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EPA Superfund
Record of Decision:

ABERDEEN PROVING GROUND (EDGEWOOD AREA)
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BEACH POINT TEST SITE
ABERDEEN PROVING GROUND, MARYLAND
RECORD OF DECISION

Directorate of Safety, Health and Environment
Environmental Conservation and Restoration Division
Installation Restoration Program
U.S. Army Garrison Aberdeen Proving Ground, Maryland

SEPTEMBER 1997

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1.1 SITE NAME AND LOCATION

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Aberdeen Proving Ground (APG), Maryland

1.2 STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for the Beach Point Test Site. The remedial action was developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986 (CERCLA), and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the administrative record for this site.

The Maryland Department of the Environment (MDE) has not contested the Technical Impracticability (TI) Waiver for this site, and thus has acknowledged the ability of the Army and the U.S. Environmental Protection Agency (USEPA) to waive Applicable or Relevant and Appropriate Requirements (ARARs) for groundwater. Consequently, the MDE has concurred with the selected remedy.

1.3 ASSESSMENT OF THE SITE

Recent sampling of this site's surface soils, subsurface soils, and offshore sediments have found little evidence of elevated chemical concentrations when compared to off-site background levels. One soil boring indicated an elevated concentration of 1, 1,2,2-tetrachloroethane (PCA) at 14 feet below the ground surface. Sampling results also indicated contamination of the surficial aquifer with dense non-aqueous phase liquids (DNAPLs). This groundwater is toxic to human health and the ecological receptors, and modeling has shown that groundwater is discharging into the Bush River. Dilution and other attenuation processes (e.g., advection, dispersion, sorption, etc.), however, appear to result in nontoxic concentrations in the surface waters. For example, groundwater discharge from the Beach Point surficial aquifer is likely diffused over a relatively large area, thus contributing to the dispersion of the contamination prior to discharge into a large volume of surface water. The ecological and human health risk assessments at this site found no adverse effects to human and ecological receptors, however, uncertainties with respect to the environment exist for some chemical concentrations in The Bush River. Implementing the response action selected in this ROD will provide sufficient future protection to public health, welfare, and the environment.

1.4 DESCRIPTION OF THE SELECTED REMEDY

Based on the site assessment, the Army and USEPA developed response actions which primarily focused on the contaminated groundwater. However, because of the technical impracticability associated with remediating and/or containing the DNAPL contamination at this site, the selected remedy for this site does not involve groundwater treatment or containment. In addition, the human health and ecological risk assessments found no unacceptable levels of risk associated with this site. Thus, the final remediation of the Beach Point Test Site involves the use of institutional controls. In order to account for the uncertainties with respect to the environment associated with some chemical concentrations in the Bush River, a monitoring program involving the sampling of affected media will be conducted.

Institutional controls, or use restrictions, include: 1) the posting of signs prohibiting unauthorized excavation and installation of additional groundwater wells; 2) the prohibition of groundwater use in order to prevent exposure to the contaminated groundwater; 3) inputting these restrictions into APG's Geographical Information System (GIS) which is utilized in the development of APG's Real Property Master Plan; and 4) incorporating these restrictions/prohibitions into any real property documents necessary for transferring ownership from the Army, in the unlikely event that the Army sells this property. The real property documents would also include a discussion of the National Priorities List (NPL) status of this site, as well as a description of the groundwater and very limited soil contamination at this site. The final wording, and the location and number of posted signs will be determined during the workplan development phase and through negotiations with USEPA and MDE. Authorization to excavate soil and/or install groundwater wells will require testing and monitoring in order to ensure worker safety. In addition, the Director of the Directorate of Safety, Health and Environment (DSHE) will certify to USEPA on an annual basis that there have been no violations of these prohibitions. If a violation has occurred, a description of the violation and corrective actions to be taken will be provided.

Monitoring of the Bush River will involve the sampling and analysis of affected media (such as sediments and surface water) at locations within the projected groundwater plume beneath the Bush River. Chemical analyses and bioassessments of these samples could be conducted; however, the specifics of the monitoring program (i.e., media sampled, target analytes, number of samples, location and frequency of samples, and

deliverables) will be determined through discussions and negotiations with USEPA and MDE during the workplan development phase.

1.5 STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment and is cost-effective. In addition, a TI Waiver from some Federal and State ARARs has been justified and has been approved by USEPA (see Appendix J, Focused Feasibility Study (FFS), Final Beach Point Test Site FFS Technical Impracticability Evaluation). ARARs to be waived are the Federal Safe Drinking Water Act Maximum Contaminant Levels (MCLs) and Maximum Contaminant Level Goals (MCLGs) (40 CFR 141.11-12, 141.50-51, and 141.61-62), which were adopted by the State of Maryland in Code of Maryland Regulations (COMAR) 26.04.01 Regulation of Water Supply, Sewage Disposal, and Solid Waste. Other ARARs to be waived are as follows: Annotated Code of Maryland, Title 9, Subtitle 3, Water Pollution Control, Sections 9-302 and 9-322; and Annotated Code of Maryland, Title 4, Subtitle 4, Water Pollution Control and Abatement, Section 4-402.

This remedy utilizes permanent solutions as currently available to the maximum extent practicable for this site. However, because treatment of the principal threats of the site was not found to be practicable, this remedy does not satisfy the statutory preference for treatment as a principal element.

Because this remedy will result in some hazardous substances remaining on-site (in the surficial aquifer) above health-based levels, a review will be conducted within 5 years after commencement of the long-term monitoring program to ensure that the remedy continues to provide adequate protection of human health and the environment.

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2.0 DECISION SUMMARY

2.1 SITE NAME, LOCATION, AND DESCRIPTION

APG is a 72,000-acre Army Installation located in southeastern Baltimore County and southern Harford County, Maryland, on the western shore of the upper Chesapeake Bay (Figure 1). The installation is bordered to the east and south by the Chesapeake Bay; to the west by Gunpowder Falls State Park, the Crane Power Plant and residential areas; and to the north by the Bush River. The Edgewood Area of APG (APG-EA) lies to the west of the Bush River and The Aberdeen Area lies to the east of it. Elevations within APG-EA range from sea level near large rivers to approximately 40 feet above mean sea level at several of the highest locations. The APG-EA is listed on the NPL, which is USEPA's list of hazardous substance sites in the United States that are priorities for long-term remedial evaluation and response.

The Beach Point Test Site is a 6.9-acre peninsula located in APG-EA. It is located approximately 2 miles south of the APG-EA's northern boundary and nearby populations. As seen in Figure 1, the Beach Point Test Site lies at the convergence of the Bush River and Kings Creek. The Bush River is one of the major estuarine channels on the western shore of the Chesapeake Bay. Kings Creek is a major tributary of the Bush River, and these two surface water bodies drain the majority of the areas at APG-EA. Kings Creek forms the northwestern boundary of the Beach Point Test Site, while the Bush River borders the Beach Point peninsula to the northeast and southeast. The Bush River is frequently used for fishing and other recreational purposes, whereas Kings Creek is closed to the public and used primarily for fisheries and wildlife management support functions. The area southwest of the Beach Point Test Site is occupied by a wastewater treatment plant and several vacant structures, all of which are part of the Canal Creek Study Area.

The Beach Point Test Site contains a gravel access road, an office trailer to support restoration activities, seven concrete building pads, and a steel rocket fuel fire suppression burn pan of approximately 16 square feet (Figure 2). The remainder of the site is grass- and shrub-covered and partially forested with several species of deciduous hardwoods. Subsurface features at the site include a series of drainage pipes that discharge to both Kings Creek and the Bush River and to the land surface, evidence of a French drain, and other subsurface manmade features. A marshy, vegetated area occupies the northernmost portion of the peninsula and a portion of the Kings Creek shoreline. In addition, a series of drainage swales and erosional gullies are located along the Kings Creek shoreline. Topographic relief is slight at the site, except for the Kings Creek and Bush River shorelines, which are characterized by steep (8- to 12- foot high) erosional slopes. The center of the Beach Point peninsula is approximately 14 feet higher than the shoreline; therefore, site elevations range from 0 feet to 14 feet above the site datum (National Geodetic Vertical Datum). Prior to the promulgation of current regulations concerning shoreline erosion control, construction debris was deposited as rip-rap along the Bush River shoreline.

Sands and silts underlay the Beach Point peninsula to a depth of 65 feet. The groundwater in this surficial aquifer is slightly brackish and the groundwater flow is highly influenced by both high and low tides. This surficial aquifer is underlain by a continuous clay confining layer (i.e., the Upper Confining Unit) which is

estimated to be 80 to 100 feet thick. As seen in Figure 3, this confining layer dips to the southeast following the regional trend. At Beach Point, low conductivity silts predominate on the northwest side and neck of the peninsula, thereby mitigating contaminant transfer in those directions. The higher conductivity sands at Beach Point predominate on the eastern and southeastern side of the peninsula, but they discontinue in the offshore regions of the Bush River. In summary, the surficial aquifer at Beach Point eventually discharges into the Bush River. Although this groundwater resource currently is not used for drinking water, its natural yield and quality render it a potential drinking water resource. (Thus, this aquifer has been classified as a IIB aquifer by the State of Maryland. However, even if this groundwater resource were not contaminated with DNAPLs from historical activities at this site, the brackish nature of this groundwater would necessitate significant amounts of treatment prior to use as drinking water.)

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2.2 SITE HISTORY AND ENFORCEMENT ACTIVITIES

2.2.1 History of the Beach Point Test Site

APG was established in 1917 as the Ordnance Proving Ground and was designated a formal military post in 1919. Testing of ammunition and materiel, and operation of training schools began at APG in 1918. Prior to World War II, activities at APG were characterized by research and development and large-scale testing of a wide variety of munitions, weapons, and materiel. Just before and during World War II, the pace of weapons, munitions, and materiel development increased, and the number of personnel at APG exceeded 30,000. Similar but smaller-scale increases in munitions and materiel development and testing activities at APG occurred during the Korean and Vietnam Wars.

