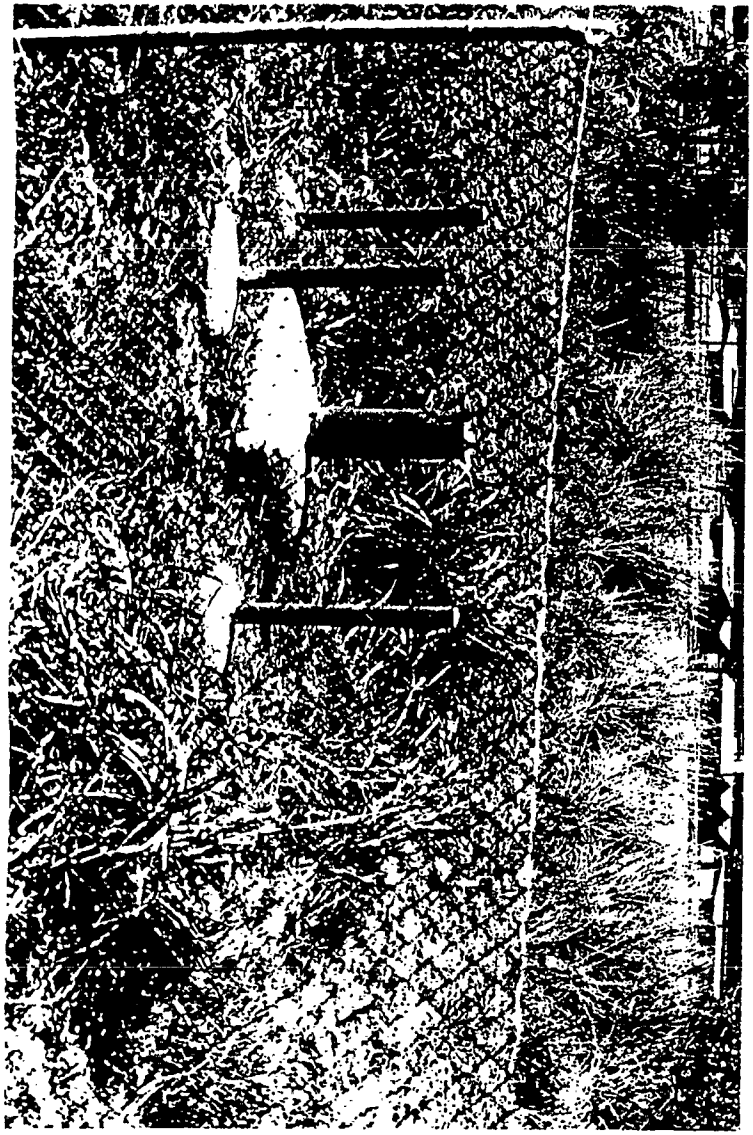
Inspection of	Condition		Action Required?		Comments/Locations	Date of Corrective Action
	Adequate/ Stable	Damaged/ Deteriorating	yes	no		
5. Groundwater Monitoring System	✓			✓		
A. Monitoring Wells	✓			✓		
1. Well Casing and Cap	✓			✓		
2. Protective Casing	✓			✓		
3. Locks	✓			✓		
4. Grout Seal	✓			✓		

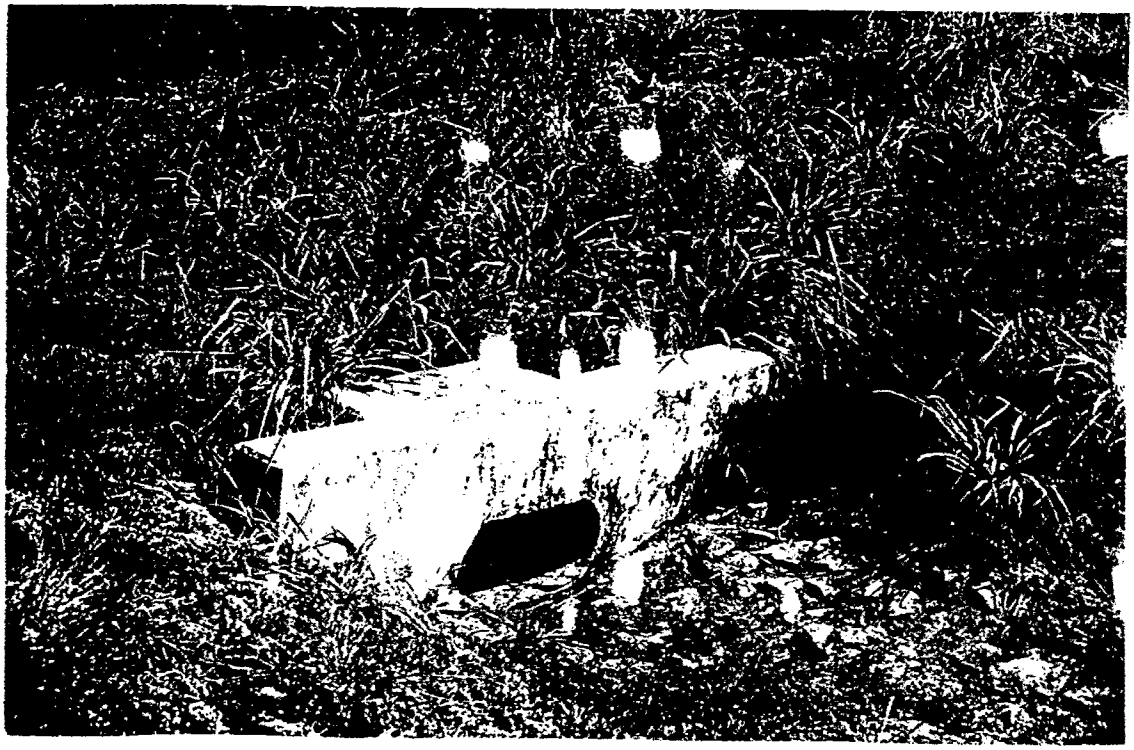












Operable Unit 4, Former Landfill
Post-Closure Inspection Report
Schofield Barracks, Island of Oahu, Hawaii
January 29, 1999.

Post-closure maintenance and operation of the Former Landfill at Schofield is conducted in accordance with the "Final Operation and Maintenance and Long-Term Monitoring Plan for Operable Unit 4, Schofield Barracks, Island of Oahu, Hawaii." Post-closure Applicable Relevant and Appropriate Requirements (ARARs) identified in Hawaii Administrative Rules (HAR) 11-58.1-17(b) requires that the integrity and effectiveness of any final cover be maintained. Routine inspections are performed as part of the post-closure program to routinely evaluate the integrity of the cover.

This inspection took place on January 29,1999, by the undersigned. Systems inspected include the landfill cover and drainage system, the passive gas collection/monitoring system, groundwater monitoring well network, security fence, access roads and survey monuments. The field inspection form is at enclosure 1. The inspections are described below.

1. Landfill Cover.

The landfill cover is inspected on a quarterly basis. This is the second inspection since the completion of construction of landfill cover and drainage system repairs. The Army, the Environmental Protection Agency, and the Hawaii Department of Health conducted the final inspection for the construction activity on July 21, 1998. The landfill cover was inspected for evidence of damage due to erosion, settlement, slumping, drought, fire, pestilence, debris accumulation, animal burrows an any other adverse conditions. Special attention was paid to the vegetative cover, the side-slopes, and the drainage systems. In contrast to the previous inspection conducted in October 1998, the landfill has received a fair amount of rain in the three-month period. Much of the dessication cracks that were prevalent then are no longer present. The grass is showing signs of recovery. The inspection process for each of these areas is described below.

- Vegetative Cover - The vegetative cover was inspected to confirm appropriate vegetative species are established on the cover and to identify any barren areas or areas of tree and shrub growth. The rye and buffalo grass planted after construction activities are recovering from the long dry period over the summer and fall. Their color is now green as opposed to the brown to gray appearance during the previous inspection. Guinea grass continues to be a problem in the area to the west of the central drainage swale and on the northern slopes. Much of the barren patches that were present in the northwest corner of the landfill are now vegetated.

- Sideslopes - Sideslopes appear stable, no signs of cracking, slumping or erosion. Integrity of slopes remains intact.

- Drainage System - Due to the large amounts of rainfall in the past month the drainage systems were given special attention. The drainage system appears to be intact with no apparent damage. There are no obstructions present that would impede surface runoff flow. All structures are intact. The concrete drop pit at the very bottom of the drainage channel has filled with mud, rocks, and debris, and requires cleaning. The crack that had developed in the drainage swale on western edge of the landfill alongside Kahoolawe Street no longer is present.

2. Existing Landfill Passive Gas Wells - The existing passive gas wells are intact. The hairline crack noted in the previous inspection has not grown and does not appear to affect the structural integrity of the well. All other passive gas wells are still intact.

3. Perimeter Landfill Gas Monitoring Wells - Perimeter gas wells are intact and fully functional. These wells are utilized on a quarterly basis to monitor landfill methane gas generation.

4. Groundwater Monitoring Well Network - All four groundwater monitoring wells in the vicinity of the landfill are intact and fully functional.

5. Security Fence - Security fence, locks, signs are intact and fully functional.

6. Access Roads - Access roads are in good shape, despite the recent rains, with no potholes or obstructions preventing vehicular traffic.

7. Survey Monuments - No damage evident to survey monument.

Recommended corrective actions. Controlling of the Guinea grass continues to be the single largest challenge at the former landfill site. Recommend landscaping contractor continues to herbicide Guinea grass to the west of the central swale to bring under control. Also recommend cutting and herbiciding of the Guinea grass on the northern slopes to bring under control. The drop pit at the bottom of was cleaned out subsequent to the inspection and has been restored to its fully functional state.

Inspection completed by:

Jon Fukuda
Installation Restoration Program Manager

TABLE F.1
POST-CLOSURE INSPECTION REPORT FORM
OPERABLE UNIT 4
SCHOFIELD ARMY BARRACKS
ISLAND OF OAHU, HAWAII

Date of Inspection (M/D/Y) 1/29/99 Time 0930 (am/pm)

Inspector(s) Name/Title Jon Fukuda, Restoration Program Mgr

Inspection of	Condition: Adequate/ Stable	Condition: Damaged/ Deteriorating	Action Required? yes	Action Required? no	Comments/Locations	Date of Corrective Action
1. Facility Access Control System						
A. Security Fence						
1. Gaps Beneath Fence	✓			✓		
2. Chain - Link Fabric	✓			✓		
3. Barbed Wire						
4. Fence Posts	✓			✓		
B. Site Access Gates						
1. Gate Locks	✓			✓		
2. Gate Operation	✓			✓		
C. Warning Signs	✓			✓		
D. Access Roads	✓			✓		

TABLE F.1
POST-CLOSURE INSPECTION REPORT FORM
OPERABLE UNIT 4
SCHOFIELD ARMY BARRACKS
ISLAND OF OAHU, HAWAII

Date of Inspection (M/D/Y) 1/29/99 Time 0930 (am/pm)

Inspector(s) Name/Title John Fukunaga Restoration Program Mgr

Inspection of	Condition: Adequate/ Stable	Condition: Damaged/ Deteriorating	Action Required?: yes	Action Required?: no	Comments/Locations	Date of Corrective Action
3. Final Cover System (Top and Side Slopes)						
A. Vegetation Establishment	✓			✓		
1. Barren Areas	✓			✓		
2. Tree Growth	✓			✓		
B. Slope Failure/Slumping	✓			✓		
C. Settlement	✓			✓		
D. Erosion Damage	✓			✓		
E. Debris Accumulation	✓			✓		
F. Animal Burrows	✓			✓		
G. Fire/Explosion Damage	✓			✓		

TABLE F.1
POST-CLOSURE INSPECTION REPORT FORM
OPERABLE UNIT 4
SCHOFIELD ARMY BARRACKS
ISLAND OF OAHU, HAWAII

Date of Inspection (M/D/Y) 1/29/99 Time 0930 (am/pm)

Inspector(s) Name/Title Jon Fukunda Restoration Program Mgr

Inspection of	Condition		Action Required?		Comments/Locations	Date of Corrective Action
	Adequate/ Stable	Damaged/ Deteriorating	yes	no		
5. Groundwater Monitoring System						
A. Monitoring Wells						
1. Well Casing and Cap	✓			✓		
2. Protective Casing	✓			✓		
3. Locks	✓			✓		
4. Grout Seal	✓			✓		

TABLE G.1
POST-CLOSURE MAINTENANCE REPORT FORM
OPERABLE UNIT 4
SCHOFIELD ARMY BARRACKS
ISLAND OF OAHU, HAWAII

Date of Activity (M/D/Y) 8/22/99 Time (am/pm) 1030

Name/Title of Person Performing Work Jon Fukada / Robin Yamamoto

AREA	DESCRIPTION OF REPAIR OR MAINTENCE ACTIVITIES
2. Runon/Runoff Controls	
A. Northern Runoff Control Berms	
B. Center Drainage Channel	
C. Northern Drainage Channel	
D. Western Drainage Channel	
E. Northcentral Side Slope Drainage Chute	Cleared mud, debris, rocks from drop pit at bottom of drainage chute.
F. Northern Side Slope Drainage Chute	

Operable Unit 4, Former Landfill
Post-Closure Inspection Report
Schofield Barracks, Island of Oahu, Hawaii
April 27, 1999.

Post-closure maintenance and operation of the Former Landfill at Schofield is conducted in accordance with the "Final Operation and Maintenance and Long-Term Monitoring Plan for Operable Unit 4, Schofield Barracks, Island of Oahu, Hawaii." Post-closure Applicable Relevant and Appropriate Requirements (ARARs) identified in Hawaii Administrative Rules (HAR) 11-58.1-17(b) requires that the integrity and effectiveness of any final cover be maintained. Routine inspections are performed as part of the post-closure program to routinely evaluate the integrity of the cover.

This inspection took place on April 27, 1999, by the undersigned. Systems inspected include the landfill cover and drainage system, the passive gas collection/monitoring system, groundwater monitoring well network, security fence, access roads and survey monuments. The field inspection form is at enclosure 1. The inspections are described below.

1. Landfill Cover.

The landfill cover is inspected on a quarterly basis. This is the third inspection since the completion of construction of landfill cover and drainage system repairs. The Army, the Environmental Protection Agency, and the Hawaii Department of Health conducted the final inspection for the construction activity on July 21, 1998. The landfill cover was inspected for evidence of damage due to erosion, settlement, slumping, drought, fire, pestilence, debris accumulation, animal burrows an any other adverse conditions. Special attention was paid to the vegetative cover, the side-slopes, and the drainage systems. Rainfall has tapered off from the previous quarter. Overall the grass cover on the landfill cap is still in good condition. The inspection process for each of these areas is described below.

- Vegetative Cover - The vegetative cover was inspected to confirm appropriate vegetative species are established on the cover and to identify any barren areas or areas of tree and shrub growth. The rye and buffalo grass planted after construction activities continue to recover from the long dry period last summer and fall. Their color is now green as opposed to the brown to gray appearance during the previous inspection. Guinea grass continues to be a problem in the area to the west of the central drainage swale and on the northern slopes. Much of the barren patches that were present in the northwest corner of the landfill are now vegetated.

- Sideslopes - Sideslopes appear stable, no signs of cracking, slumping or erosion. Integrity of slopes remains intact.

- Drainage System - As mentioned previously, rainfall has dropped off from the previous quarter. The drainage system appears to be intact with no significant damage. The hairline crack appears in the rip-rap on the central drainage chute first noted during the January 1999 inspection has not grown in size and still does not appear to affect the structural integrity of the chute. There are no obstructions present that would impede surface runoff flow. All structures are intact.

2. Existing Landfill Passive Gas Wells - The existing passive gas wells are in intact and in good condition.

3. Perimeter Landfill Gas Monitoring Wells - Perimeter gas wells are intact and fully functional. These wells are utilized on a quarterly basis to monitor landfill methane gas generation.

4. Groundwater Monitoring Well Network - All four groundwater monitoring wells in the vicinity of the landfill are intact and fully functional. They will need cosmetic repair to the well casings as they are showing signs of corrosion.

5. Security Fence - Security fence, locks, signs are intact and fully functional. Guinea grass overgrowing the Eastern fenceline of the landfill.

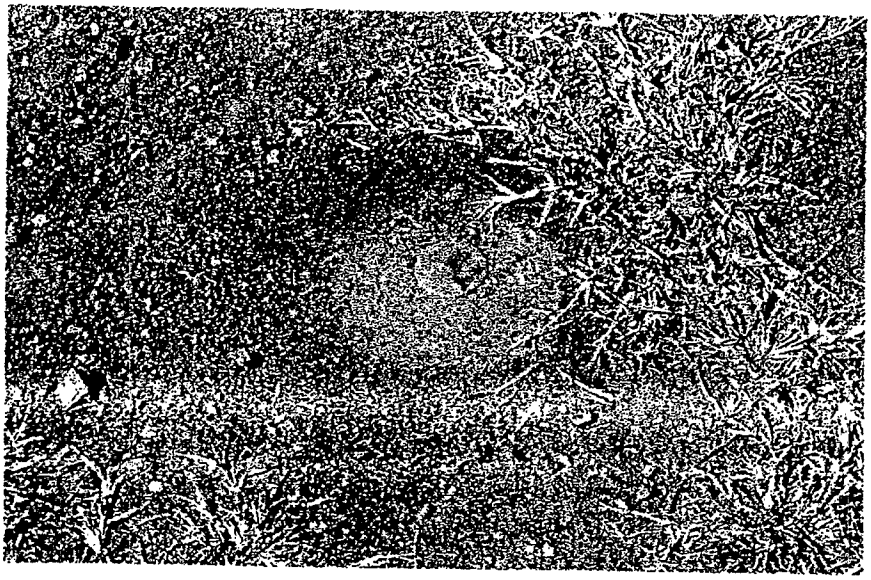
6. Access Roads - Access roads are in good shape with no potholes or obstructions preventing vehicular traffic.

