DEPARTMENT OF THE ARMY
PUBLIC WORKS BUSINESS CENTER
HEADQUARTERS, FORT BRAGG GARRISON COMMAND (AIRBORNE)
INSTALLATION MANAGEMENT AGENCY

DECISION DOCUMENT

FOR RESOURCE CONSERVATION AND RECOVERY ACT (RCRA)
REMEDIAL ACTION (RA)

SOLID WASTE MANAGEMENT UNIT (SWMU) 8, (DSERTS #FTBR008)
FORT BRAGG, NORTH CAROLINA

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FINAL

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1.0 SCOPE OF THE DECISION DOCUMENT/REMEDIAL ACTION.

a. A Resource Conservation and Recovery Act of 1976 (RCRA) facility investigation (RFI) has been completed for Operable Unit (OU) 3 on the Fort Bragg Military Reservation, North Carolina. The OU3 consists of Solid Waste Management Units (SWMUs) 8, 9, and 2/14, abandoned landfills occupying the flanks of a north–south-trending stream valley formed by Beaver Creek and its tributaries. The scope of this Decision Document/Remedial Action is limited to SWMU 8. The other SWMUs of OU3 will be addressed in other SWMU-specific Decision Documents/Remedial Actions.

b. The following conclusions and recommendations were made for SWMU 8 based on sample analysis during the RFI and extended remedial investigation/feasibility study.

(1) Two contaminants (Aroclor-1242 and arsenic) were discovered in surface soil. Restriction of future residential and industrial land uses at SWMU 8 would alleviate the risk posed by Aroclor-1242. The maximum concentration of arsenic (2.5 mg/kg) in surface soil at SWMU 8 is comparable to arsenic concentrations (0.13 to 4.0 mg/kg) detected in soil samples from a background location; therefore, no further action (NFA) is recommended for arsenic in subsurface soil.

(2) Five constituents were discovered in groundwater: bis(2-ethylhexyl)phthalate, heptachlor, arsenic, iron, and thallium. The Fort Bragg water treatment plant currently provides treated municipal water to the cantonment area for drinking water purposes; therefore, groundwater in the cantonment area is not used as a source of drinking water. If Fort Bragg adheres to this practice in the future and does not use groundwater at SWMU 8 as a water supply source, this would alleviate any risk posed by the contaminants to potential future residents. Long-term monitoring of groundwater would sample at frequent intervals to monitor groundwater contamination levels.

(3) Twenty-six ecological contaminants were identified in surface soil, including 3 volatile organic compounds (VOCs), 4 semivolatile organic compounds (SVOCs), 5 pesticides, Aroclor-1242, and 13 metals. Results of the risk characterization indicate that terrestrial wildlife species that might live or forage at SWMU 8 are unlikely to be at risk from exposure to contaminants in surface soil at the site. Adverse effects to terrestrial invertebrates from exposure to contaminants in surface soil also are unlikely. Maximum and average exposure point concentrations of aluminum, chromium, and vanadium exceeded plant reference toxicity values, indicating that sensitive plant species could potentially be at risk from exposure to these contaminants in surface soil. Any potential risks posed by these analytes, however, are not considered to be site-related because Fort Bragg background concentrations of aluminum, chromium, and vanadium also exceeded their respective reference toxicity values.

(4) Four metals were discovered in surface water. For streambed sediment, 12 SVOCs, chlordane, and 2 metals were identified. Wildlife receptors are unlikely to be at risk from exposure to contaminants in surface water and sediment associated with SWMU 8. Aquatic receptors downstream from SWMU 8 might be at risk from exposure to aluminum, iron, and lead in surface water because concentrations of this ecological contaminant of potential concern exceeded available benchmarks. Groundwater discharging to the Beaver Creek from the landfill at SWMU 8 might be a source of these metals. The aluminum, iron, and lead concentrations, however, are comparable to those detected at upstream locations and are not considered site-related.