Historical documents, aerial photography, and interviews with knowledgeable personnel reveal that several operations took place at the Beach Point Test Site from the World War II era to the 1970's. The first recorded operations at the site involved the field testing of one semi-permanent and two mobile process plants used to develop and test the impregnation of military clothing. (Clothing impregnation was needed to protect soldiers from the effects of chemical warfare agents.) Each plant operated for a period of approximately 1,000 hours from March through May 1943. Associated with each plant was a small laboratory.

As seen in Figure 2, the clothing impregnation plants roughly were located in the central portion of the Beach Point peninsula. Specifically, the semi-permanent impregnation plant was probably located at the site of the largest concrete pad in the center of the peninsula. The two mobile units, M1 and M2, likely flanked the semi-permanent plant. The semi-permanent plant utilized either the M1 or M2 process.

The M1 plant used a solvent-based process and the impregnite CC2 (i.e., 2,4,6-trichlorophenyl urea) as the active protective agent that reacts with and destroys the effectiveness of blister gas vapors and droplets. PCA was used as a solvent to carry the protective chemicals to the cloth fibers, and was later recovered for reuse. A chlorinated paraffin binder was added to retain (fix) the CC2 in the fabric.Three thousand pounds of clothing could be impregnated in a 24-hour period at the M1 plant.

The M2 plant used a water emulsion consisting of the impregnite XXCC3, polyvinyl alcohol (an emulsifier and dispersing compound), chlorinated paraffin, a dye, and water. XXCC3 is formed by mixing 10 parts CC2 to 1 part zinc oxide. The M2 plant was capable of processing 4,000 pounds of clothes within a 24-hour period.

Monochlorobenzene was used in large quantities in the M1 laboratory for the testing of CC2. PCA was used in the M2 laboratory in order to test the XXCC3 for CC2.

According to the APG-EA Resource Conservation and Recovery Act (RCRA) Facility Assessment (RFA) (U.S. Army Environmental Health Agency (USAEHA), 1989), PCA losses at the impregnation plants would have been primarily due to evaporation. Additional releases could have been due to spillage or leakage as well as from direct discharge of off-specification batches to surface water. Dirty or spent solvents were also discharged from laboratory sinks to the ground.

Testing of fire and vapor suppression methods for liquid rocket fuels was conducted in the northern portion of Beach Point from 1963 to 1964. A typical procedure involved mixing propellants (e.g., hydrazine and red fuming nitric acid) and an oxidizer (e.g., nitrogen tetroxide) in a steel burn pan, and then attempting to suppress the resultant flame with a water deluge or mist. During the 1970's, small quantities of explosive mixtures and compounds also were tested in this part of Beach Point. Examples of explosives that may have been tested include trinitrotoluene (TNT), tetryl, RDX, and HMX.

Other operations at the Beach Point Test Site included test firing of 4.2-inch mortars during the 1940's, storage of small quantities of chemical warfare agents (nerve agents) in Building E3990 at the northern end of the peninsula, and storage of smoke generator fog oil at a drum/tank storage rack on the southernmost portion of the site.

2.2.2 History of Site Investigations and Enforcement Activities

Several investigations conducted in the Canal Creek Study Area have included or focused on the Beach Point Test Site. USAEHA conducted an assessment of surface waters throughout APG-EA during July 1977. This assessment included four locations in Kings Creek. Major findings of the study included evidence of severe nutrient overloading to Kings Creek; significant contamination of sediments with mercury, silver, and zinc, and elevated levels of cadmium, copper, mercury, and zinc in clam, fish, and crab populations.

In 1985, USAEHA conducted a study to investigate the presence and biological effects of priority pollutants in water, sediment, fish, and macroinvertebrates (i.e., small crustaceans, insect larvae, etc.) in Canal, Kings, and Watson Creeks. Three sampling stations were established in each creek and a four-phase sampling program was implemented which encompassed surface water, sediment, fish, and macroinvertebrates. The program included four rounds of surface water sampling for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), metals, pesticides, polychlorinated biphenyls (PCBs), and nutrients: two rounds of sediment sampling for metals, pesticides, and PCBs; one round of fish tissue residue analysis for metals, pesticides, and PCBs; and one round of macro invertebrate sampling for species diversity. Analytical results for the Kings Creek sampling events indicated the presence of the following contaminants: 1) SVOCs (i.e., phthalates, dinitrotoluene) and metals (most notably copper, lead, and zinc) in surface water; 2) metals, pesticides and 2,4,6-trichlorophenyl urea in sediments; and 3) chlordane, DDT, PCBs, mercury, selenium, and zinc in fish tissues. Macroinvertebrate community diversity was considered intermediate to poor, however, diversity indices showed downstream improvement from the headwater area of Kings Creek to the Beach Point Test Site.

USAEHA conducted another study in July 1986 which evaluated the presence of APG-related contaminants in sediments of receiving water bodies in proximity to APG, and the diversity of the macroinvertebrate community in these sediments. The sampling included three locations within Kings Creek. Sediment samples were analyzed for nutrients, metals, pesticides, and PCBs. Macro invertebrate species (i.e., small crustaceans, insect larvae, worms, clams, pill bugs, etc.) were collected and taxonomically classified at all locations. The study reported that sediment samples from Kings Creek and other APG-EA sampling locations contained moderate to high concentrations of arsenic, chromium, and lead. Several chlorinated pesticides were present at low levels, and PCBs were not detected in samples from Kings Creek. The natural variability in macroinvertebrate diversity masked any possible minor impacts on the biotic community; therefore, USAEHA was unable to draw conclusions about macroinvertebrate species diversity in this study.

Also in 1986, the Army contracted with the United States Geological Survey (USGS) to conduct an investigation of the groundwater, soil, and surface water at Beach Point as a part of the USGS Canal Creek Study (Lorah and Clark, 1996). During this investigation, the USGS installed six groundwater monitoring wells at the Beach Point Test Site. Sampling and analysis indicated the presence of VOCs, SVOCs, metals, and inorganics, in the groundwater. The surficial aquifer was found to contain PCA, trichloroethene (TCE), and other chlorinated VOCs. Chlorinated VOCs were detected at the highest concentrations in wells CC-33A and CC-33B, with the deeper well (33B) exhibiting the higher concentration (maximum 9,480 Ig/L of PCA). Zinc, copper, nickel, and silver concentrations also may have resulted from site operations. Iron and manganese concentrations tended to be relatively higher in wells CC-33A and CC-33B than in the other wells (e.g., CC-32 and CC-34), indicating reducing conditions possibly resulting from organic contamination. Analytical results for the surface soil samples detected the presence of several common soil inorganics (i.e., iron, manganese, calcium, magnesium, sodium, and arsenic), organic halides, and trichlorofluoromethane. The metals detected in surface water at concentrations above background included aluminum, cadmium, iron, lead, manganese, mercury, and zinc. Iron, manganese, and lead were detected at concentrations above background at all surface water sampling locations. Zinc, mercury, and cadmium were detected at above background levels in surface water samples from the Kings Creek shoreline of Beach Point. The USGS report also stated that PCA and other chlorinated VOCs primarily were found in two surface water samples; however, these concentrations were well below the relevant Ambient Water Quality Criteria (AWQC) (USEPA, 1986). It should be noted that current standard operating procedures and protocols for collecting surface water data differ from those used by USGS for this study; therefore, these results should be used for making qualitative rather than quantitative statements today. These data were not used to make comparisons to existing standards and risk levels.

The USAEHA RFA (1989) contains detailed information on the activities conducted at Beach Point and a summary of data on solid waste management units (SWMUs) in the Kings Creek drainage area, including waste types and quantities, contaminant behavior, migration pathways, and recommendations for further study. The RFA does not contain any Beach Point environmental sampling data.

ICF Kaiser Engineers (a contractor for the Army) conducted a preliminary baseline risk assessment of the

Canal Creek Study Area between October 1989 and January 1991. This preliminary assessment involved the review and analysis of existing data, and covered the Beach Point Test Site as well as other areas in this study area. ICF concluded at that time that it was not possible to fully evaluate potential human health risks with the available data. In addition, ICF also concluded that acute and chronic toxicity from contaminants in Canal Creek probably had affected the composition and structure of the resident aquatic communities, and that terrestrial wildlife feeding in Canal Creek appeared to be at risk from dietary exposure to heavy metals. It should be noted that the findings from this preliminary analysis were not definitive, and that additional investigations were warranted in order to determine the actual risk to human health and environment in the Canal Creek Study Area.

In September 1993, the Army conducted a removal action at the former drum rack area of The Beach Point Test Site. Activities included the removal of four overpack drums containing fog oil, an empty 500-gallon aboveground storage tank, a cinder block wall, and miscellaneous debris. Analytical results for the composite soil sample taken at the site revealed detectable levels of metals (in parts per million (ppm)), VOCs (in parts per billion or (ppb)), and pesticides (in ppb). One analyte, beryllium, was detected at a level which exceeded proposed RCRA Corrective Action Standards. Complete results from the analytical program are tabulated in the FFS prepared for the Beach Point Test Site.

During 1994 and 1995, the Army more fully characterized Beach Point through a series of environmental sampling events, including soil gas sampling around possible source areas, sediment sampling in areas of suspected release or discharge near the shorelines, surface soil sampling in the top 6 inches, subsurface sampling from 6 inches to the top of the water table, and sampling of the surficial aquifer groundwater. In addition to environmental sampling, aquifer tests were performed on all wells, tidal influence was measured, and geophysical surveys were conducted.

The Beach Point Test Site has never been the subject of any CERCLA enforcement activities.

2.3 HIGHLIGHTS OF COMMUNITY PARTICIPATION

The FFS for the Beach Point Test Site was finalized in June 1996. The Proposed Plan and The TI Waiver were finalized and released to the public on May 7, 1997, initiating a 45-day comment period. These documents, which are included in the administrative record for Beach Point, have been made available to the public at the Harford County Public Library (both the Aberdeen and Edgewood Branches) and the Miller Library at Washington College in Chestertown, Maryland.