7. Survey Monuments - No damage evident to survey monument.

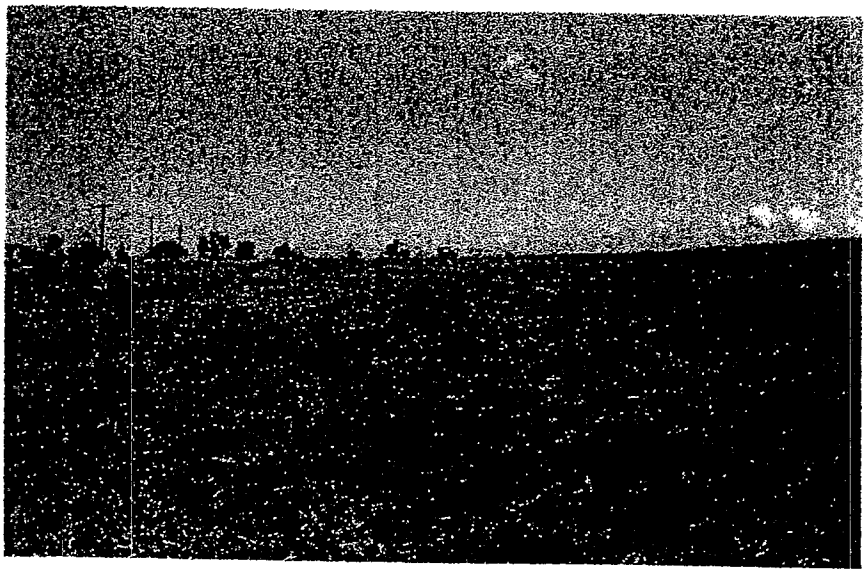
Recommended corrective actions. As noted in previous inspections, controlling of the Guinea grass continues to be the single largest challenge at the former landfill site. Recommend that the landscaping contractor continue to herbicide Guinea grass to the west of the central swale as well as along the Eastern fenceline to bring under control. Also recommend cutting and herbiciding of the Guinea grass on the northern slopes to bring under control. Although not currently affecting functional use, removal corrosion and subsequent repainting from the groundwater monitoring well casings appears warranted. Work will be done through the U.S. Army Garrison, Hawaii, Directorate of Public Works.

Inspection completed by:

Jon Fukuda
Installation Restoration Program Manager

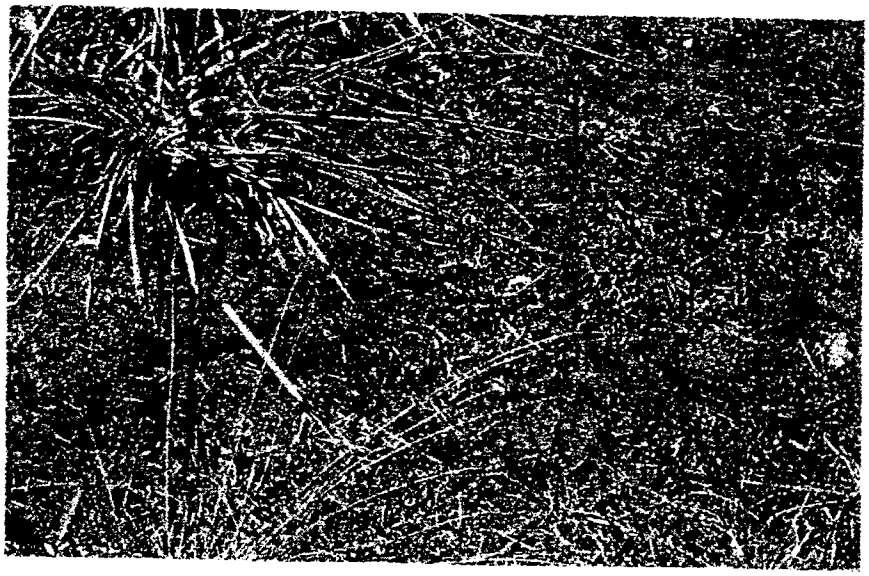


Survey Monument



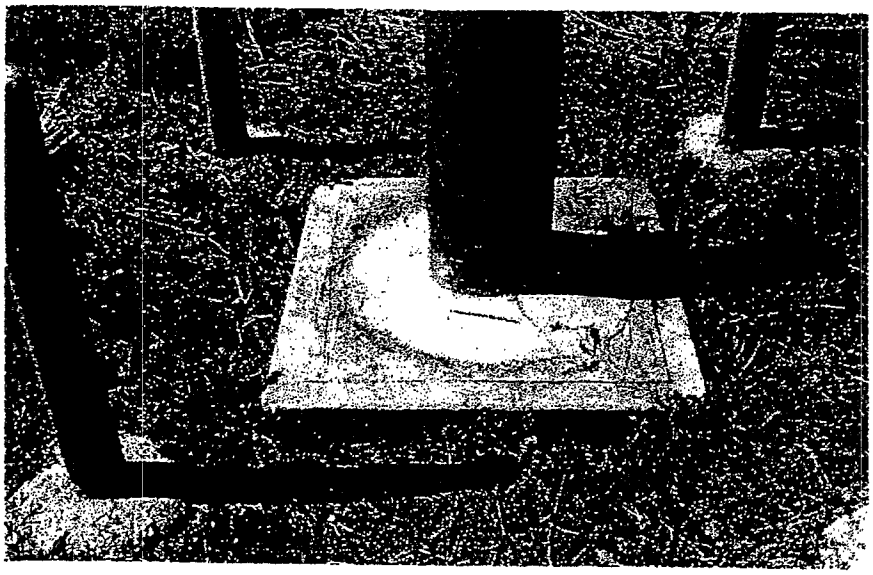
looking North from gate area

Looking Northeast from gated area



Minor cracking on landfill cover in western swale

looking southwest from corner of western swale



Existing hairline crack at base of gas vent #4

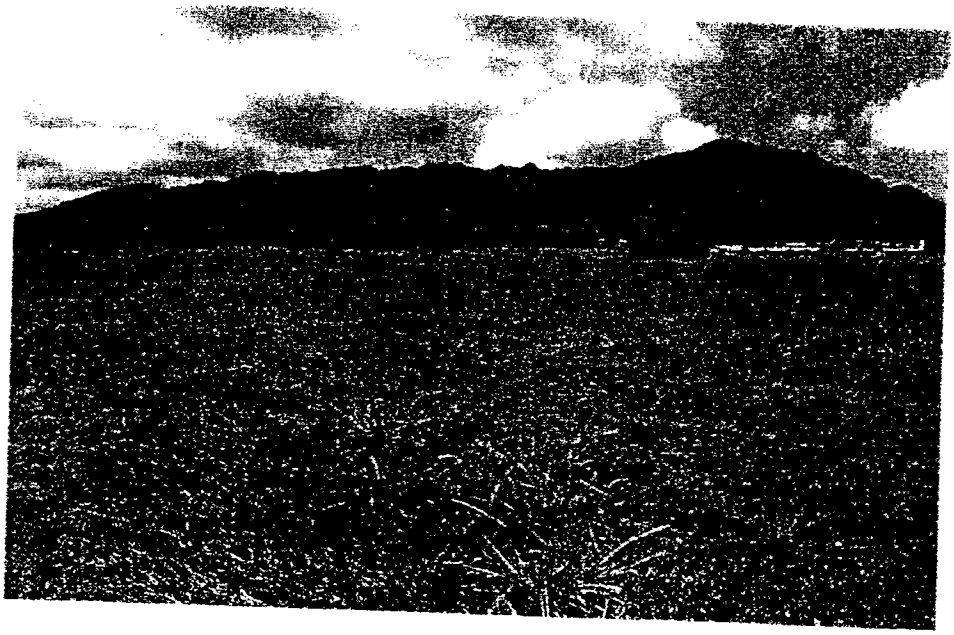
Looking east from western swale

Looking east at backslopes of landfill

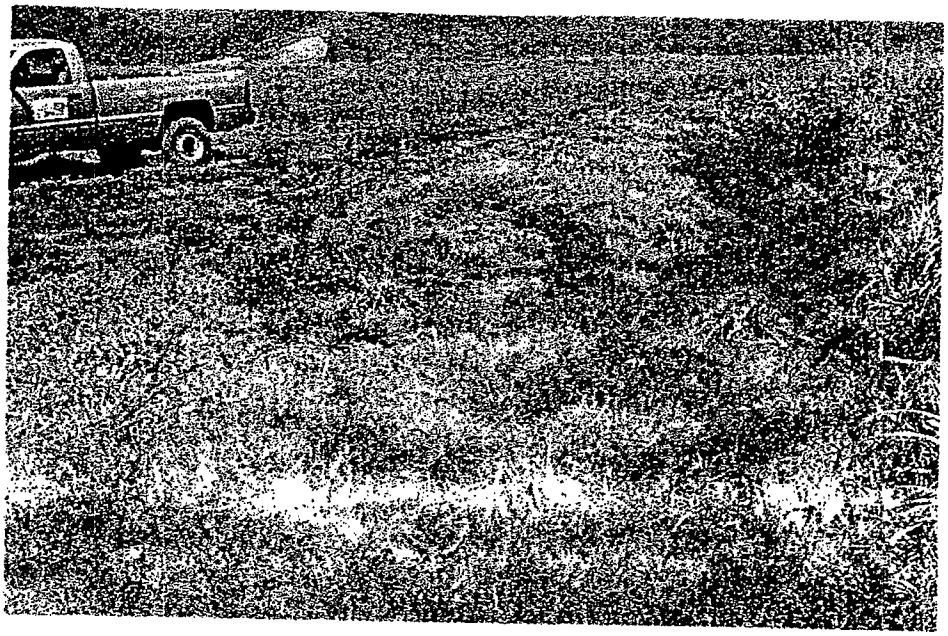
Northern Drainage Chute headwall

Northern drainage swale

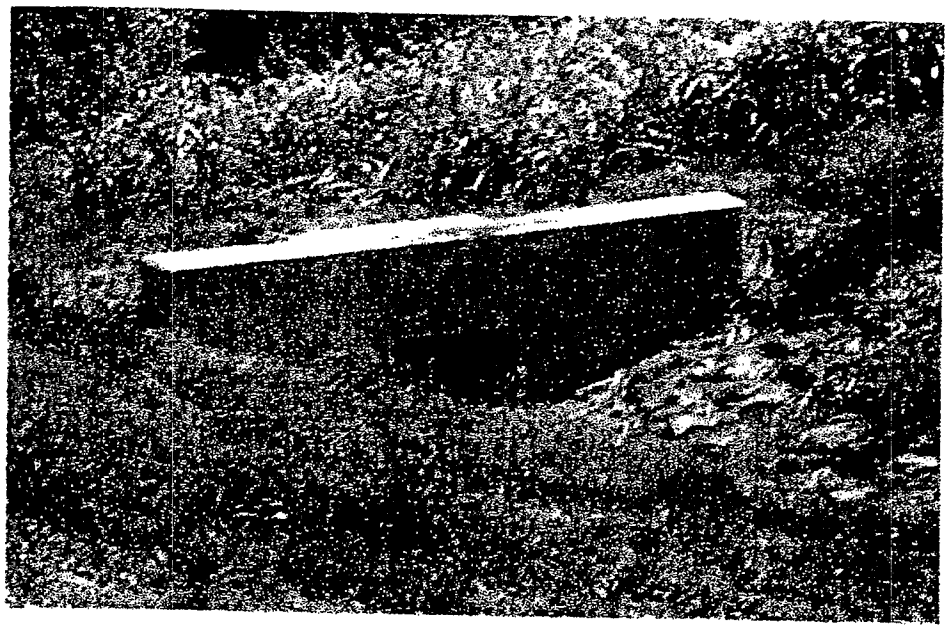
Northern Backslopes



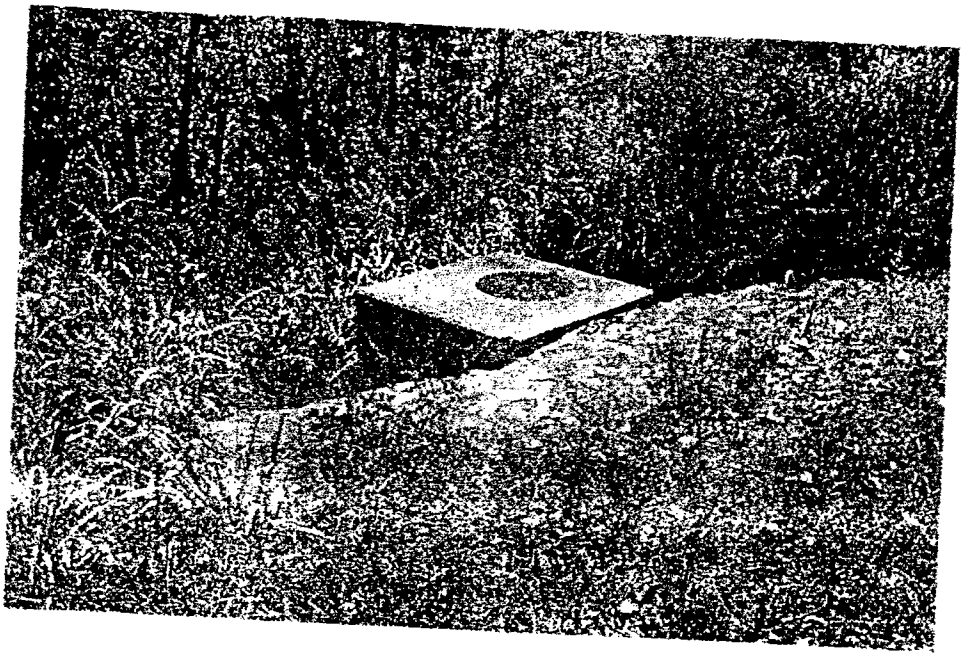
Looking West from berm at backslope



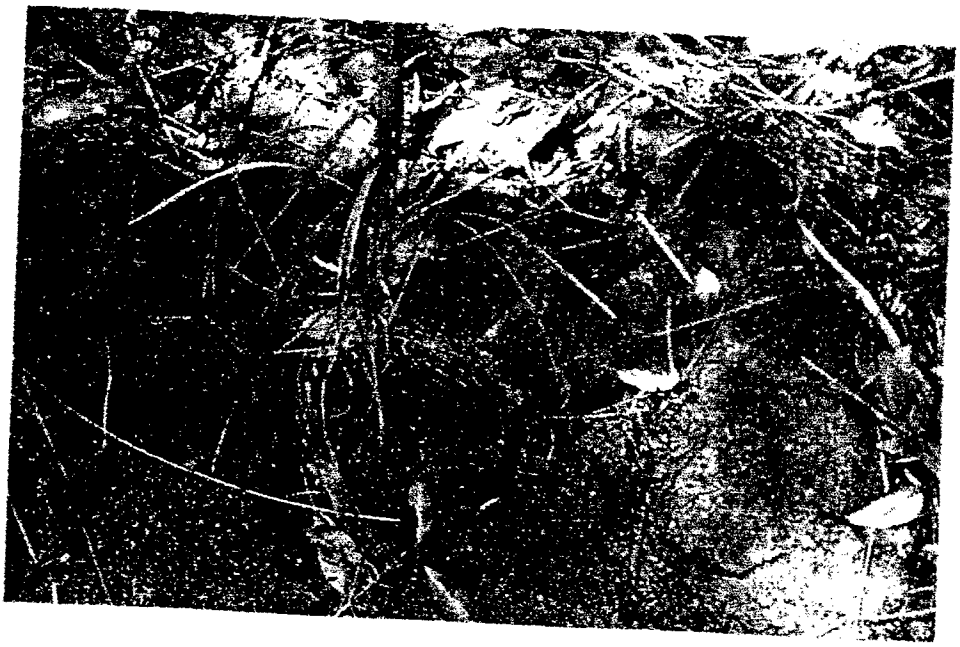
Evidence of Bermuda grass taking hold in northern area along backslope berm



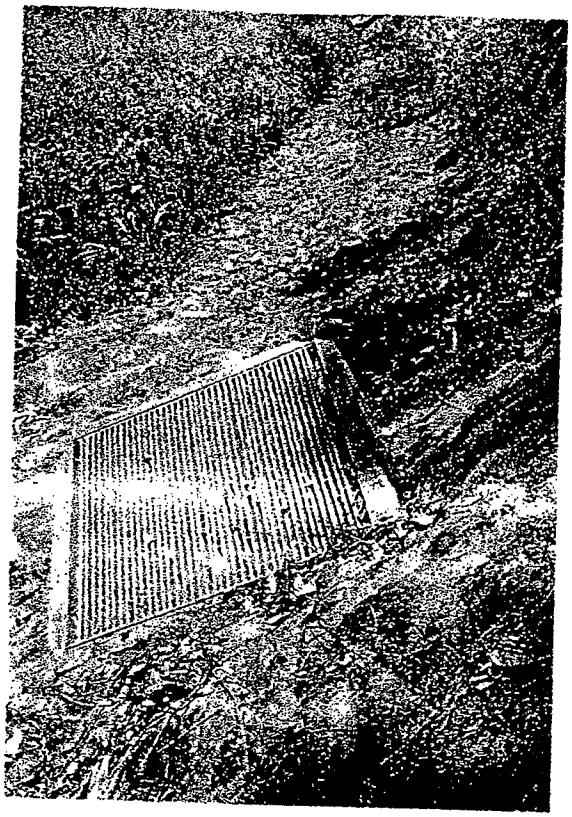
Headwall at central drainage chute



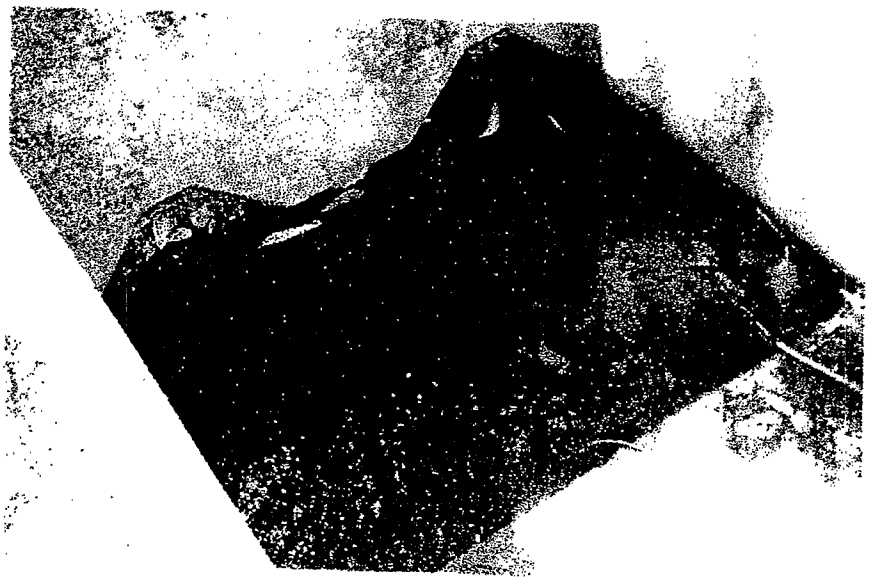
Junction box #1
Central Drainage Chute



Existing hairline crack
(Pencil in picture for scale)