(5) Aquatic receptors in Beaver Creek might be at risk due to the presence of benzo(a)anthracene, benzo(b)fluoranthene, chrysene, fluoranthene, phenanthrene, pyrene, and chlordane in sediment at concentrations exceeding North Carolina values. These SVOCs were detected in upstream sediment samples at similar concentrations and were not detected in surface soil at SWMU 8. This information suggests that SWMU 8 is not the source of the SVOCs observed in Beaver Creek sediment. Other potential sources of SVOCs in the vicinity of SWMU 8 include the following: SWMU 9, SWMU 103, and SWMUs 4 and 18; automobile exhaust and surface water runoff from nearby roadways; and the Cape Fear railroad tracks that border the site to the east.

c. Additional characterization was performed at OU3 to more thoroughly evaluate the groundwater characteristics and the methane concentrations at the landfills in SWMU 8, SWMU 9, and

SWMU 14. This decision document (DD) utilizes information from the RFI report (U.S.Geological Survey (USGS) 1996), along with supplemental data collected from subsequent field investigations in 1999, 2000, and 2001. The combined information is used to develop and evaluate corrective actions for the abandoned landfill designated SWMU 8 to achieve the proposed remedial levels.

d. The selected remedy for SWMU 8 is Institutional Controls (Base Master Plan (BMP), Chain-Link Fence Barrier, Fence-Mounted Warning Signs), Groundwater Monitoring, and Implementation of Operations and Maintenance (O&M) Plan. The institutional controls comprising this alternative will provide a combination of land-use restrictions and prohibitions, as well as providing a physical barrier with warning signs to restrict access to the abandoned landfill. Land-use restrictions will be documented and enforced through the BMP, fencing, and signage with a life-cycle cost of approximately $647,000.

1.1 SITE OVERVIEW.

a. Fort Bragg is situated in northwestern Cumberland County and northern Hoke County. Cumberland County occupies approximately 661 mile^2 and has a population of approximately 303,000 people. Hoke County occupies approximately 414 mile^2 and has a population of approximately 34,000 people (U.S. Census Bureau 2000).

b. Fort Bragg had a combined military and civilian population of approximately 29,000 in 2000 (U.S. Census Bureau 2000). The principal population centers near Fort Bragg are the city of Fayetteville, 5 miles southeast, and Spring Lake, adjacent to the northeastern boundary of Fort Bragg. The estimated populations of Fayetteville and Spring Lake in 2000 were 121,000 and 8,000, respectively (U.S. Census Bureau 2000).

1.2 SITE BACKGROUND. The SWMU 8 covers an area of approximately 50 acres and consists of four inactive landfills, designated 8a through 8d. Landfills 8a, 8b, and 8c were active from 1967 to 1970 (See Figure 3-3). The operational history of Landfill 8d is unknown. Oil sludge, debris, and other unknown wastes were disposed of in trenches at these unlined landfills. Vegetative cover consisting of grasses and scrub pines predominates at the landfills except for Landfill 8b. The SWMU 8 is bounded, in general, by railroad tracks on the east, Gruber Road on the south, and the Tactical Training Compound on the west. Beaver Creek and its tributaries border Landfill 8b

on the north and east, Landfill 8c on the east, and Landfills 8a and 8d on the west. A Carolina Power and Light transmission line and associated right-of-way traverse the landfills in a north-south direction.

1.3 REGULATORY BACKGROUND.

a. Fort Bragg is a U.S. Department of Defense (DOD) facility in the Installation Restoration Program (IRP). Under the IRP, the facility is required to work toward compliance with Federal and State environmental laws and regulations. In 1988, a RCRA facility assessment of the reservation was performed to identify areas of concern with respect to compliance with RCRA and the Hazardous and Solid Waste Amendments (Kearney, Inc., and DPRA, Inc. 1988). Fort Bragg holds a RCRA permit issued by the U.S. Environmental Protection Agency (EPA) Region 4 and the North Carolina Department of Environment and Natural Resources (NCDENR). An RFI was performed to address environmental conditions at 31 SWMUs and 7 areas of concern at Fort Bragg in accordance with RCRA corrective action guidelines. The RFI included a field investigation of OU3 in 1994 and 1995 to determine the nature and extent of contamination in soil and groundwater and the potential for migration of contamination from the source areas. Soil gas surveys were performed to obtain preliminary information for locating soil-boring sample collection and monitoring well installation sites. The RFI report for OU3 was completed in December 1996 (USGS 1996). Additional field investigations to update information on contamination levels at OU3 were conducted in March and April 1999, March 2000, March 2001, and August 2002.

b. The regulatory authority governing the action at OU3 is the RCRA 40 Code of Federal Regulations 264, Title II, Subpart C, Section 3004 (42 USC 690 et seq.). Regulatory criteria and guidance for corrective actions at OU3 include both soil and groundwater cleanup standards as well as methane monitoring and mitigation criteria.