The notice of availability of the Proposed Plan was published in several local newspapers in Harford, Baltimore, Kent, and Cecil counties. In addition, a story appeared in the APG News. A public meeting was held at the Edgewood Senior Center in Edgewood, Maryland on May 20, 1997 to inform the public of the preferred alternative and to seek public comments. At this meeting, representatives from APG, USEPA, and MDE discussed their position with respect to the preferred alternative. Fact sheets which included a comment form were sent to approximately 2,590 residents of the aforementioned counties. Responses to the comments received during this 45-day period are included in the Responsiveness Summary (see Section 3.0 of this document).

2.4 SCOPE AND ROLE OF ACTION

The final remedial action at the Beach Point Test Site represents one component of a comprehensive environmental investigation and clean-up action currently being performed at APG to comply with CERCLA requirements. This ROD primarily addresses the contaminated groundwater of the surficial aquifer at this site, but also addresses the minimal soil contamination and any possible uncertainties associated with contamination of the Bush River. According to the Baseline Risk Assessment (BLRA) conducted in 1995, no unacceptable levels of risks to human health and the environment are posed by the groundwater, sediments, surface soil, subsurface soil, and surface water at this site. The purpose of this remedial action, however, is to ensure that future potential exposures to the contaminated groundwater and soil do not occur, and that any adverse changes in risk to the environment can be detected through the monitoring of the Bush River (i.e., potentially including but not limited to sampling and analysis of the surface water and sediments).

Because of the technical impracticability associated with remediating the DNAPL contamination in the surficial aquifer to all clean-up standards and/or containing the DNAPL zone, USEPA has approved a TI Waiver for this site. Thus, the selected remedy of Institutional Controls utilizes permanent solutions as currently available to the maximum extent practicable for this site. Because treatment of the principal threats of the site was not found to be practicable, this remedy does not satisfy the statutory preference for treatment as a principal element.

2.5 SUMMARY OF SITE CHARACTERISTICS

One objective of the study of the Beach Point Test Site was to evaluate the potential on-site sources and

whether releases from these sources to the environment have occurred with lasting impact. From existing records, it was concluded that activities associated with the clothing impregnation operations have impacted the site soils and groundwater more extensively than the activities associated with the drum rack area or the rocket fuel fire suppression testing area. Potential source areas also were identified from site reconnaissance and aerial photography interpretation of historical surface features. Geophysical survey techniques were used to identify subsurface features such as pipes, trenches, drains, and fill areas as potential release points. These subsurface conduits could serve as potential migration pathways for contaminants. Geophysical surveys, soil gas surveys, soil sampling, and excavations were performed in order to determine whether any underground storage tanks (USTs) at the Beach Point Test Site were present; no USTs were found.

As previously stated, the nature and extent of contamination at the Beach Point Test Site was investigated through soil gas surveys and extensive sampling of groundwater, surface soil, subsurface soil, and sediments in 1994 and 1995. The sampling locations for this investigation were selected by evaluating the locations of historical activities and likely release points. The following discussions summarize the results of these investigations.

2.5.1 Soil Gas Surveys

Active soil gas surveys were taken near many of the concrete pads, the suspected location of an UST, and in the southern-most area of the peninsula near the site of the 1993 removal action. These surveys investigated the upper 4 feet of the vadose zone. (The vadose, or unsaturated, zone is between the land surface and the water table. The pore spaces in this zone contain water at less than atmospheric pressure, as well as air and other gases.) Results indicated that most of the soil gas in the area of the concrete pads and suspected UST likely was associated with petroleum contamination rather than the variety of chlorinated solvents that were used in past operations. There was an indication that minor amounts of chlorinated VOCs were present in soil vapors in the area of former impregnation operations; however, the results did not indicate the presence of a contaminant source within the soils.

2.5.2 Surface Soil

Fifteen surface soil samples from 13 locations were collected at the Beach Point Test Site in 1995. See Figure 4 for these locations as well as the analytical results of significant detections in these samples. For a complete listing of analytical results for both inorganic and organic compounds, refer to. Table 1. Generally, these samples represent the soil chemistry in the top 6 inches of the soil. In addition, off-post soil sampling conducted by ICF Kaiser Engineers for the Reference Sampling and Analysis Program (U.S. Army Environmental Center (USAEC), 1995) provided background soil chemistry data (i.e., inorganics, polynuclear aromatic hydrocarbons (PAHs), phthalates, pesticides, PCBs, dioxins, furans, and radioactive isotopes) for comparison. The findings of these soil sampling efforts are summarized as follows.

- Six inorganic constituents exceeded the maximum concentrations of the background soils. These are calcium, lead, magnesium, mercury, selenium, and nickel.

- The maximum arsenic concentration at Beach Point did not exceed the maximum concentration of background soils, but it exceeded the carcinogenic level established by USEPA Region III as the Risk-Based Concentration (RBQ for industrial soils.

- VOC detections were found at five surface sample locations; SO3N006, 007, 008, 009, and 011. The highest VOC concentration was found at sample location SO3N008 (e.g., 124 Ig/kg of styrene). Acetone was found in five surface soil samples taken from four sampling locations, with concentrations ranging from 3.7 to 20 Ig/kg.

- The following VOCs also were detected in surface soil samples: chloroform, PCA, toluene, TCE, and methylene chloride. Methylene chloride detections corresponded to several sampling locations, but these detections always were found in blanks and therefore likely resulted from laboratory contamination. Detections of chloroform, PCA, toluene, and TCE were below approximately 5 Ig/kg.

- PCA and TCE were found at sampling location SO3N007, near the smaller concrete pad at the location of the former impregnation operations. TCE was not detected in a duplicate sample of soil from that same location. PCA detections were below 5 Ig/kg, and TCE was detected at 3.14 Ig/kg.

- The Reference Sampling and Analysis Program (USAEC, 1995) did not analyze off-post soils for VOCs; therefore, comparisons between Beach Point and off-post surface soils could not be made for these types of compounds. None of the Beach Point organic concentrations exceeded the RBCs.

The surface soil contamination at this site is insignificant when compared to off-site background levels. In addition, the BLRA found no unacceptable levels of current or future risk to human health and the environment from exposure to these soils.

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2.5.3 Subsurface Soil

Subsurface soil chemistry was investigated using numerous soil borings at The Beach Point Test Site from a depth of 6 inches to the top of the water table. No background subsurface soil samples were collected as part of the Reference Sampling and Analysis Program (USAEC. 1995), and there is no other available background data for subsurface soils that can be used as a basis for comparison to this site. Figure 5 illustrates the locations of most of the soil borings at the Beach Point Test Site, as well as the analytical results for VOCs detected in these samples. The analytical results for both inorganic and organic concentrations included in Tables 2 and 3 are summarized as follows,

- Aluminum, barium, iron, magnesium, manganese, potassium, and zinc were detected in all samples. Vanadium and arsenic were detected in almost every sample (i.e., 20 out of 21). At least half of the samples contained calcium, chromium, cobalt, lead, copper, and/or nickel. Arsenic exceeded its carcinogenic industrial soil RBC in only two samples, and the arithmetic mean concentration was less than the RBC.

- Traces of pesticides and related compounds (e.g., 2,4-D, 2,4,5-T, Silvex, DDT, DDD, DDE, and Endrin) and dioxins (e.g., hexachlorodibenzodioxin (HCDD) and octochlorodiberizodioxin (OCDD)) were detected in a few subsurface soil samples at concentrations ranging from 0.0002 to 0.0 166 mg/kg. The OCDD detection very likely results from laboratory contamination, but the pesticide detections are found at regional background concentrations and therefore are likely valid.

- Concentrations of bis(2-ethylhexyl) phthalate, butylbenzyl phthalate, and di-n-butyl phthalate were commonly detected in the subsurface soils at 0.023 to 1.2 mg/kg. Almost every sample analyzed contained at least one of the above compounds. These detections may likely result from laboratory contamination.

- PCA and TCE concentrations were detected near the site of the former clothing impregnation operations. Aside from the aforementioned phthalate concentrations (which likely result from laboratory contamination), PCA was detected at the highest concentration for any organic compound (i.e., maximum concentration is 770 Ig/kg at approximately 14 feet below the ground surface). No detections of organic compounds exceeded their RBCs.

The subsurface soil contamination at this site is insignificant when compared to the applicable industrial soil RBCs. In addition, the human health risk assessment screened out this media from analysis because all contaminant concentrations were below industrial soil RBCs and/or reference screening concentrations. Regardless, people could be exposed to this subsurface soil contamination through soil excavation activities. The chosen remedial action for this site (Institutional Controls) will prohibit unauthorized excavation and groundwater well installation, and will therefore mitigate potential exposures to these contaminants.

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TABLE 2. Subsurface Soil Chemistry-- Detected Inorganics (1995)

Sample ID	SB3N001A	SB3N002A	SB3N003A	SB3N004A	SB3N005A	SB3N006A	SB3N007A	SB3N008A	SB3N011A	SB3N011D	SB3N012A	SB3N013A
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Aluminum	4970 J	6530 J	4090 J	3230 J	2340 J	10600 J	4210 J	3010 J	1800 J	1850 J	3020 J	2850 J
Arsenic	2.7	2.3	1.5 J	2.6	1.1	5.7	1.3 J	1.3 J	1.1 J	0.44 J	0.92 J	2.1 J
Barium	15.9 J	17.6 J	20.0 J	11.6 J	11.0 J	33.0 J	18.0 J	10.8 J	5.2 J	4.6 J	15.1 J	13.6 J
Beryllium	0.22 J	0.25 J	0.43 J			0.39 J					0.25 J	0.39 J
Cadmium												
Calcium	95.2 K	41.7 K	74.2 K	53.3 K	136 K	226 K	59.7 K	78.2 K	59.4 B	36.4 B	190 B	81.6 B
Chromium	7.2	10.7	7.2	4.5	5.0	20.5	7.2	6.0	3.0 B	1.9 B	4.9	6.0
Cobalt		4.2 J				4.9 J						3.2 J
Copper	4.0 J	6.4	3.8 J			8.4	4.5 J					6.1 J
Iron	10200 J	14200 J	10000 J	7020 J	3800 J	21800 J	9910 J	5690 J	3000	2860	19800	16600
Lead	4.0 J	4.4 J	7.9 J	5.9 J	3.2 J	18.6 J	3.9 J	3.4			2.8 B	3.6 B
Magnesium	514 K	774 K	1150 K	737 K	494 K	1570 K	995 K	760 K	268 J	302 J	844 J	596 J
Manganese	38.4 J	71.5 J	51.9 J	68.2 J	17.6 J	69.5 J	33.9 J	25.9 J	51.7	29.7	20.5	47.4
Mercury	0.06 J	0.06 J										0.06 J
Nickel		6.5 J	7.6 J	6.9 J		8.3 J		5.5 J			5.2 J	
Potassium	381 J	476 J	490 J	318 J	318 J	553 J	343 J	402 J	214 J	204 J	669 J	295 J
Silver												
Sodium											293 J	141 J
Vanadium	12.1	11.8	8.3J	5.1 J		31.1	7.1 J	4.1 J	3.0 J	2.5 J	7.3 J	7.8 J
Zinc	14.2	28.0	20.9	17.2	13.3	34	20.7	16.5	6.7	8.8	16.2	12.9