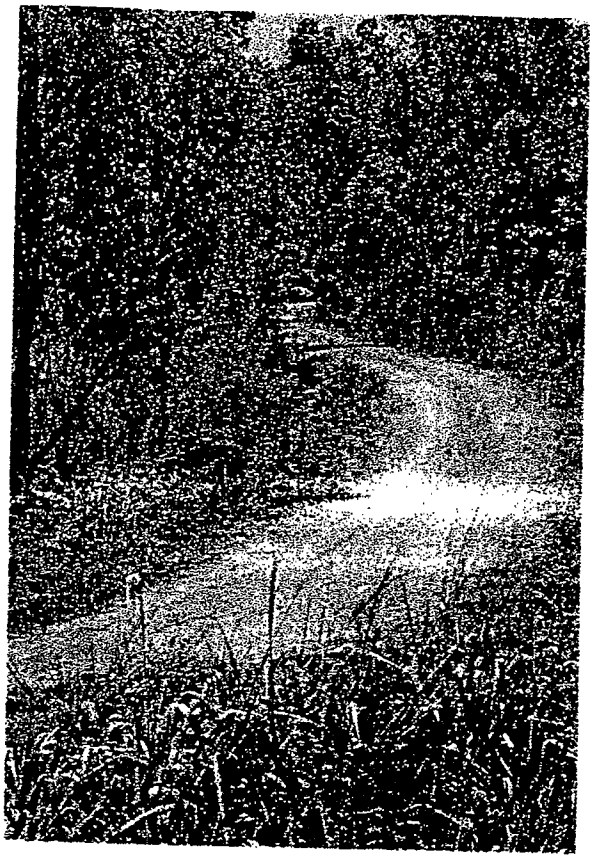
Central drainage chute below junction box #2



Drop pit energy dissipater at outlet of Central Drainage Chute
(Mud has been cleared from previous inspection)

End of Central Drainage chute below
Junction Box #3

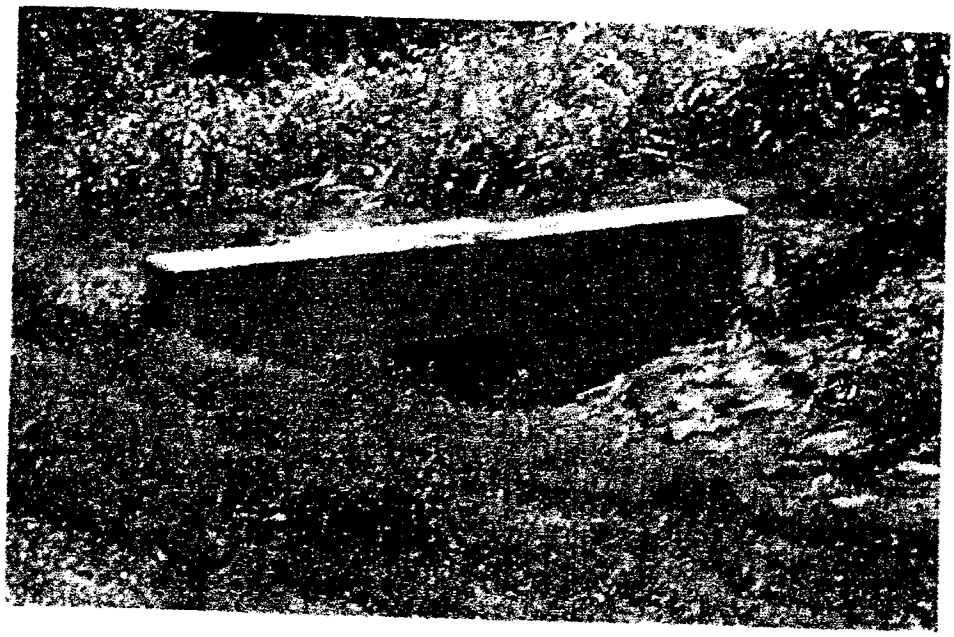
Monitoring Well # 4-4 casing



Access road to Monitoring Well 4-4

Guinea grass overgrowing the fence on eastern boundary of landfill

Evidence of Bermuda grass taking hold in northern area along backslope berm



Headwall at central drainage chute

Northern Backslopes

Looking West from berm at backslope

TABLE F.1
POST-CLOSURE INSPECTION REPORT FORM
OPERABLE UNIT 4
SCHOFIELD ARMY BARRACKS
ISLAND OF OAHU, HAWAII

Date of Inspection (M/D/Y) 4/27/99 Time 0930 (am/pm)

Inspector(s) Name/Title Sam Fukuda

Inspection of	Condition		Action Required?		Comments/Locations	Date of Corrective Action
	Adequate/ Stable	Damaged/ Deteriorating	yes	no		
1. Facility Access Control System						
A. Security Fence						
1. Gaps Beneath Fence	✓			✓		
2. Chain - Link Fabric	✓			✓		
3. Barbed Wire	N/A					
4. Fence Posts	✓			✓		
B. Site Access Gates	✓			✓		
1. Gate Locks	✓			✓		
2. Gate Operation	✓			✓		
C. Warning Signs	✓			✓		
D. Access Roads	✓			✓		

TABLE F.1
POST-CLOSURE INSPECTION REPORT FORM
OPERABLE UNIT 4
SCHOFIELD ARMY BARRACKS
ISLAND OF OAHU, HAWAII

Date of Inspection (M/D/Y) 4/21/99 Time 0950 (am/pm)
Inspector(s) Name/Title Jon Kikuda

Inspection of	Condition: Adequate/ Stable	Condition: Damaged/ Deteriorating	Action Required? yes	Action Required? no	Comments/Locations	Date of Corrective Action
3. Final Cover System (Top and Side Slopes)						
A. Vegetation Establishment						
1. Barren Areas	✓			✓		
2. Tree Growth	✓			✓		
B. Slope Failure/Slumping	✓			✓		
C. Settlement	✓			✓		
D. Erosion Damage		✓	✓		previously noted in system	[illegible]
E. Debris Accumulation	✓			✓		
F. Animal Burrows	✓			✓		
G. Fire/Explosion Damage	✓			✓		

TABLE F.1
POST-CLOSURE INSPECTION REPORT FORM
OPERABLE UNIT 4
SCHOFIELD ARMY BARRACKS
ISLAND OF OAHU, HAWAII

Date of Inspection (M/D/Y) _____ Time _____ (am/pm)

Inspector(s) Name/Title _____

Inspection of	Condition		Action Required?		Comments/Locations	Date of Corrective Action
	Adequate/ Stable	Damaged/ Deteriorating	yes	no		
5. Groundwater Monitoring System						
A. Monitoring Wells						
1. Well Casing and Cap		✓	✓		casings showing signs of corrosion	
2. Protective Casing	✓			✓		
3. Locks	✓			✓		
4. Grout Seal	✓			✓		

Operable Unit 4, Former Landfill
Post-Closure Inspection Report
Schofield Barracks, Island of Oahu, Hawaii
July 21, 1999.

Post-closure maintenance and operation of the Former Landfill at Schofield is conducted in accordance with the "Final Operation and Maintenance and Long-Term Monitoring Plan for Operable Unit 4, Schofield Barracks, Island of Oahu, Hawaii." Post-closure Applicable Relevant and Appropriate Requirements (ARARs) identified in Hawaii Administrative Rules (HAR) 11-58.1-17(b) requires that the integrity and effectiveness of any final cover be maintained. Routine inspections are performed as part of the post-closure program to routinely evaluate the integrity of the cover.

This inspection took place on July 21, 1999, by the undersigned. Systems inspected include the landfill cover and drainage system, the passive gas collection/monitoring system, groundwater monitoring well network, security fence, access roads and survey monuments. The field inspection form is at enclosure 1. The inspections are described below.

1. Landfill Cover.

The landfill cover is inspected on a quarterly basis. This is the third inspection since the completion of construction of landfill cover and drainage system repairs. The Army, the Environmental Protection Agency, and the Hawaii Department of Health conducted the final inspection for the construction activity on July 21, 1998. The landfill cover was inspected for evidence of damage due to erosion, settlement, slumping, drought, fire, pestilence, debris accumulation, animal burrows an any other adverse conditions. Special attention was paid to the vegetative cover, the side-slopes, and the drainage systems. Rainfall has tapered off from the previous quarter. Overall the grass cover on the landfill cap is still in good condition. The inspection process for each of these areas is described below.

- Vegetative Cover - The vegetative cover was inspected to confirm appropriate vegetative species are established on the cover and to identify any barren areas or areas of tree and shrub growth. The rye and buffalo grass planted after construction activities continue to recover from the long dry period last summer and fall. Their color is now green as opposed to the brown to gray appearance during the previous inspection. Guinea grass continues to be a problem in the area to the west of the central drainage swale and on the northern slopes. Much of the barren patches that were present in the northwest corner of the landfill are now vegetated.

- Sideslopes - Sideslopes appear stable, no signs of cracking, slumping or erosion. Integrity of slopes remains intact.

- Drainage System - The drainage system appears to be intact with no significant damage. The hairline crack appears in the rip-rap on the central drainage chute first noted during the January 1999 inspection has not grown in size and still does not appear to affect the structural integrity of the chute. There are no obstructions present that would impede surface runoff flow. All structures are intact.

2. Existing Landfill Passive Gas Wells - The existing passive gas wells are in intact and in good condition.

Enclosure 1

3. Perimeter Landfill Gas Monitoring Wells - Perimeter gas wells are intact and fully functional. These wells are utilized on a quarterly basis to monitor landfill methane gas generation.

4. Groundwater Monitoring Well Network - All four groundwater monitoring wells in the vicinity of the landfill are intact and fully functional. They will need cosmetic repair to the well casings as they are showing signs of corrosion.

5. Security Fence - Security fence, locks, signs are intact and fully functional.

6. Access Roads - Access roads are in good shape with no potholes or obstructions preventing vehicular traffic.

7. Survey Monuments - No damage evident to survey monument.

Recommended corrective actions. As noted in previous inspections, controlling of the Guinea grass continues to be the single largest challenge at the former landfill site. Recommend that the landscaping contractor continue to herbicide Guinea grass to the west of the central swale as well as along the Eastern fenceline to bring under control. Also recommend cutting and herbiciding of the Guinea grass on the northern slopes to bring under control. Although not currently affecting functional use, removal corrosion and subsequent repainting from the groundwater monitoring well casings appears warranted. Repair work will be done through the U.S. Army Garrison, Hawaii, Directorate of Public Works.

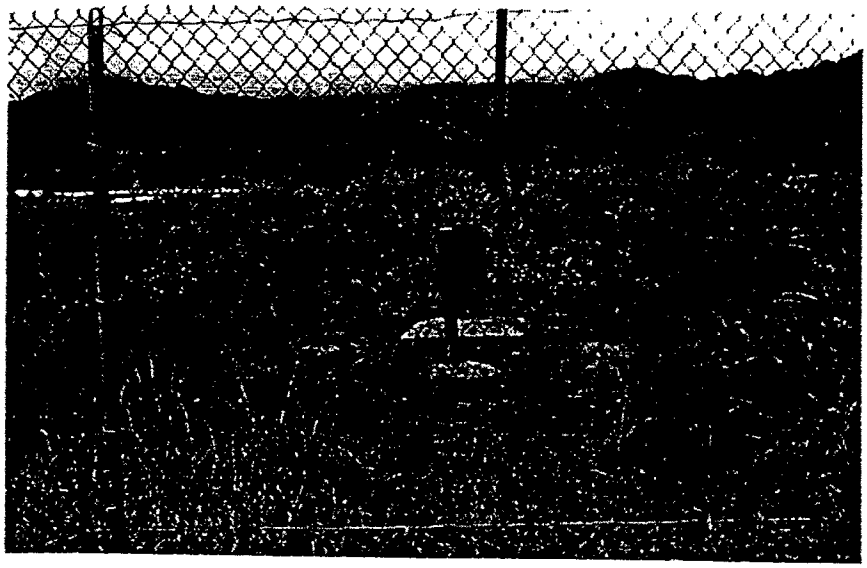
Inspection completed by:

Jon Fukuda
Installation Restoration Program Manager

Survey Monument

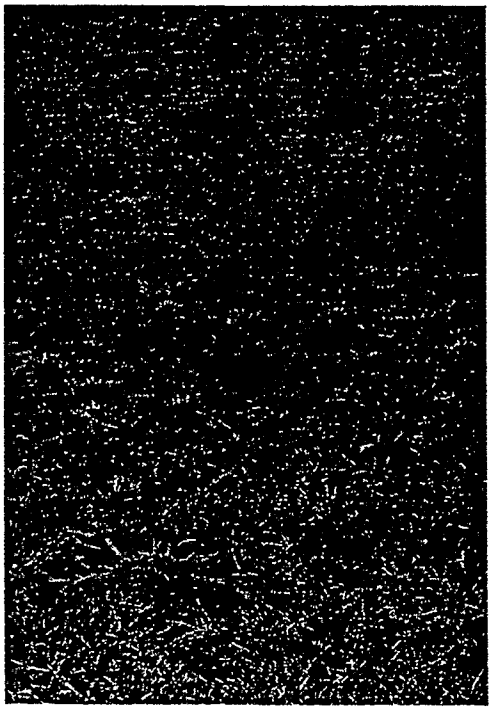
looking Northeast from gate area

Looking North from gated area

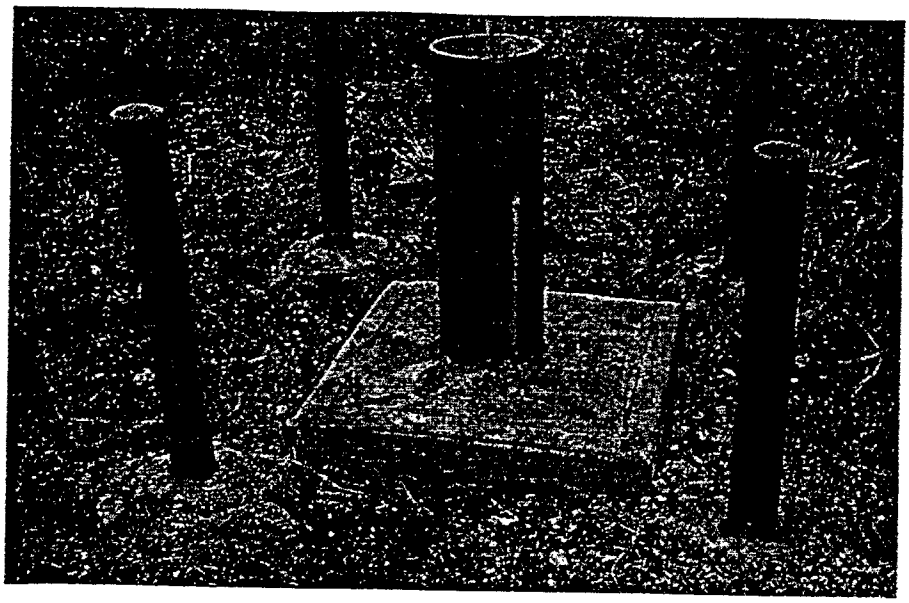


Gas Monitoring Well #3
(West of Landfill near entry gate)

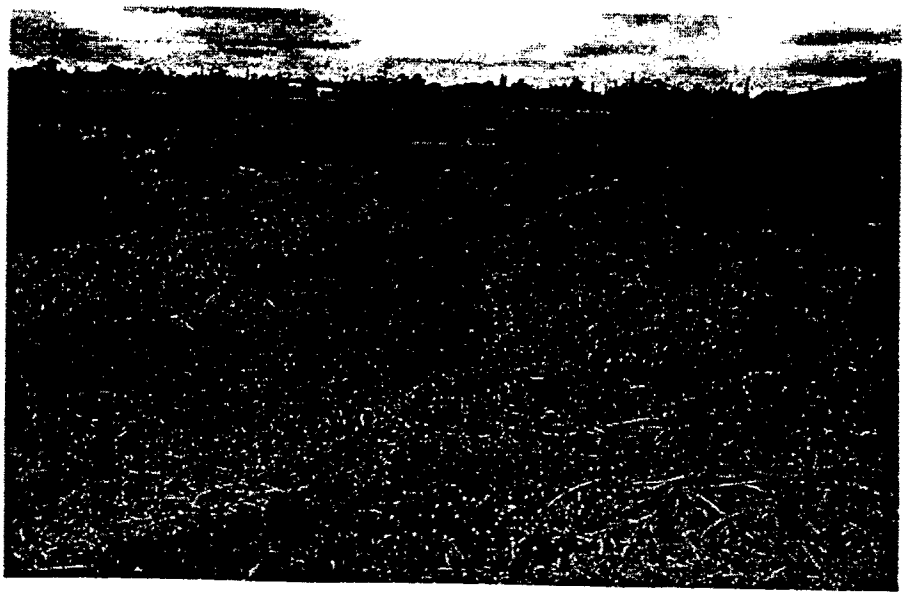
looking southwest from corner of western swale
(erosion damage)



Erosion damage on western drainage channel
(shovel on right for scale)