c. Soil cleanup criteria include the risk-based remedial goal objectives (RGOs) calculated by the USGS in the 1996 RFI. Other guidance used in establishing remedial levels for soil include the North Carolina total petroleum hydrocarbons (TPH) guidance levels for soils (NCDENR 1993) and the *Revised Interim Soil Lead Guidance for Comprehensive Environmental Response, Compensation and Liability Act and RCRA Corrective Action Facilities*, EPA Office of Solid Waste and Emergency Response Directive 9355.4-12 (EPA 1994).

d. For groundwater, the criteria for cleanup include the EPA maximum contaminant levels (MCLs) for drinking water, and North Carolina Standards for Groundwater Protection: 15A North Carolina Administrative Code 2L.0202 (hereafter called NC 2L) and interim maximum acceptable concentrations (IMAC). Other guidelines used in establishing remedial levels for the groundwater include the EPA Region 9 tap water screening levels. The North Carolina action levels are calculated values equivalent to an RGO protective of a 10^{-6} excess cancer risk or a non-cancer hazard quotient of 0.1. The risk management evaluation process presented in the RFI provides for an acceptable range of risk between 10^{-6} and 10^{-4}.

e. The methane results collected were compared to the lower explosive limit (LEL) for methane of 5 percent. No methane levels exceeded the LEL. Though SWMU 8 was an unpermitted landfill, as a reference point, the North Carolina operational requirements for permitted municipal solid waste landfills (Title 15A, Chapter 13, Subchapter 13B, Section .1600) require owners and operators to ensure that:

(1) The concentration of methane gas generated by the facility does not exceed 25 percent of the LEL for methane in facility structures (1.25 percent), and

(2) The concentration of methane gas does not exceed the LEL for methane at the facility property boundary.

2.0 PURPOSE OF CORRECTIVE ACTION SELECTION. The EPA has provided risk based corrective action guidance that specifies the major components to be considered in selecting a corrective action. These include the following threshold criteria: (1) protect human health and the environment and the management of wastes; (2) attain media cleanup standards set by the implementing agency (i.e., NCDENR); (3) control the source of the releases so as to reduce or eliminate, to the extent practicable, further releases that might pose a threat to human health and the environment; (4) comply with any applicable standards for management of wastes; and (5) other factors. Corrective action alternatives meeting the threshold criteria are then balanced against the following: (1) long-term reliability and effectiveness; (2) reduction of toxicity, mobility, or volume of wastes; (3) short-term effectiveness; (4) implementability; and (5) cost.

2.1 EVALUATION OF CORRECTIVE ACTION TECHNOLOGIES.

a. A no-action with groundwater monitoring alternative and five categories of corrective action technologies were identified for the soil and groundwater: (1) source removal; (2) institutional controls: land-use controls and physical barriers; (3) capping; (4) native soil cover; and (5) groundwater monitoring. The technologies were evaluated using the screening criteria of effectiveness, implementability, and cost.

b. The no-action alternative provides a baseline against which other technologies can be compared. Under the no-action alternative, no further action would be taken to mitigate risks posed by materials in the landfills. Groundwater monitoring would be performed to document groundwater contaminant concentrations. This is a requirement of North Carolina Solid Waste Section, which will not give NFA to landfills where groundwater exceeds the 2L standards by any factor. This alternative has the lowest associated cost. The acceptability of the no-action alternative is judged in relation to the assessment of known site risks and by comparison with other corrective action technologies. The no-action alternative is not considered viable because it provides no reliable or effective method for protecting human health; therefore, the no-action alternative has been eliminated from further evaluation.

(1) Source removal would excavate the buried waste and contaminated soils. Proper disposal of the buried waste, site and safety health plans, and remedial actions would be the greatest cost. Groundwater would require monitoring until action levels drop below 2L groundwater standards. This would be the most expensive of actions with a cost exceeding $5.4M. Investigation has determined the waste extends into the groundwater and employing this method would not achieve reuse of the land. As this landfill is within the existing greenbelt of the installation with no planned construction projects; this alternative was removed from consideration.

(2) Institutional controls include actions taken to restrict access to contaminated areas by establishing land-use controls or by providing physical barriers. Land-use controls (training restrictions, intrusive activities, residential restrictions) would be implemented through the Base Master Plan (BMP). Restrictions would be documented in the BMP. Physical barriers include installation of chain-link fencing and placement of signs or markers around the SWMU 8 landfills' boundaries or contaminated areas. Fencing is required to prevent use of the SWMU by troops during training exercises.