TABLE 2. Subsurface Soil Chemistry-Detected Inorganics (1995)
(continued)

Sample ID	SB3N014A	SB3N015A	SB3N016A	SB3N017A	SB3N029A	SB3N030A	SBR032BA01	SBR032BA02	SBR033BA01	SBR033BA02
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Aluminum	4860 J	4290 J	1030 J	722 J	6410	6220	9870	1070	10600	2400
Arsenic	2.5	2.3 J	1.4 J	1.6 J	2.7 B	5.3 K	4.4 L	1.1 JL	3 L	1.1 JL
Barium	18.0 J	14.9 J	5.7 J	6.4 J	13.2 J	17.0 J	45.9 L	5.4 JL	36.6	11.2 J
Beryllium	0.30 J	0.30 J			0.24 J	0.50 J				
Cadmium	0.64 J									
Calcium	88.5 B	118 B	99.9 B	93.4 B	629 J	768 J	839	74.3 J	3010	71.6 J
Chromium	8.4	7.2	2.8 B	3.5 B	11.8	20	17.9 L	2.2 L	17.5	3.3
Cobalt	2.7 J	3.4 J			3.6 J	4.7 J	3.9 J	2.5 J	3.6 J	1.7 J
Copper	3.9 J	5.0 J			6.1 J	14.3 J	13.4 L	2.1 JL	6.9	2.6 J
Iron	9690	8010	1790	2360	11300	18000	16300	1570	19400	4340
Lead	3.7 B	5.0 B	2.0 B	1.6 B	23.3 K	9.5 K	65.3 J	1.6 J	7.2	1.7
Magnesium	936 J	992 J	265 J	146 J	1620	1390 J	2090	224 J	2270	603 J
Manganese	28.8	33	11.1	8.4	115	106	147 L	33.5 L	135 K	23 K
Mercury							0.08 B		0.08 B	
Nickel	6.6 J	4.9 J			7.3 J	10.6 J	16.8 L		8.5	2.9 J
Potassium	588 J	495 J	180 J	136 J	762 J	730 J	463 J	154 J	321 J	292 J
Silver	0.18 J									
Sodium		75.7 J	111 J		751 J	1150 J	368 J	448 J	367 JK	399 JK
Vanadium	9.4 J	9.9 J	3.4 J	3.8 J	14.3	32.8	30.3 L	2.4 JL	29	3.7 J
Zinc	18.3	18.8	5.7	51 J	20.3 J	29 J	79.4 L	4.6 L	23.3	116

Note: Each sample concentration is followed by EPA Region III data validation qualifiers
EPA Region III Data Qualifiers
B = detected in associated QC blank
J = estimated value
K = biased high
L = biased low
Blank means below detection or analysis not performed.

TABLE 3. Subsurface Soil Chemistry--Detected Organics (1995)

Sample ID	SB3N001A	SB3N002A	SB3N003A	SB3N004A	SB3N005A	SB3N006A	SB3N007A	SB3N008A	SB3N009A	SB3N011A	SB3N011D	SB3N012A	SB3N013A
Units	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
2,4-D				8.56 J	8.87 J		16.6						
Aceton	107.0 J			28.7 J		178.0 J	34.9 J	32.5 J			15 B	10 BJ	
Benzoic Acid			26.3 J										
Trichloromethane (chloroform)										2 J			
Methylene Chloride	9.48 B	9.87 B	9.74 B	9.74 B	6.59 B	6.89 B	5.64 JB	6.25 JB	7.34 B	6 BJ	5 BJ	6 BJ	5 BJ
2-Butanone											4 J	3 J	
Toluene										2 J	3 J	7 J	
Styrene											4 J	12	
4,4'-DDD						4.55 J							
4,4'-DDE						6.88 J							
4,4'-DDT						0.53 J					0.72 JP		
Silvex				4.78									11.32 J
Total Phosphorus	68.4	174	92.0	211	82.4	209	105	89.8					
Endrin											0.57 J		
OCDD	0.64		0.28			0.97	0.49						0.32
HCDD						0.23							
butylbenzyl phthalate												130 JB	
bis(2-Ethylhexyl) phthalate			23.2 J							140 JB	230 JB	210 JB	46 JB
di-n-Butylphthalate	361.0 B		357.0 B	429.0 B	412.0 B	416.0 B	370.0 B				77 JB	110 JB	43 J

TABLE 3. Subsurface Soil Chemistry--Detected Organics (1995)
(continued)

Sample ID	SB3N014A	SB3N015A	SB3N015ADL	SB3N016A	SB3N017A	SB3N018A	SB3N019A	SB3N020A	SB3N021A	SB3N022A	SB3N022A DL
Units	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
2,4,5,-T		3.74									
Methylene Chloride	4 BJ	7 BJ	7 BJD	7 BJ							
Acetone	1 BJ	2 BJ				5 BJ	5 BJ				
Tetrachloroethene										2 J	
trichloroethene		6 J	15 JD	2 J						3 J	
1,1,2-trichloroethane		1 J									
1,1,2,2-tetrachloroethane		610 J	770 D	30		13	2 J	9 J	13	440 E	510 D
Toluene		1 J			3 J						
Xylene(total)				3 J							
Chlorethane					6BJ						
4,4'-DDD											
4,4'-DDE											
4,4'-DDT											
Silvex				4.04	9.36 J						
beta-BHC											
alpha-BHC											
Endrin											
OCDD											
butylbenzyl phthalate				110 J	570 J						
bis(2-ethylhexyl)phthalate		57 JB		220 J	95 JB						
di-n-butylphtalate	45 JB	64 JB		53 J							

TABLE 3. Subsurface Soil Chemistry--Detected Organics (1995)
(continued)

Sample ID	SB3N023A	SB3N023ADL	SB3N024A	SB3N025A	SB3N026A	SB3N027A	SB3N028A	SB3N029A	SB3N030A	SB3N032A01	SB3N032BA02	SBR33BA01	SBR033BA02
Units	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
2,4,5,-T													
Methylene Chloride										4.0 JB	6 JB	3 JB	8 JB
Acetone											6 JB	4 JB	
Tetrachloroethene													
trichloroethene	13 J												
1,1,2-trichloroethane													
1,1,2,2-tetrachloroethane	850 E	480 D	76	2 J	6 J								
Toluene													
Xylene(total)													
Chlorethane													
4,4'-DDD								1.4 JP	4.5 J	8.87	140 D		
4,4'-DDE									1.6 J	130	73 D		
4,4'-DDT								5.2 B	3.0 BJ	77			
Silvex													
beta-BHC								1.0 JP					
alpha-BHC									1.3 TP				
Endrin										2.2			
OCDD								2.8 J	3.9 J				
butylbenzyl phthalate													
bis(2-ethylhexyl)phthalate								52 J		210 JB	130 JB	250 JB	770 B
di-n-butylphtalate								1000	1200				

Note: Each sample concentration is followed by EPA Region III data validation qualifiers
EPA Region III Data Qualifiers
B = detected in associated QC blank
D = reanalyzed at a high dilution factor
J = estimated value
K = biased high
P = greater than 25% difference for detected concentrations between the two GC columns
Blank means below detection or analysis not performed

2.5.4 Sediments

Ten sediment samples-from nine locations in close proximity to Beach Point were collected during this investigation (see Figure 6). These samples were collected from both Kings Creek and the Bush River. The results of the sampling and analysis are included in Table 4 and are summarized as follows. Off-post sediment sampling for the Reference Sampling and Analysis Program (USAEC, 1995) provided background sediment chemistry data for comparison, although sediments were not analyzed for VOCs in this USAEC study.

- Of the inorganic compounds, only antimony and silver were detected at levels very near or exceeding maximum background concentrations. Antimony detections ranged from 1.7 to 2.9 mg/kg (at SE3N003, 009, 010, and 011), and the maximum background concentration for this compound was 1.6 mg/kg. Silver was detected in one sample (SE3N011) at 0.54 mg/kg, which approximates the maximum background concentration of 0.58 mg/kg.

- The maximum lead detection (i.e., 17.8 mg/kg) was found in sample SE3N011, taken at the farthest western extent of the study area. This concentration did not exceed the mean background concentration for lead of 27.85 mg/kg.

- Acetone, methylene chloride, toluene, and 1, 1, 1-trichloroethane (TCA) were the only VOCs detected in the sediments. Acetone was detected in one sample (SE3N010) at 44 Ig/kg. Methylene chloride was detected in three samples (SE3N003, SE3N004, and SE3N005) at concentrations ranging from 4.38 to 5.10 Ig/kg. Toluene and 1, 1, 1 - TCA were only detected at sampling location SE3N011 (located at the farthest western extent of the study area) at 11.1 and 1.90 Ig/kg, respectively.

- No RBCs exist for sediments, but the comparison of sediment concentrations to industrial soil RBCs resulted in only arsenic exceeding its carcinogenic RBC at two locations (SE3N008 and SE3N009). The arsenic concentration detected at both of these locations was 5.7 mg/kg. Arsenic was detected at all sediment sampling locations, and the concentrations ranged from 0.6 to 5.7 mg/kg. The arithmetic mean arsenic concentration at Beach Point was 2.3 mg/kg, which is less than the RBC, however.