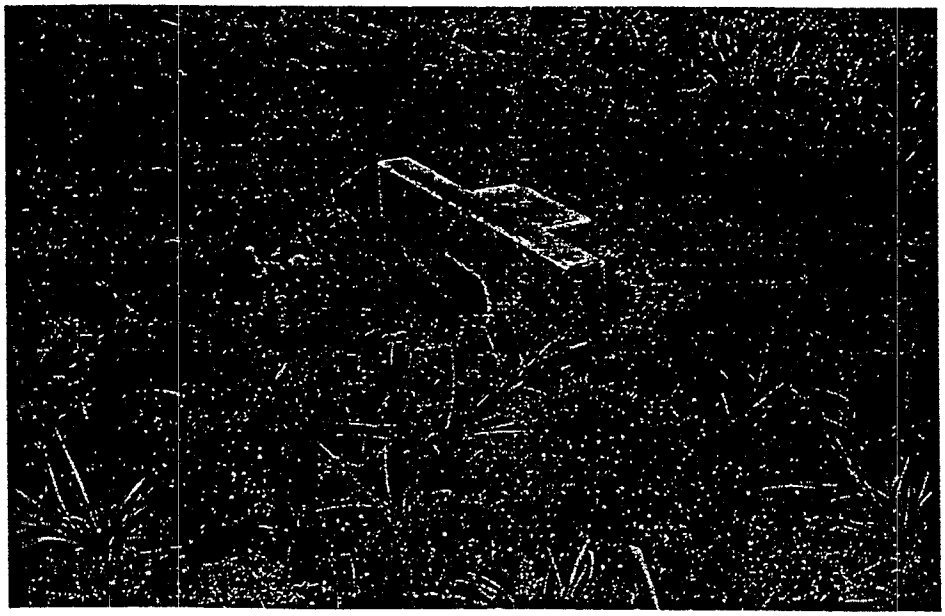


Existing hairline crack at base of gas vent #4



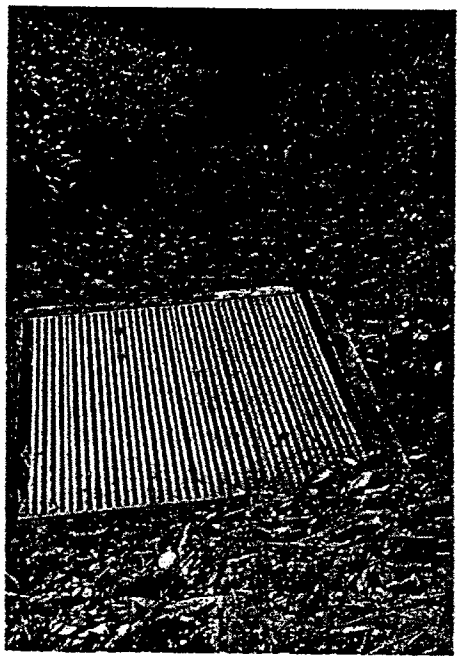
Looking east at backslopes of landfill

Western Drainage Swale

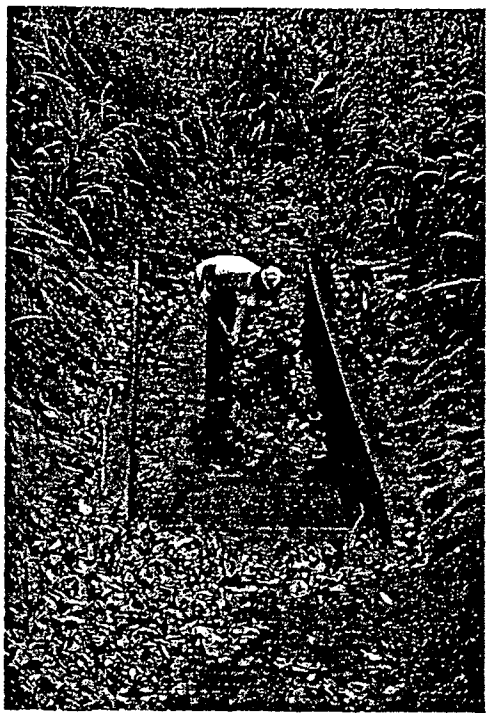


Headwall at central drainage chute

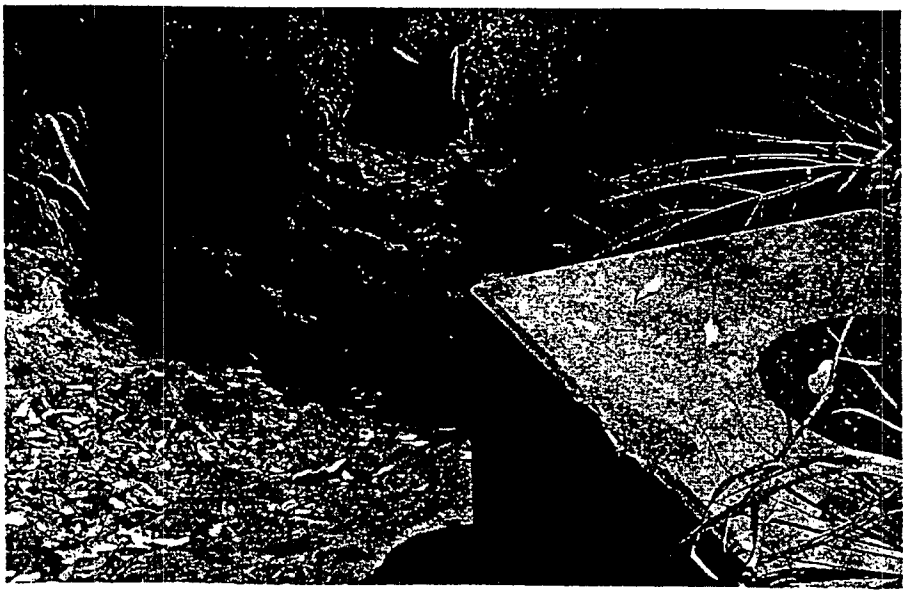
Junction box #1
Central Drainage Chute



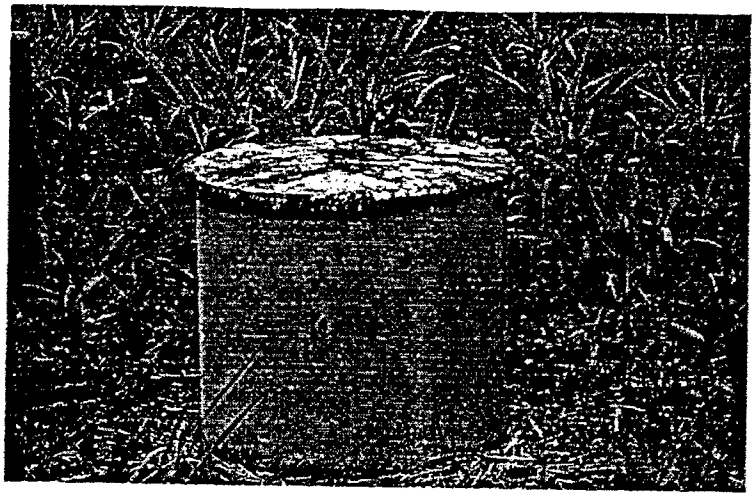
Central drainage chute below junction box #2



Mud being cleared at Drop pit energy dissipater outlet
At bottom of Central Drainage Chute



End of Central Drainage chute below
Junction Box #3



Monitoring Well # 4-4 casing

Operable Unit 4, Former Landfill
Post-Closure Inspection Report
Schofield Barracks, Island of Oahu, Hawaii
November 15, 1999.

Post-closure maintenance and operation of the Former Landfill at Schofield is conducted in accorda with the "Final Operation and Maintenance and Long-Term Monitoring Plan for Operable Unit 4, Schofield Barracks, Island of Oahu, Hawaii." Post-closure Applicable Relevant and Appropriate Requirements (ARARs) identified in Hawaii Administrative Rules (HAR) 11-58.1-17(b) requires that t integrity and effectiveness of any final cover be maintained. Routine inspections are performed as part the post-closure program to routinely evaluate the integrity of the cover.

This inspection took place on November 15, 1999, by the undersigned. Systems inspected include t landfill cover and drainage system, the passive gas collection/monitoring system, groundwater monitor well network, security fence, access roads and survey monuments. The field inspection form is at enclosure 1. The inspections are described below.

Landfill Cover.

The landfill cover is inspected on a quarterly basis. This is the third inspection since the completio construction of landfill cover and drainage system repairs. The Army, the Environmental Protection ncy, and the Hawaii Department of Health conducted the final inspection for the construction activ on July 21, 1998. The landfill cover was inspected for evidence of damage due to erosion, settlement, slumping, drought, fire, pestilence, debris accumulation, animal burrows an any other adverse conditio Special attention was paid to the vegetative cover, the side-slopes, and the drainage systems. Rainfall l increased from the previous quarter. Overall the grass cover on the landfill cap is still in good conditio The cap is showing signs of stress with cracks starting to develop in the northwestern corner and the southeastern area. The inspection process for each of these areas is described below.

- Vegetative Cover - The vegetative cover was inspected to confirm appropriate vegetative species are established on the cover and to identify any barren areas or areas of tree and sh growth. Guinea grass continues to be a problem but is being brought under control. The northern slope has been cut back and herbicided and is in much better control. Much of th barren patches that were present in the northwest corner of the landfill are now vegetated.

  Sideslopes - Sideslopes appear stable, no signs of cracking, slumping or erosion. Integrit of slopes remains intact.

  Drainage System - The drainage system appears to be intact with no significant damage. central drainage chute was cleared of surface debris. There are no obstructions present tha would impede surface runoff flow. All structures are intact.

2. Existing Landfill Passive Gas Wells - The existing passive gas wells are in intact and in gooc condition.

3. Perimeter Landfill Gas Monitoring Wells - Perimeter gas wells are intact and fully functional. These wells are utilized on a quarterly basis to monitor landfill methane gas generation.

4. Groundwater Monitoring Well Network - All four groundwater monitoring wells in the vicinity of the landfill are intact and fully functional.

5. Security Fence - Security fence, locks, signs are intact and fully functional.

6. Access Roads - Access roads are in good shape with no potholes or obstructions preventing vehicular traffic.

7 Survey Monuments - No damage evident to survey monument.

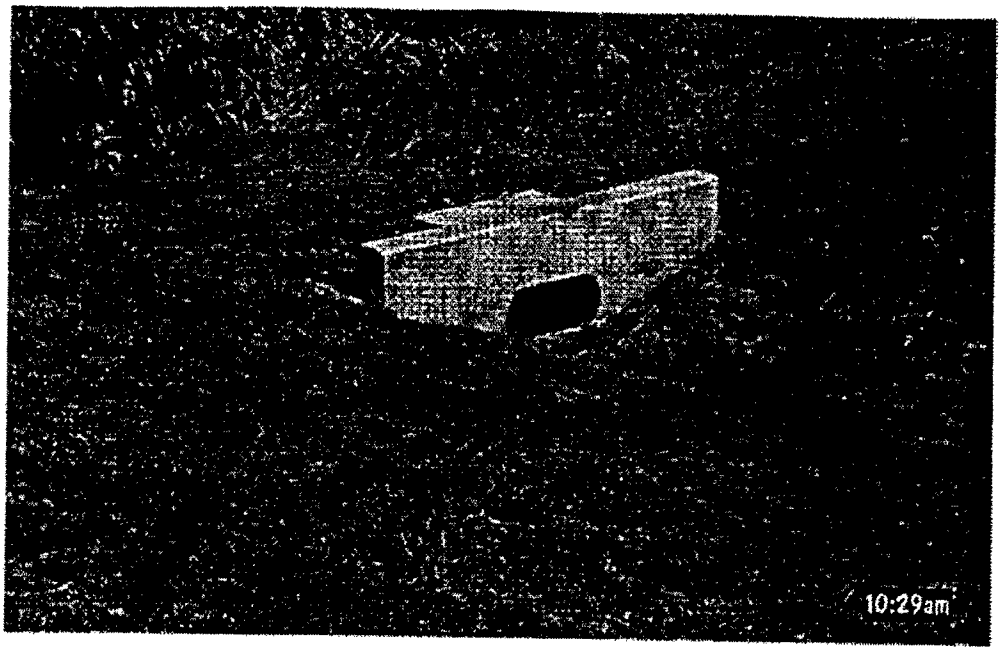
Recommended corrective actions. As noted in previous inspections, controlling of the Guinea grass continues to be the single largest challenge at the former landfill site. Recommend that the landscaping contractor continue to herbicide Guinea grass to the west of the central swale as well as along the Eastern fenceline to bring under control. Also recommend continued cutting and herbiciding of the Guinea grass on the northern slopes to bring under control. DPW will effect crack repairs in the two affected areas.

Inspection completed by:

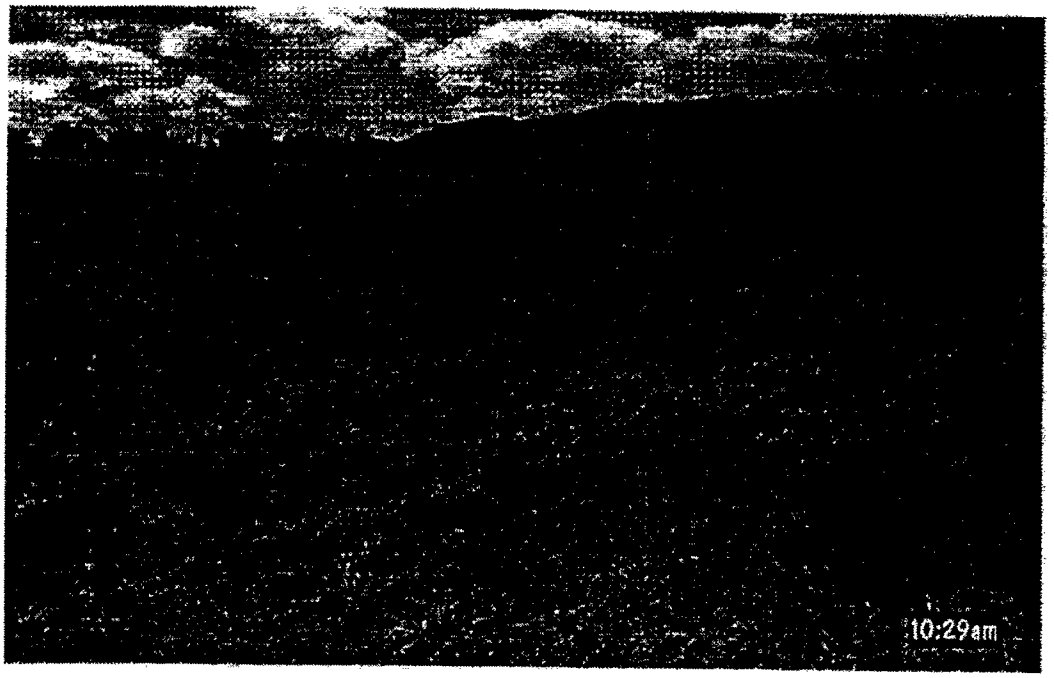
Jon Fukuda
Installation Restoration Program Manager

Central Drainage Chute
Junction box

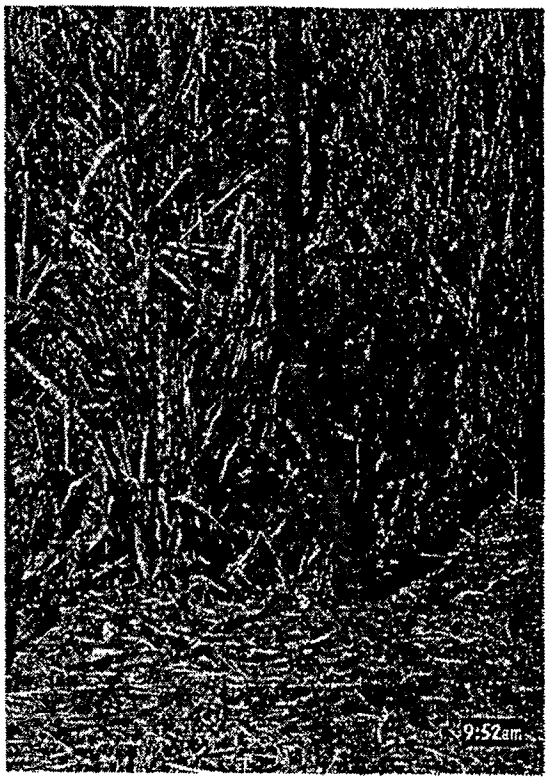
Central drainage Chute



Central Drainage Chute
Headwall



Central Drainage Swale



Damaged Fencepost

Northwestern corne
(looking northeast)

TABLE F.1
POST-CLOSURE INSPECTION REPORT FORM
OPERABLE UNIT 4
SCHOFIELD ARMY BARRACKS
ISLAND OF OAHU, HAWAII

Date of Inspection (M/D/Y) 4/15/99 Time 0930 (am/pm)

Inspector(s) Name/Title JON FUKUDA

Inspection of	Condition: Adequate/ Stable	Condition: Damaged/ Deteriorating	Action Required? yes	Action Required? no	Comments/Locations	Date of Corrective Action
1. Facility Access Control System						
A. Security Fence						
1. Gaps Beneath Fence	✓			✓		
2. Chain - Link Fabric	✓			✓		
3. Barbed Wire	NA					
4. Fence Posts	✓			✓		
B. Site Access Gates						
1. Gate Locks	✓			✓		
2. Gate Operation	✓			✓		
C. Warning Signs	✓			✓		
D. Access Roads	✓			✓		

TABLE F.1
POST-CLOSURE INSPECTION REPORT FORM
OPERABLE UNIT 4
SCHOFIELD ARMY BARRACKS
ISLAND OF OAHU, HAWAII

Date of Inspection (M/D/Y) 11/15/99 Time 0930 (am/pm)

Inspector(s) Name/Title JN Fukuda

Inspection of	Condition: Adequate/ Stable	Condition: Damaged/ Deteriorating	Action Required?: yes	Action Required?: no	Comments/Locations	Date of Corrective Action
2. Runon/Runoff Controls						
A. Northern Runoff Control Berms	✓			✓		
B. Center Drainage Channel	✓			✓		
C. Northern Drainage Channel	✓			✓		
D. Western Drainage Channel	✓			✓		
E. Northcentral Side Slope Drainage Chute	✓			✓		
F. Northern Side Slope Drainage Chute	✓			✓		
G. Northwestern Side Slope Drainage Chute	✓			✓		

TABLE F.1
POST-CLOSURE INSPECTION REPORT FORM
OPERABLE UNIT 4
SCHOFIELD ARMY BARRACKS
ISLAND OF OAHU, HAWAII

Date of Inspection (M/D/Y) 11/15/99 Time 0930 (am/pm)

Inspector(s) Name/Title Jon Fukuda

	Condition		Action Required?			
	Adequate/ Stable	Damaged/ Deteriorating	yes	no	Comments/Locations	Date of Corrective Action
A. Vegetation Establishment						
1. Barren Areas	✓			✓		
2. Tree Growth	✓			✓		
B. Slope Failure/Slumping	✓			✓		
C. Settlement	✓			✓		
D. Erosion Damage	✓			✓		
E. Debris Accumulation	✓			✓		
F. Animal Burrows	✓			✓		
G. Fire/Explosion Damage	✓			✓		

TABLE F.1
POST-CLOSURE INSPECTION REPORT FORM
OPERABLE UNIT 4
SCHOFIELD ARMY BARRACKS
ISLAND OF OAHU, HAWAII

Date of Inspection (M/D/Y) 11/15/99 Time 0930 (am/pm)
Inspector(s) Name/Title [illegible]

Inspection of	Condition: Adequate/ Stable	Condition: Damaged/ Deteriorating	Action Required?: yes	Action Required?: no	Comments/Locations	Date of Corrective Action
4. Gas Monitoring/Control System						
A. Well Casing and Cap	✓			✓		
B. Protective Casing	✓			✓		
C. Grout Seal	✓			✓		

TABLE F.1
POST-CLOSURE INSPECTION REPORT FORM
OPERABLE UNIT 4
SCHOFIELD ARMY BARRACKS
ISLAND OF OAHU, HAWAII

Date of Inspection (M/D/Y) 11/15/99 Time 0930 (am/pm)

Inspector(s) Name/Title Jon Fukuda

Inspection of	Condition: Adequate/ Stable	Condition: Damaged/ Deteriorating	Action Required?: yes	Action Required?: no	Comments/Locations	Date of Corrective Action
5. Groundwater Monitoring System						
A. Monitoring Wells						
1. Well Casing and Cap	✓			✓		
2. Protective Casing		✓	✓		Casing rusted	
3. Locks	✓			✓		
4. Grout Seal	✓			✓		

Operable Unit 4, Former Landfill
Post-Closure Inspection Report
Schofield Barracks, Island of Oahu, Hawaii
March 13, 2000.

Post-closure maintenance and operation of the Former Landfill at Schofield is conducted in accorda with the "Final Operation and Maintenance and Long-Term Monitoring Plan for Operable Unit 4, Schofield Barracks, Island of Oahu, Hawaii." Post-closure Applicable Relevant and Appropriate Requirements (ARARs) identified in Hawaii Administrative Rules (HAR) 11-58.1-17(b) requires that t integrity and effectiveness of any final cover be maintained. Routine inspections are performed as part the post-closure program to routinely evaluate the integrity of the cover.