Land-use restrictions and/or physical barriers would provide effective, readily implementable, and cost-effective methods for preventing inadvertent human exposure to buried waste at the site; therefore, this technology has been retained for further consideration.

(3) Capping would include placing a low-permeability clay cover on the landfills. Placement of the clay cap would require a state-approved erosion control plan and silt fencing around the perimeter of the site. The capped area would be seeded with grass to minimize erosion of the area. The clay cap would minimize rainwater infiltration into the buried debris and minimize the potential for human exposure to the buried waste. The depth of the waste is unknown and could be below the water table; therefore, the effectiveness of a low-permeability cap to prevent leaching is uncertain. This area is particularly susceptible to erosional forces because of the large open areas. A Carolina Power and Light transmission line traverses Landfills 8a and 8d, which imposes an impediment to implementation of a low-permeability cap. For these reasons, the low-permeability cap has been eliminated from further evaluation.

(4) Placement of a native soil cover on the landfills would minimize inadvertent human exposure to buried waste and minimize transport of contaminants through surface water runoff and air dispersion. It has been suggested by NCDENR Solid Waste Section that an appropriate soil cover would be 18- to 24-in. thick with vegetation to minimize erosion. A native soil cover is present over portions of some of the landfills. As with the low-permeability cap, existing land uses impose impediments to placement of a native soil cover; however, the cover could be used as a hot-spot treatment covering the areas posing the greatest risk and leaving existing structures in place. Placement of the native soil cover might require a state-approved erosion control plan and silt fencing around the perimeter of the site. Providing a native soil cover would be an effective, readily implementable, and cost-effective method for preventing inadvertent human exposure to buried waste at the site; therefore, this technology has been retained for further consideration.

(5) Groundwater monitoring would include sampling and analysis of site monitoring wells to establish contaminant concentration trends or to verify that hazardous constituents leaching from buried waste are not posing a threat to human health. Groundwater monitoring is effective, readily implementable, and can be a cost-effective method for monitoring

changes in the site conditions and providing an early warning to prevent potential human exposure to contaminated groundwater. Therefore, groundwater monitoring has been retained for further consideration.

2.2 CORRECTIVE ACTION ALTERNATIVES.

a. The technologies retained following the screening step were combined in various ways to develop alternatives that would meet the remedial response objective of protection of human health and safety. Regardless of the alternative, the landfills will require a civil survey to establish the legal landfill boundaries for the BMP.

b. Methane levels at SWMU 8 were found to be within regulatory limits during the Additional Methane Survey (SAIC 2001c); therefore, no action is required for methane abatement.

c. Alternative 1: Native Soil Cover, Institutional Controls, Groundwater Monitoring, and Implementation of O&M Plan.

(1) Only two surface soil samples were taken during the RFI in which the remedial levels for Aroclor-1242 (0.2 mg/kg) were exceeded (1.4 mg/kg in 8CSB9 and 1.3 mg/kg in 8DSB3). A study was conducted in August 2002 to determine the size of the area that would need to be covered. Nine samples were collected from 6 in. to 1 ft at, and around, each of the estimated RFI sampling locations that exceeded the remedial level and analyzed for polychlorinated biphenyl (PCBs). The PCBs were not detected in the nine samples collected from Landfill 8d. The PCBs were detected in three samples collected from Landfill 8c. Additional samples were taken in Landfill 8c in order to establish boundaries for the contamination. At the point of highest contamination, two additional depths were sampled and seven samples were collected from 6 in. to 1 ft in a semicircular sector south-southwest of this point with a radius projected in the direction of increasing concentration to establish boundaries for the contamination. The soil cover would, therefore, be installed with a tapered contour within the 20-ft radius, with the crown at the point of the 0.19 mg/kg detection on the 20-ft radius.

(2) In this alternative, 18 in. of soil would be placed over the contaminated soil in Landfill 8c and graded to a gradual slope around the hot spot. Six inches of topsoil would be placed over the cover, and the area would be seeded with grass utilizing erosion control blankets. Silt fences would be erected around the cover to prevent siltation of Beaver Creek

and maintained until vegetation is established. Signs would be placed on four sides along the base of the cover carrying warnings not to dig in the covered area and warning that Aroclor-1242 contaminated soil lies under the cover. Digging in these areas would also be precluded by the BMP.