At the request of MDE, additional sediment sampling in the Bush River was conducted in June 1995 to further evaluate whether groundwater could be detected discharging through the bottom sediments of the Bush River. Five sediment samples were collected from five locations at 50 foot intervals in a line perpendicular to the shoreline at well CCJ-158B (see Figure 6). No VOCs were detected in these sediment samples.

The human health risk assessment screened out sediments from analysis because all contaminant concentrations in this media were less than industrial soil RBCs and/or reference screening concentrations. In addition, the ecological risk assessment found very little evidence of risk to aquatic receptors from exposure to contaminants in the sediments. The selected remedy includes a monitoring program of the Bush River in order to determine whether adverse changes in risk to the environment are occurring at this site. This monitoring program could include, but is not limited to, the sampling and analysis of Bush River sediments and surface water.

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TABLE 4. Sediment Chemistry - Detected Inorganics and Organics
(1995)

Sample No.	SE3N003A	SE3N003D	SE3N004A	SE3N005A	SE3N006A	SE3N008A	SE3N009A	SE3N010A	SE3N011A	SE3N015A
Parameter	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Aluminum	956	841	1800	2400	1710	1090	2930	3200	4090	1750
Antimony		1.8 J					1.8 J	1.7 J	2.9 J	
Arsenic		0.60 J	0.76 J	1.8 J	1.2 J	5.7 L	5.7 L	1.8 J	2.1 J	1.1 J
Barium	4.0 J		6.4 J	11.5 J	5.8 J	4.2 J	5.0 J	11.9 J	24.2 J	6.9 J
Beryllium				0.27 J	0.24 J		0.26 J	0.24 J	0.28 J	0.15 J
Calcium	207 J	83.2 J	124 J	671 J	557 J	1140 J	148 J	315 J	732 J	128 J
Chromium	4.8	3.6	3.2	11.9	5.3	3.6	6.6	7.4	15.7	3.7
Cobalt									4.7 J	2.6 J
Copper				11.0 L				7.6 L	13.7 L	3.2 J
Iron	3940	1510	3690	12300	4070	3840	11500	7310	10900	3560
Lead	6.2 J	3.4 J	2.3 J	12.8 J	2.0 J	7.8 J	7.8 J	9.9 J	17.8 J	5.4
Magnesium	170 J	103 J	473 J	793 J	572 J	479 J	353 J	817 J	1160 J	421 J
Mangenese	35	19.2	32.7	54.7	519	35.6	22.8	97.6	54.9	57
Mercury				0.07 J				0.16		
Nickel				7.5 J				9.3 J	9.5 J	4.4 J
Potassium	214 J	252 J	338 J	338 J	535 J	161 J	404 J	581 J	506 J	221 J
Silver									0.54 J	
Sodium	150 B	124 B	196 B	428 B	516 J	182 B	382 B	405 B	183 B	406 B
Vanadium	10.2 J			16.1			13.5 J	9.1 J	19.5	3.8
Zinc	10.8 J	8.6 K	9.8 K	19.5 K	10.8 K	10.9 K	14.2 K	37.6 K	104	19.3
Units	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
1,1,1-Trichloroethane									1.90 J	
2,4-D	58 J		31.7 J						46.6 J	
Silvex	4.65 J		2.46 J			2.19 J	4.26 J		5.03	
4,4'-DDD	0.110 J	0.070 J					0.86 J	0.54 J	4.53 J	2.2 J
4.4,4-DDT		0.60 J					0. 750 J	5.87		
Acetone							44.0 J			
alpha-BHC										0.69 JP
beta-BHC		0.21 J								1.6 JP
Endosulfan II							0.75 J	5.87		
Methylene Chloride	4.73 J		4.38 J	5.10 J						
OCDD	0.15	0.10		0.38	0.18	0.15	0.32	0.33	0.40	
Toluene									11.1	
Total Phosphorus	317	15.3	45.3	43.1	154	171	133	103	279	

Note: Each sample concentration and is followed by EPA Region III data validation qualifiers.
EPA Region III Data Qualifiers; B = detected in association QC blank. J = estimated value. K = biased high.
L = biased low. P = greater than 25% difference for detected concentrations between the two GC columns.
Blank means below detection or analysis not performed.

2.5.5 Surface Water

Surface water sampling was not performed for this most recent study (in 1994 and 1995) because sediment sampling is a more reliable indicator of whether groundwater discharge from the site is impacting the Bush River. As previously mentioned in Section 2.2.2, surface water sampling was conducted in the Canal Creek Study Area by USGS in 1988 and 1989 (Lorah and Clark, 1996), and some of these results can be used to provide an indication of the general water quality of Kings Creek and the Bush River. Specifically, eight surface water samples from these water bodies were collected by USGS in 1988/89, all during low tide. The results of this study are as follows.

- Concentrations of inorganic constituents in surface water are highly variable in the Canal Creek Study Area, including Kings Creek and the Bush River. On each sampling trip, concentrations varied among the different surface water bodies at different locations. The variable inorganic chemistry can be largely attributed to the tidal nature of the creeks and estuaries and to the varying amounts of groundwater input at the different sampling locations. Refer to Table 4-8 of the FFS for a summary of the detected inorganics in Kings Creek and the Bush River.

- The September 1988 sampling event revealed 21 common inorganic constituents and 2 VOCs (e.g., methylene chloride and TCE) in unfiltered samples of surface water near the Beach Point Test Site. Methylene chloride was detected in all samples, pointing to the possibility that it was introduced as a laboratory contaminant. TCE was detected in two samples, at 3 and 16 Ig/L. See Tables 4-8 and 4-9 of the FFS for summaries of the data collected during the 1988 sampling event.

- During the 1989 sampling event, 18 common inorganic constituents and 18 VOCs were detected in surface water samples near Beach Point. Most of the VOC detections were from two sample locations: one near well CCJ-159B and another from near the western shore of Kings Creek. Of the detected VOCs, carbon tetrachloride, 1,1,1 - TCA, 1,1 - dichloroethane, tetrachloroethene (PCE), and vinyl chloride were detected at the highest concentrations (i.e., 33.5 - 42.5 Ig/L). See Tables 4-8 and 4-9 of the FFS for summaries of the 1989 sampling event.

It should be noted that this sampling and analysis was not conducted under the quality assurance/quality control protocols specified in the Beach Point and Canal Creek Study Area Quality Assurance Project Plan (Jacobs, 1994). Thus, these data only should be used to qualitatively discuss the surface water in the area of the Beach Point Test Site.

2.5.6 Groundwater

Ten groundwater monitoring wells at the Beach Point Test Site were sampled from 1994 to 1995. These wells were spatially distributed over the peninsula as shown in Figures 7 through 11. In addition, these wells were screened at varying depths in order to collect information on the vertical distribution of the dissolved contaminants. Some of the compounds used in historical operations at this site are DNAPLs; therefore, it was anticipated that contaminant concentrations may be found in the lower regions of the aquifer. Moreover, USGS (Lorah and Clark, 1996) found the highest groundwater VOC concentrations in a deeper well. Wells with an "A" designation are shallower wells and are screened from approximately 10 to 30 ft. below ground surface (BGS). Those wells with a "B" designation are deeper wells and are screened from approximately 21 to 60 ft. BGS.

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<IMG SRC 97090L>
<IMG SRC 97090M>
<IMG SRC 97090N>

The results of the sampling and analysis of these groundwater wells are summarized in Tables 5 and 6. In summary, 20 inorganic constituents were detected in the groundwater at this site. Concentrations of antimony (maximum 0.312 mg/L), beryllium (maximum 0.005 mg/L), cadmium (maximum 0.028 mg/L), lead (maximum 0.015 mg/L), and nickel (maximum 0.443 mg/L) exceeded health-based concentrations. Fifteen VOCs were detected in the groundwater samples; however, no specific VOC was found in every well. The VOCs that exceeded 10 Ig/L were methylene chloride, 1,2 dichloroethene (DCE), 2-butanone, TCE, 1,1,2-TCA, PCE, and PCA. Of the detected VOCS, concentrations of vinyl chloride (maximum 1.0 Ig/L), 1,2-DCE, (maximum 340 Ig/L), chloroform (maximum 10.0 Ig/L), TCE (maximum 2,400 Ig/L), 1,1,2-TCA (maximum 150 Ig/L), PCE (maximum 120 Ig/L), and PCA (maximum 22,000 Ig/L) exceeded RBCs.

PCA and TCE were found at the highest concentrations and in the greatest number of groundwater wells at this site; therefore, Figures 7 through 10 describe the lateral and vertical extent of these dissolved plumes.

The highest concentrations of these compounds were found in wells CCJ-158B and CCJ-157B, and both of these wells are screened in the deeper regions of the surficial aquifer near the confining layer. Both PCA and TCE are DNAPLs, and the groundwater data corraborates historical sampling results and the general knowledge of DNAPL behavior in this type of aquifer.

In addition, evaluation of the percent total solubility data for these organic compounds results in an estimation that the DNAPL zone exists in the saturated zone in the deeper regions of the aquifer in both the coarser and finer grained aquifer matrices. The DNAPL zone is likely to be in the form of residual concentrations of DNAPL, left behind in vertical masses as the DNAPL migrated downward, and as pools of DNAPL which have become trapped on low permeability surfaces that are impenetrable to the DNAPL.

Figure 11 presents an approximate delineation of the most likely extent of the DNAPL zone. The DNAPL zone also includes the most likely DNAPL source area, which is the clothing impregnation area. This area is represented on Figure 11 by two pads located just northeast of well nest 33. Note that the DNAPL zone is interpreted as existing in the offshore regions of the Bush River, because gravity flow and the prevailing subsurface geologic interfaces tend to slope in the southeast direction and because the aqueous concentration gradient is increasing in the offshore direction toward the Bush River. (One would expect higher concentrations in proximity to the DNAPL.) Ultimately, just how far the DNAPL zone extends depends upon the amount of mass that was released and where it was released. While there is some evidence that there were releases on shore near the concrete pads, there is a probability that offshore releases could also have occurred.