This inspection took place on March 13, 2000, by the undersigned. Systems inspected include the landfill cover and drainage system, the passive gas collection/monitoring system, groundwater monitor well network, security fence, access roads and survey monuments. The field inspection form is at enclosure 1. The inspections are described below.

Landfill Cover.

The landfill cover is inspected on a quarterly basis. The Army, the Environmental Protection Agen the Hawaii Department of Health conducted the final inspection for the construction activity on Ju 21, 1998. The landfill cover was inspected for evidence of damage due to erosion, settlement, slumpin drought, fire, pestilence, debris accumulation, animal burrows an any other adverse conditions. Specia attention was paid to the vegetative cover, the side-slopes, and the drainage systems. Overall the grass cover on the landfill cap is still in good condition. The cap is showing signs of stress with cracks starti to develop in the northwestern corner and the southeastern area. The inspection process for each of the areas is described below.

- Vegetative Cover - The vegetative cover was inspected to confirm appropriate vegetative species are established on the cover and to identify any barren areas or areas of tree and sh growth. Guinea grass continues to be a problem but is being brought under control.. Barr patches that were present in the northwest corner of the landfill are now vegetated.

  Sideslopes - Sideslopes appear stable, no signs of cracking, slumping or erosion. Integrit of slopes remains intact.

- Drainage System - The drainage system appears to be intact with no significant damage. central drainage chute was cleared of surface debris. There are no obstructions present tha would impede surface runoff flow. All structures are intact.

2. Existing Landfill Passive Gas Wells - The existing passive gas wells are in intact and in gooc condition.

3. Perimeter Landfill Gas Monitoring Wells - Perimeter gas wells are intact and fully functional. These wells are utilized on a quarterly basis to monitor landfill methane gas generation.

4. Groundwater Monitoring Well Network - All four groundwater monitoring wells in the vicinity of the landfill are intact and fully functional.

5. Security Fence - Security fence, locks, signs are intact and fully functional. Only minor damage to fenceposts which does not impair security.

6. Access Roads - Access roads are in good shape with no potholes or obstructions preventing vehicular traffic.

7. Survey Monuments - No damage evident to survey monument.

Recommended corrective actions. As noted in previous inspections, controlling of the Guinea grass continues to be the single largest challenge at the former landfill site. Recommend that the landscaping contractor continue to herbicide Guinea grass to the west of the central swale as well as along the Eastern fenceline to bring under control. Also recommend continued cutting and herbiciding of the Guinea grass on the northern slopes to bring under control. DPW to pursue crack repairs in the two affected areas. Initiate scoping of cap repair with Corps of Engineers.

Inspection completed by:

Jon Fukuda
Installation Restoration Program Manager

TABLE F.1
POST-CLOSURE INSPECTION REPORT FORM
OPERABLE UNIT 4
SCHOFIELD ARMY BARRACKS
ISLAND OF OAHU, HAWAII

Date of Inspection (M/D/Y) 3/13/00 Time 0915 (am/pm)

Inspector(s) Name/Title JON FUKUDA

Inspection of	Condition: Adequate/ Stable	Condition: Damaged/ Deteriorating	Action Required?: yes	Action Required?: no	Comments/Locations	Date of Corrective Action
1. Facility Access Control System						
A. Security Fence						
1. Gaps Beneath Fence	✓			✓		
2. Chain - Link Fabric	✓			✓		
3. Barbed Wire	N/A			N/A		
4. Fence Posts	✓			✓		
B. Site Access Gates						
1. Gate Locks	✓			✓		
2. Gate Operation	✓			✓		
C. Warning Signs	✓			✓		
D. Access Roads	✓			✓		

TABLE F.1
POST-CLOSURE INSPECTION REPORT FORM
OPERABLE UNIT 4
SCHOFIELD ARMY BARRACKS
ISLAND OF OAHU, HAWAII

Date of Inspection (M/D/Y) 3/13/01 Time 0915 (am/pm)

Inspector(s) Name/Title JON FUKUDA

Inspection of	Condition: Adequate/ Stable	Condition: Damaged/ Deteriorating	Action Required? yes	Action Required? no	Comments/Locations	Date of Corrective Action
2. Runon/Runoff Controls						
A. Northern Runoff Control Berms	✓			✓		
B. Center Drainage Channel	✓			✓		
C. Northern Drainage Channel	✓			✓		
D. Western Drainage Channel	✓			✓		
E. Northcentral Side Slope Drainage Chute	✓			✓		
F. Northern Side Slope Drainage Chute	✓			✓		
G. Northwestern Side Slope Drainage Chute	✓			✓		

TABLE F.1
POST-CLOSURE INSPECTION REPORT FORM
OPERABLE UNIT 4
SCHOFIELD ARMY BARRACKS
ISLAND OF OAHU, HAWAII

Date of Inspection (M/D/Y) 8/13/00 Time 0915 (am/pm)

Inspector(s) Name/Title [illegible]

Inspection of	Condition: Adequate/ Stable	Condition: Damaged/ Deteriorating	Action Required?: yes	Action Required?: no	Comments/Locations	Date of Corrective Action
3. Final Cover System (Top and Side Slopes)						
A. Vegetation Establishment						
1. Barren Areas	✓			✓		
2. Tree Growth	✓			✓		
B. Slope Failure/Slumping	✓			✓		
C. Settlement		✓	✓		southeastern section signs of settling	
D. Erosion Damage		✓		✓	signs of erosion in northwestern corner	
E. Debris Accumulation	✓			✓	Debris cleared on central drainage chute	8/16/00
F. Animal Burrows	✓			✓		
G. Fire/Explosion Damage	✓			✓		

TABLE F.1
POST-CLOSURE INSPECTION REPORT FORM
OPERABLE UNIT 4
SCHOFIELD ARMY BARRACKS
ISLAND OF OAHU, HAWAII

Date of Inspection (M/D/Y) 8/18/00 Time 0915 (am/pm)

Inspector(s) Name/Title [illegible]

Inspection of	Condition* Adequate/ Stable	Condition* Damaged/ Deteriorating	Action Required? yes	Action Required? no	Comments/Locations	Date of Corrective Action
4. Gas Monitoring/Control System						
A. Well Casing and Cap	✓			✓		
B. Protective Casing	✓			✓		
C. Grout Seal	✓			✓		

TABLE F.1
POST-CLOSURE INSPECTION REPORT FORM
OPERABLE UNIT 4
SCHOFIELD ARMY BARRACKS
ISLAND OF OAHU, HAWAII

Date of Inspection (M/D/Y) 3/14/00 Time 0915 (am/pm)

Inspector(s) Name/Title [illegible]

Inspection of	Condition: Adequate/ Stable	Condition: Damaged/ Deteriorating	Action Required? yes	Action Required? no	Comments/Locations	Date of Corrective Action
5. Groundwater Monitoring System						
A. Monitoring Wells						
1. Well Casing and Cap	✓			✓		
2. Protective Casing		✓	✓		casing rusted	
3. Locks	✓			✓		
4. Grout Seal	✓			✓		

DEPARTMENT OF THE ARMY
HEADQUARTERS, UNITED STATES ARMY GARRISON, HAWAII
SCHOFIELD BARRACKS, HAWAII 96857-5000

August 7, 2000

REPLY TO
ATTENTION OF

Directorate of Public Works

Mr. Michael Miyasaka
Remedial Project Manager
Hazard Evaluation and
Emergency Response Office
Department of Health
919 Ala Moana Boulevard
Honolulu, Hawaii 96814

Dear Mr. Miyasaka:

The Record of Decision for Operable Unit 4, Former Landfill, Schofield Barracks, Island of Oahu, Hawaii, includes the long-term maintenance of the landfill cover in the selected remedy for the site. Quarterly post-closure inspections of the cover are an integral part of this long-term maintenance action. Personnel from the U.S. Army Garrison, Hawaii conducted such an inspection on July 28,2000. The inspection report is enclosed. Settlement is evident in the southeastern corner of the landfill. The Army is currently initiating repairs on that section.

We will continue to monitor the site for any adverse changes. If you have any questions, please feel free to contact Mr. Jon Fukuda, Directorate of Public Works, Environmental Division, (808) 656-2878, extension 1055.

Sincerely,

William E. Ryan III

William E. Ryan III
Colonel, U.S. Army
Director of Public Works

Enclosure

DEPARTMENT OF THE ARMY
HEADQUARTERS, UNITED STATES ARMY GARRISON, HAWAII
SCHOFIELD BARRACKS, HAWAII 96857-5000

August 7, 2000

REPLY TO
ATTENTION OF

Directorate of Public Works

Mr. Mark Ripperda
Remedial Project Manager, H-9-4
U.S. Environmental Protection Agency
Region 9
75 Hawthorne Street
San Francisco, California 94105-3901

Dear Mr. Ripperda:

The Record of Decision for Operable Unit 4, Former Landfill, Schofield Barracks, Island of Oahu, Hawaii, includes the long-term maintenance of the landfill cover in the selected remedy for the site. Quarterly post-closure inspections of the cover are an integral part of this long-term maintenance action. Personnel from the U.S. Army Garrison, Hawaii conducted such an inspection on July 28, 2000. The inspection report is enclosed. Settlement is evident in the southeastern corner of the landfill. The Army is currently initiating repairs on that section.

We will continue to monitor the site for any adverse changes. If you have any questions, please feel free to contact Mr. Jon Fukuda, Directorate of Public Works, Environmental Division, (808) 656-2878, extension 1055.

Sincerely,

William E. Ryan III

William E. Ryan III
Colonel, U.S. Army
Director of Public Works

Enclosure

DEPARTMENT OF THE ARMY
HEADQUARTERS, UNITED STATES ARMY GARRISON, HAWAII
SCHOFIELD BARRACKS, HAWAII 96857-5000

August 7, 2000

REPLY TO
ATTENTION OF

APVG-GWV (200-1a)

MEMORANDUM FOR

Commander, U.S. Army Environmental Center, ATTN: SFIM-AEC-RPO (Mr. James Daniel), Aberdeen Proving Ground, Maryland 21010-5401

Commander, U.S. Army, Pacific, ATTN: APEN-E (Mr. Gene Kubecka), Fort Shafter, Hawaii 96858-5100

SUBJECT: Landfill Inspection, Operable Unit 4, Schofield Barracks

1. The Record of Decision for Operable Unit 4, Former Landfill, Schofield Barracks, Island of Oahu, Hawaii, includes the long-term maintenance of the landfill cover in the selected remedy for the site. Quarterly post-closure inspections of the cover are an integral part of this long-term maintenance action. Personnel from the U.S. Army Garrison, Hawaii conducted such an inspection on 28 Jul 00. The inspection report is enclosed.

2. Repairs to settlement area in the southeastern section of the landfill are being initiated to bring the cap back to grade and repair the associated cracks.

3. We will continue to monitor the site for the any adverse changes. If you have any questions, please feel free to contact Mr. Jon Fukuda, Directorate of Public Works, Environmental Division, (808) 656-2878, extension 1055.

Encl

William E. Ryan III
WILLIAM E. RYAN III
COLONEL, EN
Director of Public Works

DEPARTMENT OF THE ARMY
HEADQUARTERS, UNITED STATES ARMY GARRISON, HAWAII
SCHOFIELD BARRACKS, HAWAII 96857-5000

REPLY TO
ATTENTION OF

August 7, 2000

APVG-GWV (200-1a)

MEMORANDUM FOR

Commander, U.S. Army Environmental Center, ATTN: SFIM-AEC-RPO (Mr. James Daniel), Aberdeen Proving Ground, Maryland 21010-5401

Commander, U.S. Army, Pacific, ATTN: APEN-E (Mr. Gene Kubecka), Fort Shafter, Hawaii 96858-5100

SUBJECT: Landfill Inspection, Operable Unit 4, Schofield Barracks

1. The Record of Decision for Operable Unit 4, Former Landfill, Schofield Barracks, Island of Oahu, Hawaii, includes the long-term maintenance of the landfill cover in the selected remedy for the site. Quarterly post-closure inspections of the cover are an integral part of this long-term maintenance action. Personnel from the U.S. Army Garrison, Hawaii conducted such an inspection on 28 Jul 00. The inspection report is enclosed.

2. Repairs to settlement area in the southeastern section of the landfill are being initiated to bring the cap back to grade and repair the associated cracks.

3. We will continue to monitor the site for the any adverse changes. If you have any questions, please feel free to contact Mr. Jon Fukuda, Directorate of Public Works, Environmental Division, (808) 656-2878, extension 1055.

Encl

William E. Ryan III
WILLIAM E. RYAN III
COLONEL, EN
Director of Public Works

Operable Unit 4, Former Landfill
Post-Closure Inspection Report
Schofield Barracks, Island of Oahu, Hawaii
June 28, 2000.

Post-closure maintenance and operation of the Former Landfill at Schofield is conducted in accordance with the "Final Operation and Maintenance and Long-Term Monitoring Plan for Operable Unit 4, Schofield Barracks, Island of Oahu, Hawaii." Post-closure Applicable Relevant and Appropriate Requirements (ARARs) identified in Hawaii Administrative Rules (HAR) 11-58.1-17(b) requires that the integrity and effectiveness of any final cover be maintained. Routine inspections are performed as part of the post-closure program to routinely evaluate the integrity of the cover.

This inspection took place on June 28, 2000, by the undersigned. Systems inspected include the landfill cover and drainage system, the passive gas collection/monitoring system, groundwater monitoring well network, security fence, access roads and survey monuments. The field inspection form is at enclosure 1. The inspections are described below.

1. Landfill Cover.

The landfill cover is inspected on a quarterly basis. This is the third inspection since the completion of construction of landfill cover and drainage system repairs. The Army, the Environmental Protection Agency, and the Hawaii Department of Health conducted the final inspection for the construction activity on July 21, 1998. The landfill cover was inspected for evidence of damage due to erosion, settlement, slumping, drought, fire, pestilence, debris accumulation, animal burrows an any other adverse conditions. Special attention was paid to the vegetative cover, the side-slopes, and the drainage systems. Rainfall has been sparse during the past quarter. Overall the grass cover on the landfill cap is still in good condition. The cap is showing signs of settling in the southeastern corner of the landfill. The inspection process for each of these areas is described below.

- Vegetative Cover - The vegetative cover was inspected to confirm appropriate vegetative species are established on the cover and to identify any barren areas or areas of tree and shrub growth. Guinea grass on the cover is unde control. The northern slope has been cut back and herbicided. Although dry, the grass cover is in relatively good shape..

- Sideslopes - Sideslopes appear stable, no signs of cracking, slumping or erosion. Integrity of slopes remains intact.

- Drainage System - The drainage system appears to be intact with no significant damage. The central drainage chute was cleared of surface debris. There are no obstructions present that would impede surface runoff flow. All structures are intact.

2. Existing Landfill Passive Gas Wells - The existing passive gas wells are in intact and in good condition.

3. Perimeter Landfill Gas Monitoring Wells - Perimeter gas wells are intact and fully functional. These wells are utilized on a quarterly basis to monitor landfill methane gas generation.

4. Groundwater Monitoring Well Network - All four groundwater monitoring wells in the vicinity of the landfill are intact and fully functional.

5. Security Fence - Security fence, locks, signs are intact and fully functional.

6. Access Roads - Access roads are in good shape with no potholes or obstructions preventing vehicular traffic.

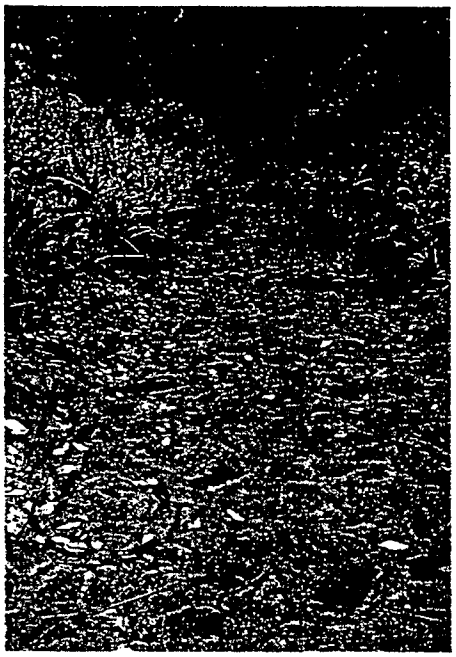
7. Survey Monuments - No damage evident to survey monument.

Recommended corrective actions. Contacted Corps of Engineers to effect repair to the area that is settling in the southeastern corner of the landfill. Need to bring cap back to grade and repair cracks resulting from settling.