(3) Groundwater would be sampled every 9 months for five sampling events to establish trends in the contaminant levels. During the first sampling event, the wells listed in Table 4-2 will be sampled. Although regulatory levels were identified for metals, benzene, naphthalene, bis(2-ethylhexyl)phthalate, and dieldrin, samples from the first sampling event will involve full analysis for RCRA metals, VOCs, SVOCs, polycyclic aromatic hydrocarbons (PAHs), and pesticides/PCBs. Contaminants detected during the initial sampling event would be screened against background (for metals only), federal MCLs, and NC 2L or IMAC groundwater standards. Based on the results of this analysis and screening in the first sampling round, the wells to be sampled every nine months on a routine basis to monitor the groundwater would be identified and an analyte list established. The BMP would prohibit installation of potable water wells at the site. No wells would be installed on the base for purposes other than monitoring without first establishing risk from groundwater use. The results of the groundwater sampling would be presented annually, in association with the O&M report. Following the fifth sampling event, all data would be evaluated to determine whether to continue or discontinue monitoring based on an analysis of data trends.

d. Alternative 2: Institutional Controls, Groundwater Monitoring, and Implementation of O&M Plan.

(1) In this alternative, signs and fencing would be placed to discourage any activities/training in the old landfill that might result in inadvertent contact with the waste. The tentative location of the fence is shown in Figure 3-3. The roadway through Landfill 8c would be closed but a gate would be placed at each end allowing tracked vehicles to access the Marshalling Yards. Gates would be provided for access to a gas pipeline in SWMU 8b and Carolina Power and Light's right-of-way through 8a and 8d. Signs warning of the hazard would be posted at approximately 200-ft intervals along the fence and on each gate. The BMP would ensure that no inappropriate land uses would be undertaken.

(2) Groundwater would be sampled every nine months for five sampling events to establish trends in the contaminant levels. Wells at SWMU 8 that would be sampled during the first sampling

event are presented in Table 2-2. Although remedial levels were developed for metals, benzene, naphthalene, bis(2-ethylhexyl) phthalate, and dieldrin, samples from the first sampling event will involve analysis for RCRA metals, VOCs, SVOCs, PAHs, and pesticides/PCBs. Contaminants detected during the initial sampling event would be screened against background (for metals only), federal MCLs, and NC 2L or IMAC groundwater standards. Based on the results of this analysis and screening in the first sampling round, the wells to be sampled every 9 months on a routine basis to monitor the groundwater would be identified and an analyte list established. The BMP would prohibit installation of potable water wells at the site. No wells would be installed on the base for purposes other than monitoring without first establishing risk from groundwater use. Following the fifth sampling event, all data will be evaluated to determine whether to continue or discontinue monitoring based on an analysis of the data trends. The results of the groundwater sampling would be presented annually, in association with the O&M report.

Table 2-2. Proposed Monitoring Well Network for SWMU 8, Fort Bragg, North Carolina

Well ID	Water Level Elevation[a] (ft)	Rationale
	Landfill 8a	
8AMWS1	205.71	Upgradient monitoring well designated as the background well for Landfill 8a during the RFI. Concentrations of iron and manganese exceeded the NC 2L Groundwater Protection Standards during the RFI.
8AMWS3	NA	Monitoring well located downgradient of northern portion of Landfill 8a. Contained iron and TPH above the NC 2L Groundwater Protection Standards during the RFI.
8AMWS4	201.55	Downgradient well that has contained concentrations of arsenic, iron, manganese, and bis(2-ethylhexyl)phthalate above NC 2L Groundwater Protection Standards.
	Landfill 8b	
8BMWS1	206.93	Upgradient well designated as the background well for Landfill 8b during the RFI. Concentrations of iron exceeded the NC 2L Groundwater Protection Standard during the RFI.
8BMWS2	201.78	Monitoring well located downgradient of the southern portion of Landfill 8b that has contained concentrations of iron above the NC 2L Groundwater Protection Standard.
8BMW3	202.68	Monitoring well located downgradient of the north-central portion of Landfill 8b that contained concentrations of iron and manganese above NC 2L Groundwater Protection Standards during the RFI.
8BMW4	200.72	Monitoring well located downgradient of the south-central portion of Landfill 8b. This well contained concentrations of iron and manganese above NC 2L Groundwater Protection Standards during the RFI.
8BMW5	203.42	Monitoring well located downgradient of the northern portion of Landfill 8b. Well 8BMW5 has contained concentrations of iron, manganese, dieldrin, and heptachlor above NC 2L Groundwater Protection Standards.
	Landfill 8c	
8CMWS1	NA	Monitoring well located upgradient of Landfill 8c near the southern boundary. This well contained iron, lead, and manganese above the NC 2L Groundwater Protection Standards during the RFI.