The migration pathways and final distribution of the DNAPL greatly depend on the heterogeneity of the aquifer materials: as the degree of heterogeneity in the aquifer increases, the likelihood of accurately locating DNAPL decreases. At the Beach Point Test Site, a high degree of stratigraphic and hydrogeologic discontinuity has been identified. As such, it is impractical, if not impossible, to locate all discontinuities (i.e., minor clay lenses, areas of low permeability, thin sand stringers, and depressions in the lower confining layer) that may affect residual and free-phase DNAPL distribution on a localized scale. Subsequently, it is also considered impractical, if not impossible, to accurately determine the location of all of the DNAPL, and hence accurately define the DNAPL zone.

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At heterogeneous sites, Cohen and Mercer (1993) state that the "subsurface DNAPL distribution may defy definition." For all DNAPL sites, Cohen and Mercer (1993) state that "a detailed delineation of the subsurface DNAPL distribution is difficult and may be impractical using conventional site characterization techniques."

Groundwater from the surficial aquifer is toxic to human health and ecological receptors, and concentrations of many VOCs exceed human health RBCs. Because this groundwater is not being extracted for any purpose (i.e., drinking water), no routes of exposure to humans currently exist. According to groundwater modeling conducted by Burton et al. (1994), this groundwater discharges into the Bush River, and dilution and other attenuation processes (e.g., advection, dispersion, sorption, etc.) appear to result in contaminant concentrations in the surface waters at nondetectable and/or nontoxic levels (i.e., below both acute and chronic aquatic life criteria). For example, groundwater discharge from the Beach Point surficial aquifer is likely diffused over a relatively large area, thus contributing to the dispersion of the contamination prior to discharge into a large volume of surface water. The chosen remedial alternative for this site (e.g., institutional controls and monitoring of the Bush River) mitigates any potential future exposure to this contaminated groundwater by prohibiting groundwater use and unauthorized installation of additional groundwater wells. Environmental monitoring of the Bush River will determine whether significant increases in risk are occurring at this site.

2.6 SUMMARY OF SITE RISKS

To assess current and future human health and ecological risks, the Army prepared a BLRA in 1995 which evaluated the potential for adverse effects on human health and the environment associated with actual or potential exposure to site-related chemicals at the Beach Point Test Site. This BLRA was based upon groundwater, surface soil, subsurface soil, and sediment data collected at Beach Point. The BLRA is comprised of a Human Health Risk Assessment (RA) and an Ecological Risk Assessment (ERA)).

2.6.1 Human Health Risk Assessment

The Human Health RA evaluated contaminant concentrations detected in the samples collected during the Remedial Investigation (RI) for this site, the toxicity of these contaminants, and the possible human exposure to these contaminants. Based on this information, conservative estimates of risk were determined following USEPA guidance to ensure that potential health effects were not underestimated. These RA steps

are summarized below.

Chemicals of Potential Concern (COPCs) were selected at this site by evaluating the contaminant concentrations and exposure routes for groundwater, surface soil, subsurface soil, and sediment. COPC identification consisted of comparing maximum contaminant concentrations to the USEPA Region III RBCs, and for inorganics, conducting a statistical comparison of site and reference concentrations.

No routes of exposure to groundwater are possible under current or anticipated future land-use conditions; therefore, COPCs for the surficial aquifer were not selected for quantitative evaluation in the RA. (Rather, a qualitative Human Health RA for the groundwater was conducted which discusses the fact that Beach Point groundwater currently is not used for any purpose, including drinking water, and that future industrial workers probably would not utilize this brackish groundwater.) Subsurface soil and sediment chemical concentrations were compared to industrial soil RBCs and/or reference screening concentrations. All chemicals in both subsurface soil and sediments were below these screening levels; therefore, no COPCs were selected for these media. In the surface soil, the only chemical that exceeded its screening concentrations was arsenic, which was retained as a COPC. The maximum concentration of arsenic in surface soil is 5.1 mg/kg.

The objective of the exposure assessment is to estimate the type and magnitude of potential exposures to the COPC that is present at or migrating from the site. Under the current land-use scenario, exposure pathways evaluated include incidental ingestion and dermal absorption of chemicals in the surface soil by a caretaker and by a trespasser. Under the future land-use scenario, incidental ingestion and dermal absorption of chemicals in surface soils by an industrial worker were evaluated. The future risk to trespassers is identical to those for trespassers under current land-use conditions; therefore, the risk calculations for trespassers were only conducted once but apply to both scenarios.

The purpose of the toxicity assessment is to assess the toxicological hazards of the COPC as a function of the anticipated routes of exposure. Quantitative indices of toxicity include cancer slope factors (CSFs) for chemicals exhibiting carcinogenic effects and reference doses (RfDs) for chemicals exhibiting noncarcinogenic effects. USEPA developed CSFs using conservative assumptions for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. CSFs, which are expressed in terms of reciprocal dose (milligram per kilogram per day) -1 or ([mg/kg-day] -1), are multiplied by the estimated intake of a potential carcinogen, in milligrams/kilogram-day (mg/kg-day) to provide an upper-bound estimate of the excess lifetime cancer risk associated with exposure at that intake level.

The RfDs have been developed by USEPA to indicate the potential for adverse health effects from exposure to chemicals exhibiting noncarcinogenic effects. RfDs, expressed in units of mg/kg-day, are estimates of daily exposure levels for humans, including sensitive individuals, that are likely to be without an appreciable risk of deleterious effects during a lifetime. RfDs incorporate uncertainty factors that help ensure that the RfDs will not underestimate the potential for adverse noncarcinogenic effects. Estimated intakes of chemicals from environmental media in units of mg/kg-day can be compared to the RfD to determine whether adverse noncarcinogenic effects could occur.

The purpose of the risk characterization is to relate exposure estimates to toxicity data in order to estimate potential excess lifetime cancer risks for carcinogens or the potential for adverse effects for noncarcinogens. Excess lifetime cancer risks, which are determined by multiplying the intake level by the CSF, are probabilities that are generally expressed in scientific notation (e.g., 1x10 -6 or 1E-06). An excess lifetime cancer risk of 1x10 -6 indicates the probability that an individual has a one in 1 million chance of developing cancer as a result of site-related exposure to a carcinogen over a 70-year lifetime, under specific exposure conditions. USEPA's acceptable risk range for cancer is 1x10 -6 to 1x10 -4, meaning that there is one additional chance in one million (1x10 -6) to one additional chance in 10,000 (1x10 -4) that a person will develop cancer.

Non-carcinogenic effects are expressed as the hazard quotient (HQ), which is the ratio of the estimated intake of the noncarcinogen to its respective RfD. The hazard index (M) can be generated by adding the HQs for all contaminants within a medium and provides a useful reference point for gauging the potential for adverse effects associated with noncarcinogenic chemicals within a single medium. An HI of less than one indicates that the human population is not likely to experience adverse health effects.

Note that only one COPC, arsenic in surface soils, exists for the Beach Point Test Site Human Health RA; therefore, the HQ is equivalent to the HI in this analysis.

Table 7 and the following discussion summarize both the carcinogenic and noncarcinogenic risks associated with exposures to the surface soils at the Beach Point Test Site.

TABLE 7. Cumulative Risks to Humans at Beach Point
Under Current and Future Land-Use Conditions

Current Land-Use Conditions

Total Cancer Risk

	CARETAKERS	TRESPASSERS
Incidental Ingestion of Soil	8E-08	1E-07
Dermal Contact with Soil	2E-07	2E-07
TOTAL CANCER RISK	3E-07	3E-07

Noncancer Hazard Index

	CARETAKERS	TRESPASSERS
Incidental Ingestion of Soil	<1 (4E-04)	<1 (6E-04)
Dermal Contact with Soil	<1 (9E-04)	<1 (9E-04)
TOTAL HAZARD INDEX	<1 (1E-03)	<1 (2E-03)

Future Land-Use Conditions

Total Cancer Risk

	WORKERS
Incidental Ingestion of Soil	(1E-06)
Dermal Contact with Soil	(3E-06)
TOTAL CANCER RISK	(4E-06)

Noncancer Hazard Index

	WORKERS
Incidental Ingestion of Soil	<1 (6E-03)
Dermal Contact with Soil	<1 (1E-02)
TOTAL HAZARD INDEX	<1 (2E-02)

2.6.1.1 Current Land Use.

Under the current land-use scenario, exposure pathways evaluated include incidental ingestion and dermal absorption of chemicals in the surface soil by a caretaker and by a trespasser.

The cancer risks for both the dermal and ingestion exposure pathways under assumed current land-use conditions were well under the lower bound (i.e., 1 x 10 -6) of USEPA's acceptable risk range. In addition, HIs were less than one, indicating that adverse noncarcinogenic effects are not likely to result from exposures through either pathway.

Cumulative risks were calculated for combinations of pathways when it was considered likely that the same receptor could be exposed via different pathways. Under current land-use conditions, the cumulative risks for both caretakers and trespassers were below the lower bound of USEPA's acceptable risk range for health protectiveness at Superfund sites. The cumulative HIs for caretakers and trespassers were less than one, indicating that noncarcinogenic effects are not likely to occur as a result of combined exposures.

2.6.1.2. Future Land Use.

Under the future land-use scenario, incidental Ingestion and dermal absorption of chemicals in surface soils by an industrial worker were evaluated. The future risk to trespassers is identical to those for trespassers under current land-use conditions; therefore. The risk calculations for trespassers were only conducted once but apply to both scenarios.

Under future land-use conditions, pathway risks were calculated for an industrial worker. The individual pathway and cumulative cancer risks to an industrial worker through ingestion and dermal absorption of chemicals in the surface soil were at the lower end of USEPA's acceptable risk range for health protectiveness at Superfund sites. Both the individual pathway and cumulative HIs were less than one, indicating that noncarcinogenic effects associated with arsenic would not be expected to occur.

2.6.2 Ecological Risk Assessment

COPCs for the ERA were selected at this site by evaluating the contaminant concentrations and exposure routes for groundwater, surface soil, subsurface soil, and sediment. COPC identification for inorganic compounds primarily consisted of statistical comparison of site and reference concentrations. All detected organic compounds were evaluated as possible COPCs. Both organic and inorganic compounds could be eliminated as COPCs if the chemicals exhibited very low toxicities (unless present at extremely high concentrations) or if the chemicals were detected in less than 10% of the samples. Essential nutrients were not selected as COPCs if it was deemed that these compounds were unlikely to adversely affect potential ecological receptors at detected concentrations.