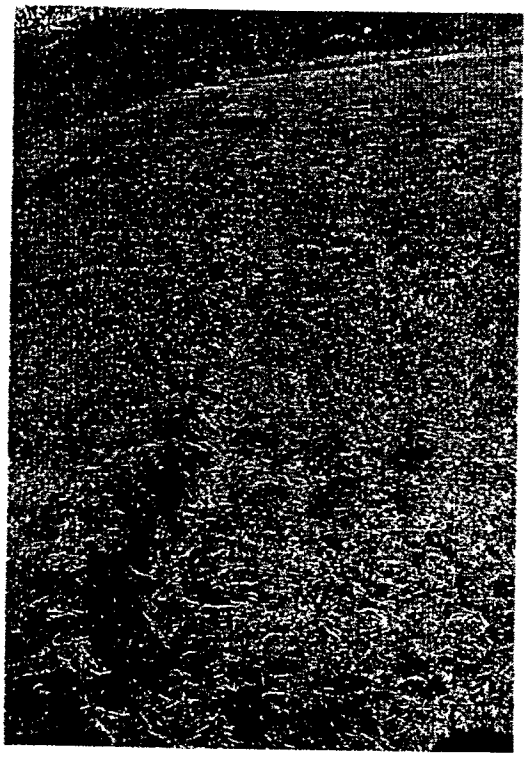
Inspection completed by:

Jon Fukuda
Installation Restoration Program Manager

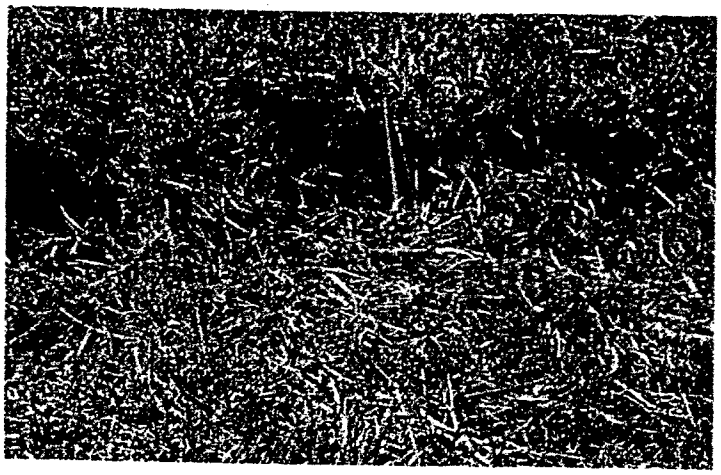
Junction box
Central Drainage Chute



Central Drainage Chute
culvert



Crack in southeasten section



Crack in southeastern section

TABLE F.1
POST-CLOSURE INSPECTION REPORT FORM
OPERABLE UNIT 4
SCHOFIELD ARMY BARRACKS
ISLAND OF OAHU, HAWAII

Date of Inspection (M/D/Y) 6/28/00 Time 0900 (am/pm)

Inspector(s) Name/Title Jim Kirkwood

Inspection of	Condition: Adequate/ Stable	Condition: Damaged/ Deteriorating	Action Required? yes	Action Required? no	Comments/Locations	Date of Corrective Action
1. Facility Access Control System						
A. Security Fence						
1 Gaps Beneath Fence	✓			✓		
2 Chain - Link Fabric	✓			✓		
3. Barbed Wire	NA					
4 Fence Posts	✓			✓		
B. Site Access Gates						
1 Gate Locks	✓			✓		
2. Gate Operation	✓			✓		
C. Warning Signs	✓			✓		
D. Access Roads	✓			✓		

TABLE F.1
POST-CLOSURE INSPECTION REPORT FORM
OPERABLE UNIT 4
SCHOFIELD ARMY BARRACKS
ISLAND OF OAHU, HAWAII

Date of Inspection (M/D/Y) 6/28/00 Time 0900 (am/pm)

Inspector(s) Name/Title Jon Kukuda

Inspection of	Condition: Adequate/ Stable	Condition: Damaged/ Deteriorating	Action Required?: yes	Action Required?: no	Comments/Locations	Date of Corrective Action
3. Final Cover System (Top and Side Slopes)						
A. Vegetation Establishment						
1. Barren Areas	✓			✓		
2. Tree Growth	✓			✓		
B. Slope Failure/Slumping	✓			✓		
C. Settlement		✓	✓		Southeastern section	
D. Erosion Damage		✓		✓	slight signs of erosion in northeastern corner but stable	
E. Debris Accumulation	✓			✓		
F. Animal Burrows	✓			✓		
G. Fire/Explosion Damage	✓			✓		

TABLE F.1
POST-CLOSURE INSPECTION REPORT FORM
OPERABLE UNIT 4
SCHOFIELD ARMY BARRACKS
ISLAND OF OAHU, HAWAII

Date of Inspection (M/D/Y) 6/28/00 Time 0900 (am/pm)

Inspector(s) Name/Title Jon Fukuda

Inspection of	Condition		Action Required?		Comments/Locations	Date of Corrective Action
	Adequate/ Stable	Damaged/ Deteriorating	yes	no		
5. Groundwater Monitoring System						
A. Monitoring Wells						
1. Well Casing and Cap	✓			✓		
2. Protective Casing		✓	✓		Casing is rusted	
3. Locks	✓			✓		
4. Grout Seal	✓			✓		

Operable Unit 4, Former Landfill
Post-Closure Inspection Report
Schofield Barracks, Island of Oahu, Hawaii
August 26, 2000.

Post-closure maintenance and operation of the Former Landfill at Schofield is conducted in accorda with the "Final Operation and Maintenance and Long-Term Monitoring Plan for Operable Unit 4, Schofield Barracks, Island of Oahu, Hawaii." Post-closure Applicable Relevant and Appropriate Requirements (ARARs) identified in Hawaii Administrative Rules (HAR) 11-58.1-17(b) requires that integrity and effectiveness of any final cover be maintained. Routine inspections are performed as par the post-closure program to routinely evaluate the integrity of the cover.

This inspection took place on August 26, 2000, by the undersigned. Systems inspected include the landfill cover and drainage system, the passive gas collection/monitoring system, groundwater monito well network, security fence, access roads and survey monuments. The field inspection form is at enclosure 1. The inspections are described below.

Landfill Cover

The landfill cover is inspected on a quarterly basis. The Army, the Environmental Protection Agen and the Hawaii Department of Health conducted the final inspection for the construction activity on Ju 21, 1998. The landfill cover was inspected for evidence of damage due to erosion, settlement, slumpir ught, fire, pestilence, debris accumulation, animal burrows an any other adverse conditions. Speci attention was paid to the vegetative cover, the side-slopes, and the drainage systems. Rainfall has bee sparse during the past quarter. Overall the grass cover on the landfill cap is still in good condition. Th cap is showing signs of settling in the southeastern corner of the landfill. The inspection process for e of these areas is described below.

Vegetative Cover - The vegetative cover was inspected to confirm appropriate vegetative species are established on the cover and to identify any barren areas or areas of tree and sh growth. Guinea grass on the cover is under control. The northern slope has been cut back and herbicided. Although dry, the grass cover is in relatively good shape..

Sideslopes - Sideslopes appear stable, no signs of cracking, slumping or erosion. Integri of slopes remains intact.

Drainage System - The drainage system appears to be intact with no significant damage. central drainage chute was cleared of surface debris. There are no obstructions present th would impede surface runoff flow. All structures are intact.

Cover Material - The clay cover material has significant cracks in the southeastern as we signs of depressions. This was noted in the previous inspection and a contract is being awarded by the Corps of Engineers to correct this deficiency.

2. Existing Landfill Passive Gas Wells - The existing passive gas wells are in intact and in goo condition

3. Perimeter Landfill Gas Monitoring Wells - Perimeter gas wells are intact and fully functional. These wells are utilized on a quarterly basis to monitor landfill methane gas generation.

4. Groundwater Monitoring Well Network - All four groundwater monitoring wells in the vicinity of the landfill are intact and fully functional.

5. Security Fence - Security fence, locks, signs are intact and fully functional.

6. Access Roads - Access roads are in good shape with no potholes or obstructions preventing vehicular traffic.

7. Survey Monuments - No damage evident to survey monument.

Recommended corrective actions. Corps of Engineers to effect repair to the area that is settling in the southeastern corner of the landfill. Need to bring cap back to grade and repair cracks resulting from settling.

Inspection completed by:

Jon Fukuda
Installation Restoration Program Manager

TABLE F.1
POST-CLOSURE INSPECTION REPORT FORM
OPERABLE UNIT 4
SCHOFIELD ARMY BARRACKS
ISLAND OF OAHU, HAWAII

Date of Inspection (M/D/Y) 8/26/00 Time 0915 (am/pm)

Inspector(s) Name/Title VON FURUDA

Inspection of	Condition: Adequate/ Stable	Condition: Damaged/ Deteriorating	Action Required? yes	Action Required? no	Comments/Locations	Date of Corrective Action
1. Facility Access Control System						
A. Security Fence						
1. Gaps Beneath Fence	✓			✓		
2. Chain - Link Fabric	✓			✓		
3. Barbed Wire	NA					
4. Fence Posts	✓			✓		
B. Site Access Gates						
1. Gate Locks	✓			✓		
2. Gate Operation	✓			✓		
C. Warning Signs	✓			✓		
D. Access Roads	✓			✓		

TABLE F.1
POST-CLOSURE INSPECTION REPORT FORM
OPERABLE UNIT 4
SCHOFIELD ARMY BARRACKS
ISLAND OF OAHU, HAWAII

Date of Inspection (M/D/Y) 8/26/00 Time 0915 (am/pm)

Inspector(s) Name/Title Jon Kuchida

Inspection of	Condition: Adequate/ Stable	Condition: Damaged/ Deteriorating	Action Required? yes	Action Required? no	Comments/Locations	Date of Corrective Action
2. Runon/Runoff Controls						
A. Northern Runoff Control Berms	✓			✓		
B. Center Drainage Channel	✓			✓		
C. Northern Drainage Channel	✓			✓		
D. Western Drainage Channel	✓			✓		
E. Northcentral Side Slope Drainage Chute	✓			✓		
F. Northern Side Slope Drainage Chute	✓			✓		
G. Northwestern Side Slope Drainage Chute	✓			✓		

TABLE F.1
POST-CLOSURE INSPECTION REPORT FORM
OPERABLE UNIT 4
SCHOFIELD ARMY BARRACKS
ISLAND OF OAHU, HAWAII

Date of Inspection (M/D/Y) 8/26/00 Time 0915 (am/pm)

Inspector(s) Name/Title Jrn Fukuda

Inspection of	Condition: Adequate/ Stable	Condition: Damaged/ Deteriorating	Action Required? yes	Action Required? no	Comments/Locations	Date of Corrective Action
3. Final Cover System (Top and Side Slopes)						
A. Vegetation Establishment						
1. Barren Areas	✓			✓		
2. Tree Growth	✓			✓		
B. Slope Failure/Slumping	✓			✓		
C. Settlement		✓	✓		southeastern section shows settling	
D. Erosion Damage		✓		✓	northwestern corner slight signs of erosion	
E. Debris Accumulation	✓			✓		
F. Animal Burrows	✓			✓		
G. Fire/Explosion Damage	✓			✓		

TABLE F.1
POST-CLOSURE INSPECTION REPORT FORM
OPERABLE UNIT 4
SCHOFIELD ARMY BARRACKS
ISLAND OF OAHU, HAWAII

Date of Inspection (M/D/Y) 8/26/00 Time 0915 (am/pm)

Inspector(s) Name/Title Von [illegible]

Inspection of	Condition: Adequate/ Stable	Condition: Damaged/ Deteriorating	Action Required?: yes	Action Required?: no	Comments/Locations	Date of Corrective Action
4. Gas Monitoring/Control System						
A. Well Casing and Cap	✓			✓		
B. Protective Casing	✓			✓		
C. Grout Seal	✓			✓		

TABLE F.1
POST-CLOSURE INSPECTION REPORT FORM
OPERABLE UNIT 4
SCHOFIELD ARMY BARRACKS
ISLAND OF OAHU, HAWAII

Date of Inspection (M/D/Y) 8/26/00 Time 0915 (am/pm)

Inspector(s) Name/Title Jon Fukuda

Inspection of	Condition: Adequate/ Stable	Condition: Damaged/ Deteriorating	Action Required? yes	Action Required? no	Comments/Locations	Date of Corrective Action
5. Groundwater Monitoring System						
A. Monitoring Wells						
1. Well Casing and Cap	✓			✓		
2. Protective Casing		✓	✓		Cap rusted	
3. Locks	✓			✓		
4. Grout Seal	✓			✓		

DEPARTMENT OF THE ARMY
HEADQUARTERS, UNITED STATES ARMY GARRISON, HAWAII
SCHOFIELD BARRACKS, HAWAII 96857-5000

REPLY TO
ATTENTION OF

APVG-GWV (200-1a)

6 APR 2001

MEMORANDUM FOR

Commander, U.S. Army Environmental Center, ATTN: SFIM-AEC-RPO (Mr. James Daniel), Aberdeen Proving Ground, Maryland 21010-5401

Commander, U.S. Army, Pacific, ATTN: APEN-E (Mr. Gene Kubecka), Fort Shafter, Hawaii 96858-5100

SUBJECT: Landfill Inspection, Operable Unit 4, Schofield Barracks

1. The Record of Decision for Operable Unit 4, Former Landfill, Schofield Barracks, Island of Oahu, Hawaii, includes the long-term maintenance of the landfill cover in the selected remedy for the site. Quarterly post-closure inspections of the cover are an integral part of this long-term maintenance action. Personnel from the U.S. Army Garrison, Hawaii conducted such inspections on Oct 31, 2000 and February 21, 2001. The inspection reports are enclosed.

2. Settlement was evident in the southeastern corner of the landfill. The repairs to that area are nearing completion, however, additional cracks have been identified in another area of the landfill, the northwestern section. Repairs to that area are currently being initiated.

3. We will continue to monitor the site for any adverse changes. If you have any questions, please contact Mr. Jon Fukuda, Directorate of Public Works, Environmental Division, (808) 656-2878, extension 1055.

Encls

WILLIAM E. RYAN III
COLONEL, EN
Director of Public Works

DEPARTMENT OF THE ARMY
HEADQUARTERS, UNITED STATES ARMY GARRISON, HAWAII
SCHOFIELD BARRACKS, HAWAII 96857-5000

April 6, 2001

REPLY TO
ATTENTION OF

Directorate of Public Works

Mr. Mark Ripperda
Remedial Project Manager, H-9-4
U.S. Environmental Protection Agency
Region 9
75 Hawthorne Street
San Francisco, California 94105-3901

Dear Mr. Ripperda:

The Record of Decision for Operable Unit 4, Former Landfill, Schofield Barracks, Island of Oahu, Hawaii, includes the long-term maintenance of the landfill cover in the selected remedy for the site. Quarterly post-closure inspections of the cover are an integral part of this long-term maintenance action. Personnel from the U.S. Army Garrison, Hawaii conducted such inspections on Oct 31, 2000 and February 21, 2001. The inspection reports are enclosed. Settlement was evident in the southeastern corner of the landfill. The repairs to that area are nearing completion, however, additional cracks have been identified in another area of the landfill, the northwestern section. Repairs to that area are currently being initiated.

We will continue to monitor the site for any adverse changes. If you have any questions, please contact Mr. Jon Fukuda, Directorate of Public Works, Environmental Division, (808) 656-2878, extension 1055.

Sincerely,

William E. Ryan III
Colonel, U.S. Army
Director of Public Works

Enclosures

DEPARTMENT OF THE ARMY
HEADQUARTERS, UNITED STATES ARMY GARRISON, HAWAII
SCHOFIELD BARRACKS, HAWAII 96857-5000

April 6, 2001

REPLY TO
ATTENTION OF

Directorate of Public Works

Mr. Michael Miyasaka
Remedial Project Manager
Hazard Evaluation and
Emergency Response Office
Department of Health
919 Ala Moana Boulevard
Honolulu, Hawaii 96814

Dear Mr. Miyasaka:

The Record of Decision for Operable Unit 4, Former Landfill, Schofield Barracks, Island of Oahu, Hawaii, includes the long-term maintenance of the landfill cover in the selected remedy for the site. Quarterly post-closure inspections of the cover are an integral part of this long-term maintenance action. Personnel from the U.S. Army Garrison, Hawaii conducted such inspections on Oct 31, 2000 and February 21, 2001. The inspection reports are enclosed. Settlement was evident in the southeastern corner of the landfill. The repairs to that area are nearing completion, however, additional cracks have been identified in another area of the landfill, the northwestern section. Repairs to that area are currently being initiated.

We will continue to monitor the site for any adverse changes. If you have any questions, please contact Mr. Jon Fukuda, Directorate of Public Works, Environmental Division, (808) 656-2878, extension 1055.

Sincerely,

William E. Ryan III
Colonel, U.S. Army
Director of Public Works

Enclosures

31 October 2000

Schofield Barracks Landfill
Inspection Report

Operable Unit 4, Former Landfill
Post-Closure Inspection Report
Schofield Barracks, Island of Oahu, Hawaii
Oct 31, 2000.

Post-closure maintenance and operation of the Former Landfill at Schofield is conducted in accordance with the "Final Operation and Maintenance and Long-Term Monitoring Plan for Operable Unit 4, Schofield Barracks, Island of Oahu, Hawaii." Post-closure Applicable Relevant and Appropriate Requirements (ARARs) identified in Hawaii Administrative Rules (HAR) 11-58.1-17(b) requires that the integrity and effectiveness of any final cover be maintained. Routine inspections are performed as part of the post-closure program to routinely evaluate the integrity of the cover.

This inspection took place on October 31, 2000, by the undersigned. Systems inspected include the landfill cover and drainage system, the passive gas collection/monitoring system, groundwater monitoring well network, security fence, access roads and survey monuments. The field inspection form is at enclosure 1. The inspections are described below.

1. Landfill Cover.

The landfill cover is inspected on a quarterly basis. The Army, the Environmental Protection Agency, and the Hawaii Department of Health conducted the final inspection for the construction activity on July 21, 1998. The landfill cover was inspected for evidence of damage due to erosion, settlement, slumping, drought, fire, pestilence, debris accumulation, animal burrows an any other adverse conditions. Special attention was paid to the vegetative cover, the side-slopes, and the drainage systems. Rainfall has been sparse during the past quarter. Overall the grass cover on the landfill cap is still in good condition. The cap is showing signs of settling in the southeastern corner of the landfill. The inspection process for each of these areas is described below.

- Vegetative Cover - The vegetative cover was inspected to confirm appropriate vegetative species are established on the cover and to identify any barren areas or areas of tree and shrub growth. Guinea grass on the cover is under control. The northern slope has been cut back and herbicided. Although dry, the grass cover is in relatively good shape..

- Sideslopes - Sideslopes appear stable, no signs of cracking, slumping or erosion. Integrity of slopes remains intact.

- Drainage System - The drainage system appears to be intact with no significant damage. The central drainage chute was cleared of surface debris. There are no obstructions present that would impede surface runoff flow. All structures are intact.

- Cover Material - The clay cover material has significant cracks in the southeastern as well as signs of depressions. This was noted in the previous inspectioon and a contract was awarded by the Corps of Engineers to correct this deficiency.

2. Existing Landfill Passive Gas Wells - The existing passive gas wells are in intact and in good condition.

3. Perimeter Landfill Gas Monitoring Wells - Perimeter gas wells are intact and fully functional. These wells are utilized on a quarterly basis to monitor landfill methane gas generation.

4. Groundwater Monitoring Well Network - All four groundwater monitoring wells in the vicinity of the landfill are intact and fully functional.

5. Security Fence - Security fence, locks, signs are intact and fully functional.

6. Access Roads - Access roads are in good shape with no potholes or obstructions preventing vehicular traffic.

7. Survey Monuments - No damage evident to survey monument.

Recommended corrective actions. Contacted Corps of Engineers to effect repair to the area that is settling in the southeastern corner of the landfill. Need to bring cap back to grade and repair cracks resulting from settling.