Proposed Monitoring Well Network for SWMU 8, Fort Bragg, North Carolina (Table 2-2 Continued)		
8CMWS2	198.86	Monitoring well located downgradient of the central portion of Landfill 8c. This well contained concentrations of iron and manganese above NC 2L Groundwater Protection Standards during the RFI.
8CMWS3	199.69	Monitoring well located downgradient of the southern portion of Landfill 8c. Well 8CMWS3 contained concentrations of iron and manganese above NC 2L Groundwater Protection Standards during the RFI.
8CMW4	199.79	Monitoring well located downgradient of the northern portion of Landfill 8c. Well 8CMW4 contained concentrations of iron and manganese above NC 2L Groundwater Protection Standards during the RFI.
AEHA 8-4	202.59	Although this well is located along the southern boundary of Landfill 8c and in a general upgradient position from the landfill, heptachlor was detected above the NC 2L Groundwater Protection Standard during the RFI.
AEHA 8-5	199.37	Downgradient monitoring well located near the southeastern corner of Landfill 8c that has contained arsenic, iron, manganese, and benzene above NC 2L Groundwater Protection Standards.
Landfill 8d		
8DMWS1	202.74	Upgradient monitoring well designated as a background well for Landfill 8d during the RFI. No constituents were detected above the NC 2L Groundwater Protection Standards during the RFI. This well will provide background water quality data for Landfill 8d.
8DMWS4	199.45	Monitoring well located downgradient of the northern portion of Landfill 8d that has contained concentrations of iron and manganese above NC 2L Groundwater Protection Standards.
8DMW5	201.35	Monitoring well located near the southern boundary of Landfill 8d that has contained concentrations of iron, lead, manganese, naphthalene, dieldrin, and benzene above NC 2L Groundwater Protection Standards.

[a]Water levels measured 12/17/02
NA = Not Available.
NC = North Carolina
RFI = Resource Conservation and Recovery Act Facility Investigation.
SWMU = Solid Waste Management Unit.
TPH = Total petroleum hydrocarbons.

2.3 EVALUATION FACTORS.

a. Based on the results of the technology screening, all the alternatives are considered applicable to the site and implementable; therefore, two primary evaluation factors were used to select the preferred corrective action alternative: (1) protection of human health and (2) life-cycle costs. Prohibiting training, intrusive activities, and restricting residential use are the chosen land restrictions to be documented in the BMP. These restrictions would accomplish the protection of human health.

b. Each alternative's effectiveness at protecting human health is dependent upon its ability to prohibit human activity associated with the disturbance of soil and the usage of groundwater. For each alternative the level of protection of

human health was evaluated and compared with those of the other alternative.

2.4 EVALUATION OF CORRECTIVE ACTION ALTERNATIVES. This section summarizes the evaluation of the corrective action alternatives with respect to the primary evaluation factors of protection of human health and life-cycle cost.

a. Alternative 1: Native Soil Cover, Institutional Controls (BMP), Groundwater Monitoring, and Implementation of O&M Plan. Alternative 1 relies on both soil cover and digging restrictions to ensure protectiveness. The BMP would be amended to prohibit digging or installation of potable or irrigation water wells. Implementation of the O&M Plan would require sampling and analysis of groundwater wells to establish trends. Following the fifth sampling event, a review would be conducted to determine, based on trends discerned in the groundwater contaminant concentrations, whether to discontinue groundwater sampling, extend sampling and analysis or modify the remedy. The BMP is an effective tool for ensuring that unauthorized use of the site is prohibited while the property is under DOD ownership. An O&M Plan would be implemented to ensure maintenance of the soil cover. The cost of this alternative is estimated at $321,000.