There are a number of uncertainties associated with the ERA, and they should be kept in mind while considering the results of this study. The most apparent uncertainty is associated with extrapolating the potential for adverse effects from individual organisms to populations or communities. The ERA includes assumptions about individual organisms for the determination of adverse effects on terrestrial species that are higher up the food chain. There are also some questions concerning the relevance of the toxicity values utilized in this ERA to the conditions and potential receptors at Beach Point. Many of the toxicity values were derived to be protective of sensitive ecological receptors; however, sensitive species are unlikely to be found in some of the Beach Point habitats.

Based on an analysis of the wildlife species occurring on Beach Point and the COPCs in the environmental media, the following endpoints were selected for evaluation: 1) the potential for adverse effects to terrestrial plant communities from direct contact with surface soil; 2) the potential for adverse effects to terrestrial invertebrate communities (represented by earthworms) from direct contact with chemicals in surface soil; 3) the potential for adverse effects to small mammals (represented by shrews) from ingestion of chemicals that have accumulated in terrestrial invertebrates (represented by earthworms) and from direct ingestion of chemicals in surface soil; 4) the potential for adverse effects to carnivorous birds (represented by robins) from ingestion of chemicals that have accumulated in terrestrial invertebrates (represented by earthworms) and from direct ingestion of chemicals in surface soil; 5) the potential for adverse effects to aquatic life from exposure to chemicals discharging from groundwater to surface water; and, 6) the potential for adverse effects to aquatic life from direct contact with chemicals in sediment.

Terrestrial plant communities were selected for evaluation based on their potential to be exposed to chemicals in surface soil. Results of the ERA indicate that the overall viability of terrestrial plant communities at Beach Point is not being adversely affected by the chemicals in the soil.

Earthworms were selected as the soil invertebrate or terrestrial species most likely to be affected by chemicals in the soil. Toxicity values were not available for any of the organic COPCs and there is

uncertainty associated with the potential for these chemicals to adversely affect soil invertebrates. Of the inorganic COPCs identified for evaluation in the ERA, only mercury has the potential to affect earthworms. The Reasonable Maximum Exposure (RME) concentration of mercury exceeded its Toxicity Reference Value (TRV), giving an Environmental Effects Quotient (EEQ) of 5.3. It was concluded that the potential for adverse effects is localized since the exceedance was highly influenced by one sample having an elevated level of mercury.

Terrestrial vertebrates may also be exposed to chemicals via several exposure pathways on Beach Point. The ERA evaluated the potential for adverse affects to shrews and robins from the ingestion of earthworms and surface soil containing DDT and the metabolites, DDD and DDE. DDTr (i.e., DDT, DDD, and DDE) was selected because of its potential to accumulate to elevated levels in terrestrial food webs. Based on the analysis in the ERA, it was concluded that shrews will not be affected by ingestion of earthworms and surface soil.

The Beach Point ERA indicated that robins could be adversely affected by the ingestion of DDTr in earthworms and surface soil; however, it must be considered that the average DDT and DDE concentrations in the reference samples (collected as part of the Reference Sampling and Analysis Program (USAEC, 1995)) also exceeded concentrations that would result in a risk to robins under the exposure scenario evaluated in the Beach Point ERA. Thus, remediation of Beach Point surface soils is unwarranted because it would not result in a risk reduction to robins (i.e., robins exposed at Beach Point also would be exposed to DDTr at many other locations as well). In addition, the risk to robins at Beach Point may have been overestimated by the use of conservative assumptions in the Beach Point ERA. For example, it was assumed that robins would obtain all earthworms for food from locations at Beach Point that corresponded to the highest expected chemical concentrations at this site (based on locations of historical Army activities).

Based on a qualitative evaluation of the pathways by which aquatic life could be exposed to chemicals in surface water and on the results of a Groundwater Hazard Assessment conducted by Burton et al. (1994), it was concluded that only very limited effects, if any, are likely to occur to aquatic life in Kings Creek or the Bush River from the presence of chemicals in the groundwater discharging into the surface water. If occurring, these adverse effects likely would be localized to the areas around the point of groundwater discharge. Sediment sampling conducted in 1995 at likely areas of groundwater discharge (see Section 2.5.4 and Figure 6) showed no evidence of chemicals being released through sediments.

With respect to potential adverse effects to aquatic receptors from the presence of chemicals in sediment, available TRVs were exceeded by RME concentrations of DDTr, 2-methylnaphthalene, and antimony, indicating the potential for these compounds to cause adverse affects to benthic organisms. However, with the exception of DDT, which just exceeded the Effects Range-Median (ER-M), the RME concentrations of these chemicals remained below the ER-M values. TRVs were not available for several organic chemicals detected in sediment and there is uncertainty associated with the potential for these chemicals to adversely affect benthic organisms.

For the Beach Point Test Site, no endangered or threatened species were identified during the ERA. In addition, no critical habitats have been identified at APG.

2.7 REMEDIATION OF THE BEACH POINT TEST SITE

The site characterization discussed in the FFS indicated the extreme unlikelihood of surface water contamination at concentrations toxic to human health and ecological receptors. In addition, there is little evidence of elevated concentrations of chemicals of concern in sediments, surface soil, and subsurface soil when compared to off-site background levels. The surficial aquifer, however, is contaminated with DNAPLs. With respect to remediating this site, the Army focused on the risk of human exposure at Beach Point, especially through groundwater from the surficial aquifer. The human health risk assessment clarified that there are no routes of exposure to groundwater under current or likely future land-use conditions, and therefore, there is no human health risk associated with this contaminated groundwater. Contaminant transfer from the Beach Point surficial aquifer is mitigated on the northwest side and the neck of the peninsula by low conductivity silts, but groundwater discharges on the eastern and southeastern side at considerably reduced concentrations into the Bush River. That is, dilution and other attenuation processes (e.g., advection, dispersion, sorption, etc.) appear to result in nontoxic concentrations in the surface waters. For example, groundwater discharge from the Beach Point surficial aquifer is likely diffused over a relatively large area, thus contributing to the dispersion of the contamination prior to discharge into a large volume of surface water. Finally, the U.S. Army Center for Health Promotion and Preventive Medicine (on behalf of the Office of the Army Surgeon General) stated that there is little environmental exposure at Beach Point and they believe that human health is protected without any remedial action.

Although no exposure routes to groundwater exist at Beach Point, some groundwater treatment technologies and containment options were evaluated in the FFS. For example, innovative groundwater treatment technologies such as Ultraviolet (UV) Oxidation and Air Stripping were considered but were screened out because of the technical infeasibility of their applications at this site. That is, using current technology, it is not technically feasible to restore the aquifer to Federal and State drinking water standards (i.e., MCLs) by the

extraction and subsequent treatment of groundwater because the pooled and residual DNAPL present in the aquifer will continue to dissolve and release contamination. Further, it is technically infeasible to sufficiently remove the DNAPL zone at this site. The Beach Point FFS also screened out In-Situ Dehalogenation which combines the use of an impermeable barrier such as sheet piling to divert the groundwater to a permeable barrier containing iron filings. This process treats chlorinated organic compounds in the groundwater; however, PCA has been shown to be difficult to treat with iron filings. Also, the iron dechlorinates PCA to cis-1,2-DCE, which is also toxic (albeit less toxic than PCA). Moreover, the use of containment through emplacement of vertical barriers by themselves or combined with In-Situ Dehalogenation gives rise to several concerns. The potential exists for leakage resulting from the deformation and separation of the sheet piling as it is installed to a depth of 70 feet. Improper placement of the barrier may result in the movement of contaminated groundwater around or under the wall, as well as in the inadvertent disruption and mobilization of the DNAPL mass resting on the confining layer.

Although the FFS detailed the extreme technical difficulty associated with some containment options, the TI Waiver expands on this discussion (as requested by MDE) and includes evaluation of more containment options. The TI Waiver was prepared according to USEPA guidelines, and is applicable to Beach Point because of the technical impracticability associated with remediating this DNAPL-contaminated aquifer to Federal or State drinking water quality criteria or standards, which are ARARs. In addition, it was deemed technically infeasible to contain this DNAPL contamination. The finalization of this document results in the waiving of the requirement to comply with Federal and State MCLs and the State groundwater policies that provide, among other things, that no waste is discharged into any State water without treatment or corrective action, and that existing water pollution be abated or controlled.

Like the FFS, the TI Waiver concludes that pumping and treating would not provide long-term restoration of the groundwater due to the presence of the DNAPL zone. Therefore, clean-up to MCLs cannot be feasibly accomplished and the State groundwater policies will not be satisfied. Passive containment (e.g., a slurry wall and cap structure) of the DNAPL zone that acts as a source of the dissolved contaminant plume is not feasible due to the presence of unexploded ordnance (UXO) and the inability to clear such ordnance in the offshore regions of the DNAPL zone that underlay the Bush River. Active hydraulic containment of the DNAPL zone is infeasible due to the presence of multiple preferential flow paths within the aquifer and the cyclical tidal effects on the groundwater flow patterns. Furthermore, requisite hydraulic gradients necessary to initiate movement (for containment or removal) of residual pooled DNAPL cannot be created at this site. Restoration of the dissolved plume in the aquifer is not technically practicable if the DNAPL zone cannot be 99% removed or contained because the DNAPL zone will provide a continuous source of contaminants to the plume.

Based on the aforementioned information, the Army and USEPA developed remedial action objectives which primarily focus on the contaminated groundwater from the surficial aquifer and which do not involve groundwater treatment or containment. These objectives define a realistic management of risk and are protective of human health and the environment.

2.7.1 Description of the Alternatives

2.7.1.1 Alternative 1: No Action.

Under the No Action Alternative, no remedial action is undertaken to remedy the contaminated groundwater from this Class IIB aquifer. The No Action Alternative excludes all activities, including institutional controls such as monitoring and prohibitions on groundwater use. The timeframe for natural restoration is expected to be well over 100 years due to the DNAPL contamination.