Inspection completed by:

Jon Fukuda
Installation Restoration Program Manager

TABLE F-1
[illegible] INSPECTION REPORT [illegible]
OPERABLE UNIT 4
SCHOFIELD ARMY BARRACKS
ISLAND OF OAHU HAWAII

Date of Inspection (M/D/Y) 10/31/00 Time 0830 (am/pm)

Inspector(s) Name/Title Jon Fukuda

Inspection of	Condition: Adequate/ Stable	Condition: Damaged/ Deteriorating	Action Required? yes	Action Required? no	Comments/Locations	Date of Corrective Action
1 Facility Access Control System						
A Security Fence	✓			✓		
1 Gaps Beneath Fence	✓			✓		
2 Chain - Link Fabric	✓			✓		
3 Barbed Wire	NA					
4 Fence Posts	✓			✓		
B Site Access Gates						
1 Gate Locks	✓			✓		
2 Gate Operation	✓			✓		
C Warning Signs	✓			✓		
D Access Roads	✓			✓		

TABLE F 1
POST-CLOSURE INSPECTION REPORT FORM
OPERABLE UNIT 4
SCHOFIELD ARMY BARRACKS
ISLAND OF OAHU, HAWAII

Date of Inspection (M/D/Y) 10/31/00 Time 0830 (am/pm)

Inspector(s): Name/Title Jon Furbank

Inspection of	Condition: Adequate/ Stable	Condition: Damaged/ Detenorating	Action Required? yes	Action Required? no	Comments/Locations	Date of Corrective Action
3 Final Cover System (Top and Side Slopes)						
A Vegetation Establishment						
1 Barren Areas		✓		✓	~~Area~~ Vegetation just north of central swale drained	
2 Tree Growth	✓					
B Slope Failure/Slumping	✓			✓		
C Settlement		✓	✓		Southeastern section settling contract to correct awarded	
D Erosion Damage		✓	✓		same as above	
E Debris Accumulation	✓			✓		
F Animal Burrows	✓			✓		
G Fire/Explosion Damage	✓			✓		

TABLE F 1
POST-CLOSURE INSPECTION REPORT FORM
OPERABLE UNIT 4
SCHOFIELD ARMY BARRACKS
ISLAND OF OAHU, HAWAII

Date of Inspection (M/D/Y) 10/31/00 Time 0830 (am/pm)

Inspector(s) Name/Title [illegible]

Inspection of	Condition: Adequate/ Stable	Condition: Damaged/ Deteriorating	Action Required? yes	Action Required? no	Comments/Locations	Date of Corrective Action
5. Groundwater Monitoring System						
A. Monitoring Wells						
1. Well Casing and Cap	✓			✓		
2. Protective Casing		✓	✓		Casing is rusted	
3. Locks	✓			✓		
4. Grout Seal	✓			✓		

21 February 2001

Schofield Barracks Landfill
Inspection Report

Operable Unit 4, Former Landfill
Post-Closure Inspection Report
Schofield Barracks, Island of Oahu, Hawaii
February 21, 2001.

Post-closure maintenance and operation of the Former Landfill at Schofield is conducted in accordance with the "Final Operation and Maintenance and Long-Term Monitoring Plan for Operable Unit 4, Schofield Barracks, Island of Oahu, Hawaii." Post-closure Applicable Relevant and Appropriate Requirements (ARARs) identified in Hawaii Administrative Rules (HAR) 11-58.1-17(b) requires that the integrity and effectiveness of any final cover be maintained. Routine inspections are performed as part of the post-closure program to routinely evaluate the integrity of the cover.

This inspection took place on February 21, 2001, by the undersigned. Systems inspected include the landfill cover and drainage system, the passive gas collection/monitoring system, groundwater monitoring well network, security fence, access roads and survey monuments. The field inspection form is at enclosure 1. The inspections are described below.

1. Landfill Cover.

The landfill cover is inspected on a quarterly basis. This is the third inspection since the completion of construction of landfill cover and drainage system repairs. The Army, the Environmental Protection Agency, and the Hawaii Department of Health conducted the final inspection for the construction activity on July 21, 1998. The landfill cover was inspected for evidence of damage due to erosion, settlement, slumping, drought, fire, pestilence, debris accumulation, animal burrows an any other adverse conditions. Special attention was paid to the vegetative cover, the side-slopes, and the drainage systems. Rainfall has been sparse during the past year. Overall the grass cover on the landfill cap is sparse in the northwestern section. Cap repairs on the southeastern section are nearing completion. The cracks and areas that had previously settled have been repaired and the vegetative cover is being installed. The inspection process for each of these areas is described below. However, additional cracks have appeared in the northwestern section of the landfill. The Corps of Engineers have been contacted to scope repairs for this area.

- Vegetative Cover - The vegetative cover was inspected to confirm appropriate vegetative species are established on the cover and to identify any barren areas or areas of tree and shrub growth. Guinea grass on the cover is under control. The northern slope has been cut back and herbicided. Due to the lack of rainfall over the past year the grass cover in the northwestern section is sparse.

- Sideslopes - Sideslopes appear stable, no signs of cracking, slumping or erosion. Integrity of slopes remains intact.

- Drainage System - The drainage system appears to be intact with no significant damage. The central drainage chute was cleared of surface debris. There are no obstructions present that would impede surface runoff flow. All structures are intact.

- Cap Material - The repairs to the cap in the southeastern section are almost complete with only the establishment of the grass cover remaining. Additional cracks have appeared in another section of the landfill (northwestern section).

2. Existing Landfill Passive Gas Wells - The existing passive gas wells are in intact and in good condition.

3. Perimeter Landfill Gas Monitoring Wells - Perimeter gas wells are intact and fully functional. These wells are utilized on a quarterly basis to monitor landfill methane gas generation.

4. Groundwater Monitoring Well Network - All four groundwater monitoring wells in the vicinity of the landfill are intact and fully functional.

5. Security Fence - Security fence, locks, signs are intact and fully functional.

6. Access Roads - Access roads are in good shape with no potholes or obstructions preventing vehicular traffic.

7. Survey Monuments - No damage evident to survey monument.

Recommended corrective actions. Contacted Corps of Engineers to effect repair to the cracks in the northwestern area of the landfill. Need to bring cap back to grade and repair cracks resulting from settling and replace vegetative cover.

Inspection completed by:

_____

Jon Fukuda
Installation Restoration Program Manager

TABLE F-1
POST-CLOSURE INSPECTION REPORT
OPERABLE UNIT 4
SCHOFIELD ARMY BARRACKS
ISLAND OF OAHU, HAWAII

Date of Inspection (M/D/Y) 2/21/01 Time 0900 (am/pm)

Inspector(s) Name/Title Jon Fukuda

Inspection of	Condition: Adequate/ Stable	Condition: Damaged/ Deteriorating	Action Required? yes	Action Required? no	Comments/Locations	Date of Corrective Action
1. Facility Access Control System						
A. Security Fence						
1. Gaps Beneath Fence	✓			✓		
2. Chain Link Fabric	✓			✓		
3. Barbed Wire	NA					
4. Fence Posts	✓			✓		
B. Site Access Gates						
1. Gate Locks	✓			✓		
2. Gate Operation	✓			✓		
C. Warning Signs	✓			✓		
D. Access Roads	✓			✓		

TABLE F 1
POST-CLOSURE INSPECTION REPORT FORM
OPERABLE UNIT 4
SCHOFIELD ARMY BARRACKS
ISLAND OF OAHU HAWAII

Date of Inspection (M/D/Y): 3/21/01 Time: 0900 (am/pm)

Inspection Name/Title: Jim Fukude

Inspection of	Condition: Adequate/ Stable	Condition: Damaged/ Deteriorating	Action Required? yes	Action Required? no	Comments/Locations	Date of Corrective Action
3 Final Cover System (Top and Side Slopes)						
A Vegetation Establishment						
1 Barren Areas		✓		✓		
2 Tree Growth	✓			✓		
B Slope Failure/Slumping	✓			✓		
C Settlement		✓	✓		Cracks found in northwestern area	
D Erosion Damage	✓			✓		
E Debris Accumulation	✓			✓		
F Animal Burrows	✓			✓		
G Fire/Explosion Damage	✓			✓		

TABLE F 1
POST-CLOSURE INSPECTION REPORT FORM
OPERABLE UNIT 4
SCHOFIELD ARMY BARRACKS
ISLAND OF OAHU, HAWAII

Date of Inspection (M/D/Y) 2/21/01 Time 0900 (am/pm)

Inspector(s) Name/Title Jon Fukuda

Inspection of	Condition: Adequate/ Stable	Condition: Damaged/ Deteriorating	Action Required? yes	Action Required? no	Comments/Locations	Date of Corrective Action
5. Groundwater Monitoring System						
A Monitoring Wells						
1. Well Casing and Cap	✓			✓		
2. Protective Casing		✓	✓		Casing is rusted	
3. Locks	✓			✓		
4. Grout Seal	✓			✓		

DEPARTMENT OF THE ARMY
HEADQUARTERS, UNITED STATES ARMY GARRISON, HAWAII
SCHOFIELD BARRACKS, HAWAII 96857-5000

August 23, 2001

REPLY TO
ATTENTION OF

Directorate of Public Works

Mr. Michael Miyasaka
Remedial Project Manager
Hazard Evaluation and
Emergency Response Office
Department of Health
919 Ala Moana Boulevard
Honolulu, Hawaii 96814

Dear Mr. Miyasaka:

The Record of Decision for Operable Unit 4, Former Landfill, Schofield Barracks, Island of Oahu, Hawaii, includes the long-term maintenance of the landfill cover in the selected remedy for the site. Quarterly post-closure inspections of the cover are an integral part of this long-term maintenance action. Personnel from the U.S. Army Garrison, Hawaii, conducted such inspection on June 27, 2001. The inspection report is enclosed. Settlement was evident in the western, central and northeastern sections of the landfill. Repairs to these identified areas will be initiated.

We will continue to monitor the site for any adverse changes. If you have any questions, please contact Mr. Randy Itamoto, Directorate of Public Works, Environmental Division, (808) 656-2878, extension 1054.

Sincerely,

William E. Ryan III
Colonel, U.S. Army
Director of Public Works

Enclosure

Operable Unit 4, Former Landfill
Post-Closure Inspection Report
Schofield Barracks, Island of Oahu, Hawaii
June 27, 2001.

Post-closure maintenance and operation of the Former Landfill at Schofield is conducted in accordance with the "Final Operation and Maintenance and Long-Term Monitoring Plan for Operable Unit 4, Schofield Barracks, Island of Oahu, Hawaii." Post-closure Applicable Relevant and Appropriate Requirements (ARARs) identified in Hawaii Administrative Rules (HAR) 11-58.1-17(b) requires that the integrity and effectiveness of any final cover be maintained. Routine inspections are performed as part of the post-closure program to routinely evaluate the integrity of the cover.

This inspection took place on June 27, 2001, by the undersigned. Systems inspected include the landfill cover and drainage system, the passive gas collection/monitoring system, groundwater monitoring well network, security fence, access roads and survey monuments. The field inspection form is at enclosure 1. The inspections are described below

1 Landfill Cover

The landfill cover is inspected on a quarterly basis. The Army, the Environmental Protection Agency, and the Hawaii Department of Health conducted the final inspection for the construction activity on July 21, 1998. The landfill cover was inspected for evidence of damage due to erosion, settlement, slumping, drought, fire, pestilence, debris accumulation, animal burrows an any other adverse conditions. Special attention was paid to the vegetative cover, the side-slopes, and the drainage systems. Rainfall has been sparse during the past year. Overall the grass cover on the landfill cap is sparse in the northwestern western sections. Cap repairs on the southeastern section are completed. The cracks and areas that had previously settled have been repaired and the vegetative cover has been established. The inspection process for each of these areas is described below. However, additional cracks have appeared in the northwestern section, western section, and the northeastern sections of the landfill. The Corps of Engineers have been contacted to develop and administer a repair contract for these areas. Additionally, there was evidence of vermin holes in the main drainage area on the top surface. Traps will be placed to determine the extent of the existing problem.

- Vegetative Cover - The vegetative cover was inspected to confirm appropriate vegetative species are established on the cover and to identify any barren areas or areas of tree and shrub growth. Guinea grass on the cover is under control. Due to the lack of rainfall over the past year the grass cover in the northwestern and western section is sparse and brown.

- Sideslopes - Sideslopes appear stable, no signs of cracking, slumping or erosion. Integrity of slopes remains intact.

- Drainage System - The drainage system appears to be intact with no significant damage. The central drainage chute was cleared of surface debris. There are no obstructions present that would impede surface runoff flow. All structures are intact.

- Cap Material - The repairs to the cap in the southeastern section are complete and the establishment of the grass cover has taken. Additional cracks have appeared in other sections of the landfill (the northwestern section, western section, and the northeastern)

2 Existing Landfill Passive Gas Wells - The existing passive gas wells are in intact and in good condition.

3. Perimeter Landfill Gas Monitoring Wells - Perimeter gas wells are intact and fully functional. These wells are utilized on a quarterly basis to monitor landfill methane gas generation

4. Groundwater Monitoring Well Network - All four groundwater monitoring wells in the vicinity of the landfill are intact and fully functional.

5. Security Fence - Security fence, locks, signs are intact and fully functional

6 Access Roads - Access roads are in good shape with no potholes or obstructions preventing vehicular traffic

7 Survey Monuments - No damage evident to survey monument

Recommended corrective actions. Contacted Corps of Engineers and visual surveys of the cracks in the northwestern section, western section, and the northeastern areas of the landfill were performed. A contract is being developed and should be awarded this Fiscal Year to bring cap back to grade and repair cracks resulting from settling and replace vegetative cover in the areas in question. The contract will be developed to perform the repairs in the worst section, and if sufficient funds are available, repairs will be performed on other areas prioritized by its current condition.

Inspection completed by:

Randy K. Itamoto 27 JUN 07

Randy Itamoto
Installation Restoration Program Manager

TABLE F 1
POST-CLOSURE INSPECTION REPORT FORM
OPERABLE UNIT 4
SCHOFIELD ARMY BARRACKS
ISLAND OF OAHU, HAWAII

Date of Inspection (M/D/Y) 6/27/01 Time 1330 (am/pm)

Inspector(s) Name/Title JON FUKUDA / RANDY IKAMOTO

Inspection of	Condition: Adequate/ Stable	Condition: Damaged/ Deteriorating	Action Required? yes	Action Required? no	Comments/Locations	Date of Corrective Action
1. Facility Access Control System						
A. Security Fence						
1. Gaps Beneath Fence	✓			✓		
2. Chain - Link Fabric	✓			✓		
3. Barbed Wire	N/A					
4. Fence Posts		✓		✓	Fence still intact	
B. Site Access Gates						
1. Gate Locks	✓			✓		
2. Gate Operation	✓			✓		
C. Warning Signs	✓			✓		
D. Access Roads	✓			✓		

TABLE F 1
POST-CLOSURE INSPECTION REPORT FORM
OPERABLE UNIT 4
SCHOFIELD ARMY BARRACKS
ISLAND OF OAHU, HAWAII

Date of Inspection (M/D/Y) 6/27/01 Time 1330 (am/pm)

Inspector(s) Name/Title Joel Fukuda / Randy Hamoto

Inspection of	Condition: Adequate/ Stable	Condition: Damaged/ Deteriorating	Action Required?: yes	Action Required?: no	Comments/Locations	Date of Corrective Action
2. Runon/Runoff Controls						
A. Northern Runoff Control Berms	✓			✓		
B. Center Drainage Channel	✓	✓		✓	Some signs of erosion and mongoose burrows	
C. Northern Drainage Channel	✓			✓		
D. Western Drainage Channel		✓	✓		Gullies are more pronounced (wider)	
E. Northcentral Side Slope Drainage Chute	✓			✓		
F. Northern Side Slope Drainage Chute	✓			✓		
G. Northwestern Side Slope Drainage Chute	✓			✓		

TABLE F.1
POST-CLOSURE INSPECTION REPORT FORM
OPERABLE UNIT 4
SCHOFIELD ARMY BARRACKS
ISLAND OF OAHU, HAWAII

Date of Inspection (M/D/Y) 6/27/01 Time 1330 (am/pm)

Inspector(s) Name/Title JN Kukuda / Randy Iyamoto

Inspection of	Condition: Adequate/ Stable	Condition: Damaged/ Deteriorating	Action Required?: yes	Action Required?: no	Comments/Locations	Date of Corrective Action
3. Final Cover System (Top and Side Slopes)						
A. Vegetation Establishment						
1. Barren Areas		✓		✓	Several areas where grass is no longer present	
2. Tree Growth	✓			✓		
B. Slope Failure/Slumping	✓			✓		
C. Settlement		✓	✓		Northwestern area has settlement	
D. Erosion Damage	✓			✓		
E. Debris Accumulation	✓			✓		
F. Animal Burrows		✓		✓	Mongoose burrows are seen in central swale	
G. Fire/Explosion Damage	✓			✓		

TABLE F.1
POST-CLOSURE INSPECTION REPORT FORM
OPERABLE UNIT 4
SCHOFIELD ARMY BARRACKS
ISLAND OF OAHU, HAWAII

Date of Inspection (M/D/Y) 6/27/01 Time 1330 (am/pm)

Inspector(s) Name/Title JON FUKUDA / RANDY ISAMOTO

Inspection of	Condition		Action Required?		Comments/Locations	Date of Corrective Action
	Adequate/ Stable	Damaged/ Deteriorating	yes	no		
4. Gas Monitoring/Control System						
A. Well Casing and Cap	✓			✓		
B. Protective Casing	✓	[illegible]	[illegible]	✓	~~Corrosion of cover/hinges~~ [illegible]	
C. Grout Seal	✓			✓		

TABLE F.1
POST-CLOSURE INSPECTION REPORT FORM
OPERABLE UNIT 4
SCHOFIELD ARMY BARRACKS
ISLAND OF OAHU, HAWAII

Date of Inspection (M/D/Y) 6/27/01 Time 1330 (am/pm)

Inspector(s) Name/Title Von Fukuda / RANDY ITA

Inspection of	Condition: Adequate/ Stable	Condition: Damaged/ Deteriorating	Action Required? yes	Action Required? no	Comments/Locations	Date of Corrective Action
5. Groundwater Monitoring System						
A. Monitoring Wells						
1. Well Casing and Cap	✓			✓		
2. Protective Casing		✓	✓		Corrosion evident on ~~casing~~ cover/hinge	
3. Locks	✓			✓		
4. Grout Seal	✓			✓		

Operable Unit 4, Former Landfill
Post-Closure Inspection Report
Schofield Barracks, Island of Oahu, Hawaii
September 5, 2001.

Post-closure maintenance and operation of the Former Landfill at Schofield is conducted in accordance with the "Final Operation and Maintenance and Long-Term Monitoring Plan for Operable Unit 4, Schofield Barracks, Island of Oahu, Hawaii." Post-closure Applicable Relevant and Appropriate Requirements (ARARs) identified in Hawaii Administrative Rules (HAR) 11-58.1-17(b) requires that the integrity and effectiveness of any final cover be maintained. Routine inspections are performed as part of the post-closure program to routinely evaluate the integrity of the cover.

This inspection took place on September 5, 2001, by the undersigned. Systems inspected include the landfill cover and drainage system, the passive gas collection/monitoring system, groundwater monitoring well network, security fence, access roads and survey monuments. The field inspection form is at enclosure 1. The inspections are described below.

1. Landfill Cover.

The landfill cover is inspected on a quarterly basis. The Army, the Environmental Protection Agency, and the Hawaii Department of Health conducted the final inspection for the construction activity on July 21, 1998. The landfill cover was inspected for evidence of damage due to erosion, settlement, slumping, drought, fire, pestilence, debris accumulation, animal burrows an any other adverse conditions. Special attention was paid to the vegetative cover, the side-slopes, and the drainage systems. Rainfall has been sparse during the past year. Overall the grass cover on the landfill cap is sparse in the northwestern western sections. Cap repairs on the southeastern section are completed. The cracks and areas that had previously settled have been repaired and the vegetative cover has been established. The inspection process for each of these areas is described below. However, additional cracks have appeared in the northwestern section, western section, and the northeastern sections of the landfill. The Corps of Engineers have awarded a contract to repair and restore the landfill cover. Rodenticide was placed near the openings of the burrows discovered during the last inspection and no further damage was noted..