b. Alternative 2: Institutional Controls (BMP, Chain-Link Fence Barrier, Fence-Mounted Warning Signs), Groundwater Monitoring, and Implementation of O&M Plan. This alternative would protect human health by providing for the implementation of land-use controls through enforcement of the BMP and erecting and maintaining a fence and warning signs to discourage unauthorized access to the site, thus preventing human exposure to contaminated soil. Fencing would be more protective of human health because there are areas in the landfill where the cover is thin to nonexistent, potentially allowing a trespasser to inadvertently come into contact with waste. The fence and warning signs decrease the likelihood of this occurring whereas the soil cover prevents contact only with the material under the cover. Land-use and groundwater restrictions would be documented in the BMP to prohibit inappropriate land use or installation of potable water wells at the site. Groundwater would be monitored to ascertain trends in the data. The BMP is an effective tool for ensuring that unauthorized use of the site is prohibited while the property is under DOD ownership. An O&M Plan would be implemented to ensure maintenance of the fence and signs. This is the more expensive of the two alternatives for SWMU 8, with a life-cycle cost of approximately $647,000.

3.0 SELECTED CORRECTIVE ACTIONS.

a. The selected alternative for SWMU 8 is Alternative 2, Institutional Controls (BMP, Chain-Link Fence Barrier, Fence-Mounted Warning Signs), Groundwater Monitoring, and Implementation of O&M Plan. The institutional controls comprising this alternative will provide a combination of land-use restrictions and prohibitions, as well as providing a physical barrier with warning signs to restrict access to the abandoned landfill. Land-use restrictions will be documented and enforced through the BMP, fencing, and signage.

b. Institutional controls will provide a sufficient and higher level of protection of human health and the environment over Alternative 1 and are still considered cost effective. The institutional controls described for this alternative will provide an adequate degree of long-term reliability and effectiveness, as well as short-term effectiveness. The institutional controls under this alternative can be easily and cost-effectively implemented. Justification for selection of this corrective action alternative is further detailed in the following evaluations of effectiveness, implementability, and cost. Groundwater monitoring will be performed to evaluate contaminant concentration trends, and a decision will be made on the need for further action after five sampling events. Proposed fencing (as shown in Figure 3-3), fence-mounted warning signs, and documented land-use restrictions will be sufficiently effective and will provide long-term reliability with respect to preventing human exposure through inadvertent physical contact with the buried waste within the boundaries of SWMU 8.

c. The groundwater-use restrictions will provide an effective method for preventing the use of groundwater at the site for drinking water or for irrigation. The surficial aquifer is not used as a source of drinking water at Fort Bragg. The BMP will be modified to officially restrict its use, preventing future use of the surficial groundwater at the site until remedial levels have been met.

d. An O&M program will be administered to inspect and replace, or repair, fencing and warning signs, which might deteriorate over time. Groundwater wells will be inspected every 9 months during sampling. Implementation of the O&M Plan will ensure the effectiveness of this program. Providing institutional controls over the short-term will be an effective means of minimizing human exposure to buried waste within the boundaries of SWMU 8. Fencing and warning signs will be most effective short-term. Current risk is below remedial levels for

the anticipated land usage. A five-year review is required to document and audit the effectiveness of the selected remedy for the site.

3.1 COST.

a. The estimated total project life-cycle cost of installing the fencing and warning signs, performing groundwater monitoring, administering activities associated with acquisition of legal controls, performing O&M activities, and providing management and oversight is $647,000 ($352,000 capital costs and $295,000 O&M costs). This is assuming a 10-year life cycle. The O&M costs might continue if additional groundwater sampling is needed.

b. Soil sampling and analysis would need to be performed to verify that the PCBs have attained remedial levels before fence and sign maintenance activities could be discontinued.

3.2 Establishment of Institutional Controls.

a. Prior to beginning construction of the fence at the landfills, land-use requirements for the site will be incorporated into the BMP, which will include all restrictions and provisions documented in this decision document. The BMP will include a description of institutional controls provided in this DD. The appropriate implementing documents will include land-use prohibitions and restrictions, including those related to activities that disturb the surface and subsurface and to construction of structures. Groundwater use also would be prohibited.

b. A survey plat for each landfill prepared by a professional land surveyor certified in the State of North Carolina will be included in the BMP. The survey plat will indicate the location and dimensions of the landfill with respect to permanently surveyed benchmarks. The plat will contain a prominently displayed note that states Fort Bragg's obligation to prohibit disturbance of the landfills in accordance with this corrective measures study.