- Vegetative Cover - The vegetative cover was inspected to confirm appropriate vegetative species are established on the cover and to identify any barren areas or areas of tree and shrub growth. Guinea grass on the cover is under control. Due to the lack of rainfall over the past year the grass cover in the northwestern and western section is sparse and brown.

- Sideslopes - Sideslopes appear stable, no signs of cracking, slumping or erosion. Integrity of slopes remains intact.

- Drainage System - The drainage system appears to be intact with no significant damage. The central drainage chute was cleared of surface debris. There are no obstructions present that would impede surface runoff flow. All structures are intact.

- Cap Material - Cracks have appeared in other sections of the landfill and a contract to repair and restore the cover has been awarded by the Corps of Engineers, and work is expected to commence beginning in November 2001.

2. Existing Landfill Passive Gas Wells - The existing passive gas wells are in intact and in good condition.

3. Perimeter Landfill Gas Monitoring Wells - Perimeter gas wells are intact and fully functional. These wells are utilized on a quarterly basis to monitor landfill methane gas generation.

4. Groundwater Monitoring Well Network - All four groundwater monitoring wells in the vicinity of the landfill are intact and fully functional.

5. Security Fence - Security fence, locks, signs are intact and fully functional.

6. Access Roads - Access roads are in good shape with no potholes or obstructions preventing vehicular traffic.

7. Survey Monuments - No damage evident to survey monument.

Recommended corrective actions. Corps of Engineers has developed and awarded a contract in September 2001 to repair cracks resulting from settling, restore the cap, and replace vegetative cover in the areas in question. The contract will perform the repairs on the three damaged areas described above.

Inspection completed by:

Randy K. Itamoto

Randy Itamoto
Installation Restoration Program Manager

TABLE F.1
POST-CLOSURE INSPECTION REPORT FORM
OPERABLE UNIT 4
SCHOFIELD ARMY BARRACKS
ISLAND OF OAHU, HAWAII

Date of Inspection (M/D/Y) 9/5/01 Time 0910 (am/pm)

Inspector(s) Name/Title RANDY ITAMOTO / ROBIN YAMAMOTO

Inspection of	Condition: Adequate/ Stable	Condition: Damaged/ Deteriorating	Action Required? yes	Action Required? no	Comments/Locations	Date of Corrective Action
1. Facility Access Control System						
A. Security Fence						
1. Gaps Beneath Fence	✓			✓		
2. Chain - Link Fabric	✓			✓		
3. Barbed Wire					N/A	
4. Fence Posts		✓		✓		
B. Site Access Gates						
1. Gate Locks	✓			✓		
2. Gate Operation	✓			✓		
C. Warning Signs	✓			✓		
D. Access Roads	✓			✓		

TABLE F.1
POST-CLOSURE INSPECTION REPORT FORM
OPERABLE UNIT 4
SCHOFIELD ARMY BARRACKS
ISLAND OF OAHU, HAWAII

Date of Inspection (M/D/Y) 5 SEP 01 Time 0910 (am/pm)

Inspector(s) Name/Title RANDY ITAMOTO/ROBIN YAMAMOTO

Inspection of	Condition: Adequate/Stable	Condition: Damaged/Deteriorating	Action Required?: yes	Action Required?: no	Comments/Locations	Date of Corrective Action
3. Final Cover System (Top and Side Slopes)						
A. Vegetation Establishment						
1. Barren Areas		✓		✓	SEVERAL AREAS WHERE GRASS IS NO LONGER PRESENT	
2. Tree Growth	✓			✓		
B. Slope Failure/Slumping	✓			✓		
C. Settlement		✓	✓		NORTHWESTERN SECTION SHOWING SIGNS OF SETTLEMENT	
D. Erosion Damage	✓			✓		
E. Debris Accumulation	✓			✓		
F. Animal Burrows		✓		✓	SOME HOLES IN CNTR. DRAINAGE	
G. Fire/Explosion Damage	✓			✓		

TABLE F.1
POST-CLOSURE INSPECTION REPORT FORM
OPERABLE UNIT 4
SCHOFIELD ARMY BARRACKS
ISLAND OF OAHU, HAWAII

Date of Inspection (M/D/Y) 4 SEP. 01 Time 0910 (am/pm)

Inspector(s) Name/Title RANDY ITAMOTO / ROBIN YAMAMOTO

Inspection of	Condition: Adequate/ Stable	Condition: Damaged/ Deteriorating	Action Required? yes	Action Required? no	Comments/Locations	Date of Corrective Action
5. Groundwater Monitoring System						
A. Monitoring Wells						
1. Well Casing and Cap	✓			✓		
2. Protective Casing		✓	✓		EVIDENCE OF CORROSION ON COVER & HINGE	
3. Locks	✓			✓		
4. Grout Seal	✓			✓		

Appendix H

OPERABLE UNIT 2 AND 4 FIVE-YEAR REVIEW INSPECTION CHECKLIST, AUGUST 2001

Please note that "O&M" is referred to throughout this checklist. At sites where Long-Term Response Actions are in progress, O&M activities may be referred to as "system operations" since these sites are not considered to be in the O&M phase while being remediated under the Superfund program.

Five-Year Review Site Inspection Checklist - OU 4/OU 2

(Working document for site inspection. Information may be completed by hand and attached to the Five-Year Review report as supporting documentation of site status. "N/A" refers to "not applicable.")

I. SITE INFORMATION	
Site name: Scofield Army Barracks Landfill	**Date of inspection:** 8/14/2001 & 8/15/2001
Location and Region: Oahu, Hawaii	**EPA ID:**
Agency, office, or company leading the five-year review: Harding ESE	**Weather/temperature:** Partly cloudy (about 80 degrees Farenheit)
Remedy Includes: (Check all that apply) × Landfill cover/containment × Access controls × Institutional controls × Groundwater pump and treatment Surface water collection and treatment Other _____	Monitored natural attenuation Groundwater containment Vertical barrier walls
Attachments: Inspection team roster attached	Site map attached
II. INTERVIEWS (Check all that apply)	
1. **O&M site manager** Jon Fukuda (Name) Restoration Program Manager (Title) 8/14/01 (Date) Interviewed (at site) at office by phone Phone no. _____ Problems, suggestions; Report attached Vegetation, cracking	
2. **O&M staff** None other (Name) _____ (Title) _____ (Date) Interviewed at site at office by phone Phone no. _____ Problems, suggestions; Report attached _____	

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 None
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 _____

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

4. **Other interviews** (optional) Report attached.

None

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

1.	**O&M Documents**			
	O&M manual	Readily available	Up to date	N/A
	As-built drawings	Readily available	Up to date	N/A
	Maintenance logs	Readily available	Up to date	N/A
	Remarks			
2.	**Site-Specific Health and Safety Plan**	Readily available	Up to date	N/A
	Contingency plan/emergency response plan	Readily available	Up to date	N/A
	Remarks			
3.	**O&M and OSHA Training Records**	Readily available	Up to date	N/A
	Remarks			
4.	**Permits and Service Agreements**			
	Air discharge permit	Readily available	Up to date	N/A
	Effluent discharge	Readily available	Up to date	N/A
	Waste disposal, POTW	Readily available	Up to date	N/A
	Other permits	Readily available	Up to date	N/A
	Remarks			
5.	**Gas Generation Records**	Readily available	Up to date	N/A
	Remarks Mostly non-detects			
6.	**Settlement Monument Records**	Readily available	Up to date	N/A
	Remarks			
7.	**Groundwater Monitoring Records**	Readily available	Up to date	N/A
	Remarks			
8.	**Leachate Extraction Records**	Readily available	Up to date	N/A
	Remarks			
9.	**Discharge Compliance Records**			
	Air	Readily available	Up to date	N/A
	Water (effluent)	Readily available	Up to date	N/A
	Remarks			
10.	**Daily Access/Security Logs**	Readily available	Up to date	N/A
	Remarks Inspectors and maintenance workers only - go through Jon Fukuda None in written log; gate is kept locked			

IV. O&M COSTS

1. **O&M Organization**

State in-house — Contractor for State
PRP in-house — Contractor for PRP
Federal Facility in-house — Contractor for Federal Facility
Other_____

2. **O&M Cost Records**

Readily available — Up to date
Funding mechanism/agreement in place
Original O&M cost estimate_____ Breakdown attached

Total annual cost by year for review period if available

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: Crack repair

V. ACCESS AND INSTITUTIONAL CONTROLS — Applicable N/A

A. Fencing

1. **Fencing damaged** — Location shown on site map — Gates secured — N/A

Remarks Good conditon

B. Other Access Restrictions

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

Remarks One sign at entry

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented — Yes (No) N/A
Site conditions imply ICs not being fully enforced — Yes (No) N/A

Type of monitoring (*e.g.*, (self-reporting), drive by) drive by
Frequency At least quarterly.
Responsible party/agency DPW
Contact Jon Fukuda (Name) Restoration Program Manager (Title) _____ (Date) _____ (Phone no.)

Reporting is up-to-date — (Yes) No N/A
Reports are verified by the lead agency — Yes No (N/A)

Specific requirements in deed or decision documents have been met — (Yes) No N/A
Violations have been reported — Yes No (N/A)
Other problems or suggestions: Report attached

2. **Adequacy** (ICs are adequate) ICs are inadequate N/A
Remarks

D. General

1. **Vandalism/trespassing** Location shown on site map (No vandalism evident)
Remarks

2. **Land use changes on site** N/A
Remarks None

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

VI. GENERAL SITE CONDITIONS

A. Roads (Applicable) N/A

1. **Roads damaged** Location shown on site map (Roads adequate) N/A
Remarks

B. Other Site Conditions

Remarks

VII. LANDFILL COVERS (Applicable) N/A

A. Landfill Surface

1. **Settlement** (Low spots) Location shown on site map Settlement not evident
Areal extent Extensive Depth
Remarks See map

2. **Cracks** Location shown on site map Cracking not evident
Lengths Widths Depths
Remarks See map of Existing Operable Unit 4 Conditions

3. **Erosion** (Location shown on site map) Erosion not evident
Areal extent Central Drainage Area Depth
Remarks Sideslopes eroded

4. **Holes** (Location shown on site map) Holes not evident
Areal extent Central Drainage Area Depth
Remarks Couple of areas with minor localized settlement

5. **Vegetative Cover** (Grass) Cover properly established No signs of stress
Trees/Shrubs (indicate size and locations on a diagram)
Remarks Sparse due to lack of rainfall

6. **Alternative Cover (armored rock, concrete, etc.)** (N/A)
Remarks

7. **Bulges** Location shown on site map (Bulges not evident)
Areal extent Height
Remarks

8. **Wet Areas/Water Damage** (Wet areas/water damage not evident)
   - Wet areas — Location shown on site map — Areal extent_____
   - 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_____

9. **Slope Instability** Slides — Location shown on site map — (No evidence of slope instability)
   Areal extent_____
   Remarks_____

B. Benches (Applicable) 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) 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 ≤ 12 inches
   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 (Applicable) N/A

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

2. **Gas Monitoring Probes**
(Properly secured/locked) (Functioning) (Routinely sampled) (Good condition)
Evidence of leakage at penetration Needs Maintenance 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 N/A
Remarks Casing corroded - in procedss of being fixed

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

5. **Settlement Monuments** Located Routinely surveyed (N/A)
Remarks_____

E. Gas Collection and Treatment Applicable (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 N/A
   Remarks_____

F. Cover Drainage Layer Applicable (N/A)

1. **Outlet Pipes Inspected** Functioning N/A
   Remarks_____

2. **Outlet Rock Inspected** Functioning N/A
   Remarks_____

G. Detention/Sedimentation Ponds Applicable (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 (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 (Applicable) N/A

1. **Siltation** (Location shown on site map) (Siltation not evident)
Areal extent_____ Depth_____
Remarks_____

2. **Vegetative Growth** Location shown on site map N/A
(Vegetation does not impede flow)
Areal extent Spotty Type Grass
Remarks Vegetation is in poor condition due to lack of rain

3. **Erosion** Location shown on site map (Erosion not evident)
Areal extent_____ Depth_____
Remarks_____

4. **Discharge Structure** (Functioning) N/A
Remarks_____

VIII. VERTICAL BARRIER WALLS Applicable (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. OU 2 GROUNDWATER/SURFACE WATER REMEDIES	(Applicable) N/A
A. Groundwater Extraction Wells, Pumps, and Pipelines	(Applicable) N/A
1. **Pumps, Wellhead Plumbing, and Electrical** (Good condition) (All required wells properly operating) Needs Maintenance N/A Remarks_____	
2. **Extraction 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_____	
B. Surface Water Collection Structures, Pumps, and Pipelines	Applicable (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 (OU 2) (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)_____
   Others_____
   Good condition — Needs Maintenance
   Sampling ports properly marked and functional
   Sampling/maintenance log displayed and up to date
   Equipment properly identified
   Quantity of groundwater treated annually See remarks
   Quantity of surface water treated annually None
   Remarks Maximum estimated at Schofield Barracks Water Treatment Plant is 6 mgd
   Maximum estimated at Del Monte Treatment Plant system is 2 mgd

2. **Electrical Enclosures and Panels** (properly rated and functional)
   N/A — (Good condition) — Needs Maintenance
   Remarks_____

3. **Tanks, Vaults, Storage Vessels**
   (N/A) — Good condition — Proper secondary containment — Needs Maintenance
   Remarks_____

4. **Discharge Structure and Appurtenances**
   (N/A) — Good condition — Needs Maintenance
   Remarks_____

5. **Treatment Building(s)**
   N/A — (Good condition (esp. roof and doorways)) — Needs repair
   Chemicals and equipment properly stored
   Remarks_____

6. **Monitoring Wells** (pump and treatment remedy)
   (Properly secured/locked) (Functioning) (Routinely sampled) (Good condition)
   (All required wells located) — Needs Maintenance — N/A
   Remarks_____

D. Monitoring Data

1. Monitoring Data
   (Is routinely submitted on time) (Is of acceptable quality)

2. Monitoring data suggests:
   (Groundwater plume is effectively contained) — Contaminant concentrations are declining

D. Monitored Natural Attenuation

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

Everything appears to be functioning and in general good shape

I did note:

- Corrosion on wells
- Landfill cracks
- Sparse vegetation on landfill

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.

Overall, the O&M appears satisfactory. Documentation could be better (i.e., security log and O&M logs).

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. Cracks in landfill cover recurring at higher than anticipated rate. Facility is fixing them. - No known better solution than to continue to repair - Site should consider permanent erosion mat or riprap in Center Drainage Channel

D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. None at this time

Appendix I

COMMENTS REGARDING DRAFT FIVE-YEAR REVIEW REPORT

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

January 23, 2002

Mr. Jon Fukuda
Directorate of Public Works
Headquarters, United States Army Garrison, Hawaii
Schofield Barracks, Hawaii 96857-5000

Re: USEPA comments on the Five-Year Review for Schofield Barracks

Dear Mr. Fukuda,

EPA has reviewed the Draft First Five-Year Review Report for Schofield Army Barracks. We have several comments submitted as an attachment to this letter, but in general, the report is very well written, and does an excellent job of presenting the required information in a clear and concise fashion.

We agree with the draft conclusion that the remedies appear effective. I will recommend to my management that EPA should issue a concurrence letter once the recommended maintenance repairs are performed and appropriate changes have been made to the document.

Please call me at (415) 972-3028 if you have any questions concerning this matter.

Sincerely,

Mark Ripperda
Remedial Project Manager

USEPA Comments on the Draft Five-Year Review for Schofield Army Barracks.

Title Page:

The signature on the title page should be an Army person. EPA provides a separate concurrence memo.

Section 1.3

This section should start with the statement that the US Army is the lead agency under CERCLA and is conducting the review. Then include the information that you currently list, including the contractor that is collecting data and writing the report. If data from the drinking water wells is collected by another entity, then also include that. Finally, mention that EPA and DOH are reviewing the report.

Section 1.4

Please state that the RODs for OU1 and OU3 were no action, and thus these ous will not be included in the Five-Year review, rather than saying that they were eliminated from the CERCLA process. Include a very short description of them as separate sections similar to Sections 1.4.1 and 1.4.2, and conclude that no contaminants were found that posed unacceptable risks to human health or the environment.

Section 1.4.1, Second Paragraph

Please provide slightly more detail on the locations of the TCE sources, including the fact that at least two distinct sources exist: The landfill and somewhere in the East Range. Reference the section on OU1 stating that the East Range source was not found after extensive effort.

Sections 4.1.4 and 4.2.4

Please end both of these sections with a statement that the operation and maintenance activities are successfully meeting the requirements of the remedy.

Section 6.1

Please change the first sentence of this section to read that: "EPA Region 9 was notified about the initiation ..." Then add a sentence after the second sentence that states that Mark Ripperda is the team member from the United States Environmental Protection Agency and Mike Miyasaka is the team member from Hawaii Department of Health.

Section 6.2.1

The symbol for micro did not print correctly in the bullet describing TCE concentration trends for wells MW-2-4 and 3-2803-1.

Please add a brief description of the changes in TCE concentrations in the appropriate wells. This could be worded for each well like: "The TCE concentration has increased (or decreased) from xxx on (a date five years ago) to zzz (the most recent date). Use some kind of average over a one year period from five years ago and from the present if

contaminated ground water. The treatment system is fully operational and functional and treats the water to remove contaminants to levels an order of magnitude below MCLs and any other health based standards. Results from the monitoring well network show that the plume is not migrating downgradient and should not impact any additional wells. The Army will continue to maintain and run the treatment system and the monitoring well network and will respond to any unforseen increases in TCE levels downgradient of Schofield. Therefore, the remedy is effective and protective.

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

BRUCE S. ANDERSON, Ph.D., M.R.H.
DIRECTOR OF HEALTH

STATE OF HAWAII
DEPARTMENT OF HEALTH
P. O. BOX 3378
HONOLULU, HAWAII 96801

In reply, please refer to:
HEER OFFICE

February 8, 2002

Mr. Jon Fukuda
Attn: APVG-GWV
Directorate of Public Works
Environmental Division
Department of the Army
Headquarters, U.S. Army Garrison, Hawaii
Schofield Barracks, Hawaii 96857-5000

Dear Mr. Fukuda:

Subject: Draft Five-Year Review Report for Operable Units 2 and 4 Schofield Barracks, Hawaii

The Hawaii Department of Health Hazard Evaluation and Emergency Response Office has reviewed the subject draft five-year report and evaluated your request to change the monitoring frequency for the monitoring well network. DOH concurs with your request for a change in the monitoring frequency as proposed in Table 9.2: Proposed Changes to the Long-term Groundwater Monitoring Program of the report.

Should you have any questions, please contact me at 586-4653.

Sincerely,

Michael K Miyasaka

MICHAEL K. MIYASAKA
Remedial Project Manager
Hazard Evaluation and Emergency Response Office