3.3 Fencing and Warning Signs.

a. Approximately 12,400 linear feet of 6-ft-high, chain-link fence will be installed at SWMU 8. Double-swing gates (20-ft wide) will be provided to allow access to the utilities on the landfills and allow track vehicles access to the Marshalling Yard. Permanent warning signs would be installed on the fences at SWMU 8 at approximate 200-ft intervals. In addition, one

sign would be placed on each access gate. The signs on the gates and fence will be worded as follows:

_____

FORMER LANDFILL
NO TRESPASSING
CONTACT PWBC (910) 396-3341, EXT. 353
POTENTIAL HEALTH HAZARD
REGARDING USE RESTRICTIONS

_____

b. Each sign will have the dimensions of 24 by 24 in. Warning signs will be metal plates with reflective paint and of weather-resistant construction. The signs will have a brown background and white lettering. All signs will be permanently labeled on the back with an identification number.

c. The fence and warning signs will be inspected in accordance with the O&M Plan. Damaged fencing and signs will be repaired, or replaced, as needed. Repair or replacement of the fence or signs will occur within one month of inspection. Should damage be observed between inspections, repair or replacement will occur within one month of observation.

3.4 Groundwater Monitoring. Groundwater will be monitored every 9 months for five sampling events. Seventeen of these wells will be sampled in the first sampling event and analyzed for RCRA metals, VOCs, SVOCs, PAHs, and pesticides/PCBs to establish a baseline. The 17 wells to be sampled are presented in Table 2-2. Contaminants detected during the initial sampling event would be screened against background (metals only), federal MCLs, and NC 2L or IMAC groundwater standards. Following this initial event, the wells and analysis to be conducted in future sampling events will be selected based on exceedance of the NC 2L or IMAC standards. If there is no NC 2L or IMAC standard, then the remedial level is set equal to the Federal MCL.

4.0 CONCLUSION. The selected remedy for SWMU 8 is Institutional Controls (BMP, Chain-Link Fence Barrier, Fence-Mounted Warning Signs), Groundwater Monitoring, and Implementation of O&M Plan. The institutional controls comprising this alternative will provide a combination of land-use restrictions and prohibitions, as well as providing a physical barrier with warning signs to restrict access to the abandoned landfill. Land-use restrictions will be documented

and enforced through the BMP, fencing, and signage with a life-cycle cost of approximately $647,000.

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ACRONYMS

BGS	below ground surface
BHC	benzene hexchloride
BLS	below land surface
BMP	Base Master Plan
CFR	*Code of Federal Regulations*
CMS	corrective measures study
COC	contaminant of concern
COPC	contaminant of potential concern
DO	dissolved oxygen
DOD	U.S. Department of Defense
DPW	Directorate of Public Works
ECOPC	ecological contaminant of potential concern
EPA	U.S. Environmental Protection Agency
gpm	gallons per minute
HHCOC	human health contaminant of concern
HHCOPC	human health contaminant of potential concern
HI	hazard index
HQ	hazard quotient
IMAC	interim maximum acceptable concentration
IRP	Installation Restoration Program
LEL	lower explosive limit
MCL	maximum contaminant level
msl	mean sea level
NCAC	North Carolina Administrative Code
NCDENR	North Carolina Department of Environment and Natural Resources
NCDOT	North Carolina Department of Transportation
NFA	No Further Action
NOAA	National Oceanic and Atmospheric Agency
NTU	nephelometric turbidity unit
O&M	operations and maintenance
OSWER	Office of Solid Waste and Emergency Response
OU	operable unit
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCE	tetrachloroethene
PID	photoionization detector
ppm	parts per million
PVC	polyvinyl chloride
RBC	risk-based concentration
RCRA	Resource Conservation and Recovery Act of 1976
RD	remedial design
Redox	oxidation-reduction potential
RFA	RCRA facility assessment
RFI	RCRA facility investigation

RGO	remedial goal objective
scfm	standard cubic feet per minute
SSE	site sensitivity evaluation
SVOC	semivolatile organic compound
SWMU	solid waste management unit
TCE	trichloroethene
TCLP	Toxicity Characteristic Leaching Procedure
TOC	total organic carbon
TPH	total petroleum hydrocarbons
USACE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey
VOC	volatile organic compound

Figure 3-3.

SWMU 8 Vicinity Map / Fort Bragg, NC