The No Action Alternative has no capital costs associated with it, since it does not require any activities to be initiated. The site evaluation report, which summarizes the results of the 5-year review, will cost approximately $40,000 per each review.

2.7.1.2 Alternative 2: Institutional Controls.

Under the Institutional Controls Alternative, the general response actions to be implemented include the following.

- Access Restrictions. Access restrictions to the Beach Point Test Site for ground surface usage do not appear to be necessary. The RI showed no surface soil contamination at levels of concern. In a few locations, very low levels of contaminants were found in the deeper soil. This alternative would include the posting of signs prohibiting unauthorized excavation, digging, and groundwater well installation. Authorization would then require testing and monitoring to ensure worker safety. The prohibition against unauthorized groundwater well installation is important in order to mitigate the potential risks of remobilizing any pooled DNAPL as well as exposing people to contaminated

groundwater.

- Prohibition of Groundwater Use. Groundwater from the surficial (Class IIB) aquifer beneath the Beach Point Test Site is significantly contaminated with DNAPLs. The use of this groundwater would be prohibited for all purposes. Groundwater on the APG-EA site (which includes the Beach Point Test Site) currently is not used for drinking water, and there are no plans for future use of the Beach Point surficial aquifer for this purpose either. As previously described, the hydrogeological conditions at Beach Point result in a general lack of continuity of the surficial aquifer with any other aquifers; therefore, contaminant transfer from this aquifer to another is naturally mitigated. All site restrictions, including the prohibition of groundwater use, would be inputted into APG's GIS, which is utilized in the development of APG's Real Property Master Plan. These use restrictions/prohibitions would be incorporated into any real property documents necessary for transferring ownership from the Army, in the unlikely event that the Army sells this property. The real property documents would also include a discussion of the NPL status of this site, as well as a description of the groundwater and very limited soil contamination at this site. In addition, the Director of DSHE will certify to USEPA on an annual basis that there have been no violations of the prohibitions. If a violation has occurred, a description of the violation and corrective actions to be taken will be provided.

- Monitoring. Environmental monitoring of the Bush River would be initiated in order to ascertain whether increases in risk are occurring at this site. This program could include chemical analyses and bioassessments of surface water and sediment samples; however, the exact monitoring program (including media sampled, target analytes, number of samples, frequency and location of sampling, and deliverables) will be determined during the workplan development phase and will be approved by USEPA and MDE prior to implementation.

Assuming an annual monitoring program involving both surface water and sediment sampling, the estimated costs for Alternative 2 are as follows:

- Capital Costs: $2,025

- O&M Costs: $68,640

- Estimated Present Worth (5% Discount Rate for 30 years): $1,055,165.

Tables 8 and 9 detail the assumptions and methodology for estimating the construction and O&M costs associated with the Institutional Controls Alternative. This cost estimate assumes that the monitoring program will continue for 30 years; however, the duration of the monitoring program will be dictated by the results of each required 5-year review.

2.7.2 Summary of Comparative Analysis of Alternatives

The remedial alternatives presented in Section 2.7.1 were evaluated in accordance with the regulatory requirements of CERCLA using the nine criteria specified by USEPA as set forth in the NCP (see Table 10). This section summarizes the relative performance of each remedial alternative with respect to these criteria.

2.7.2.1 Threshold Criteria.

- Overall Protection of Human Health and the Environment. Alternative 2, Institutional Controls, offers mitigation of risks to humans associated with any potential future use of the Beach Point Test Site. Specifically, the implementation of Alternative 2 involves the prohibition of: groundwater use; unauthorized installation of groundwater wells; and unauthorized soil excavation. Although the risk assessment results do not indicate a risk posed to human health and the environment, uncertainties with respect to the environment exist for some chemical concentrations in the surface water. These potential risks to the environment will be addressed in Alternative 2 through a monitoring program for the Bush River. In addition, implementation of Alternative 2 does not result in the creation of any pathways leading to exposure to humans. Alternative 1 (No Action) does not provide complete long-term protection to public health because it does not prohibit/restrict potential future excavation, groundwater well installation, and use of the groundwater from the surficial aquifer.

- Compliance with ARARs. Section 121(d) of CERCLA requires that remedial actions at CERCLA sites at least attain legally applicable or relevant and appropriate Federal and

State standards, requirements, criteria, and limitations which are collectively referred to as "ARARs," unless such ARARs are waived under CERCLA Section 121(d)(4).

Applicable requirements are those clean-up standards, standards of control, or other substantive requirements, criteria, or limitations promulgated under Federal environmental or State environmental law or facility siting laws that specifically address hazardous substances, pollutants, contaminants, remedial actions, locations, or other circumstances at a CERCLA site. Relevant and appropriate requirements are those same requirements that, while not directly applicable at a CERCLA site, address problems or situations sufficiently similar to those encountered that their use is well suited to the particular site. Only those State standards that are identified in a timely manner and are more stringent than Federal requirements may be relevant and appropriate. On-site actions must comply with ARARs, but need comply only with the substantive parts of those requirements. By contrast, off-site actions must comply with legally applicable requirements, including both the substantive and the administrative parts of those requirements.

TABLE 8. Estimated Capital Cost for the Selected Remedial Strategy, Institutional Controls

Item No.	Description	Quantity	Unit of Measure	Unit Cost $	Item Cost $	Reference
1	Posting of signs	1	lump sum	1,500	1,500	Engineer's estimate
Subtotal estimated construction cost				1,500		
Bid contingency (15%)				225		
Scope contingency (20%)				300		
Total capital cost				2,025		
Permitting and legal (0%)				0		
Servicing during construction (0%)				0		
Design cost (0%)				0		
Total estimated capital cost				2,025		

TABLE 9. Estimated Annual O&M Cost for the Selected Remedial Strategy, Institutional Controls

Item No.	Description	Quantity	Item Costs $
1	Annual sampling and analysis of surface water	10	12,000
2	Annual sampling and analysis of sediments	10	16,000
Subtotal of Items 1 and 2 (Total Analytical Cost)			28,000
3	QC samples associated with all sampling	40% of the total analytical cost	11,200
4	Annual reports to regulatory agencies	1	10,000
5	5-year evaluation required by EPA. Assume 1/5 of report charged each year	0.2	8,000
Subtotal estimated annual O&M cost			57,200
Scope contingency (20%)			11,440
Total estimated annual O&M cost			68,640

TABLE 10: USEPA EVALUATION CRITERIA FOR REMEDIATION ALTERNATIVES

1. Overall Protection of Human Health and the Environment addresses whether a clean-up method provides adequate protection to human health and the environment and describes how risks presented by each pathway are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

2. Compliance with ARARs addresses whether a clean-up method will meet all applicable or relevant and appropriate requirements (Federal and State environmental requirements).

3. Long-Term Effectiveness and Permanence is the ability of a clean-up method to maintain reliable protection of human health and the environment over time, after the action is completed.

4. Reduction of Toxicity, Mobility, or Volume Through Treatment is the anticipated ability of a clean-up method to reduce the toxicity, mobility, or volume of the hazardous substances present at the site through treatment.

5. Short-Term Effectiveness addresses the period of time needed to complete the clean-up, and any adverse impacts on human health and the environment that may occur during the construction and operation period.

6. Implementability is the technical and administrative feasibility of a clean-up method, including the availability of materials and services required by the method.

7. Cost includes the estimated capital and operation and maintenance costs of each clean-up method.

8. State Acceptance indicates whether the State of Maryland agrees with the preferred clean-up method.

9. Community Acceptance indicates whether public concerns are addressed by the clean-up method, and whether the community has a preference for a clean-up method. Public comment is an important part of the final decision.

Chemical-Specific ARARS. Because USEPA has determined that it is technically impracticable to remediate and/or contain the DNAPL contamination of the surficial aquifer, a TI Waiver has been issued for ARARs applicable to groundwater at this site. Neither of the two alternatives will result in compliance with all groundwater ARARs. The groundwater ARARs to be waived are the Federal Safe Drinking Water Act MCLs and MCLGs at 40 CFR 141.11-12, 141.50-51, and 141.61-62, which are adopted by the State of Maryland in COMAR 26.04.01 Regulation of Water Supply, Sewage Disposal, and Solid Waste. Other ARARs to be waived are State groundwater policies at Annotated Code of Maryland, Title 9, Subtitle 3, Water Pollution Control, Sections 9-302 and 9-322; and Annotated Code of Maryland, Title 4, Subtitle 4, Water Pollution Control and Abatement, Section 4-402. These groundwater policies: 1) prohibit waste discharge into any State waters without treatment or corrective action and 2) require the abatement and control of existing pollution.

Contaminants in the groundwater being discharged into the Bush River, as modeled, do not cause exceedances of surface water quality criteria for both Alternatives 1 and 2; therefore, compliance with chemical-specific ARARs for the surface water would likely be achieved for both alternatives. These ARARs are the water quality standards adopted by the State of Maryland and approved by USEPA pursuant to 40 CFR Part 131 (Water Quality Standards) and promulgated at COMAR 26.08.02.03-2. In addition, the AWQC publication from USEPA (1986) includes recommended numerical water quality criteria for some substances that are not included in the above-mentioned State regulations. The AWQC are also likely to be met at this site. These standards are To Be Considered (TBC) requirements and not ARARs.

Location-Specific ARARS. There are no location-specific ARARs for this site.

Action-Specific ARARs. Alternative 2 would have to comply with the following regulations to ensure worker safety and the proper handling and disposal of any hazardous waste generated during the implementation of the monitoring program: Occupational Safety and Health Administration (OSHA) regulations at 29 CFR Part 1910 (Occupational Safety and Health Standards) and 29 CFR Part 1926 (Safety and Health Regulations for Construction); and State of Maryland regulations at Title 26 (Environment), Subtitle 13 (Disposal of Controlled Hazardous Substances), including: COMAR 26.13.02 (Identification and Listing of Hazardous Wastes); COMAR 26.13.03 (Standards Applicable to Generators of Hazardous Wastes); and COMAR 26.13.04 (Standards Applicable to Transporters of Hazardous Wastes). All hazardous wastes generated must be disposed of at a Hazardous Waste Disposal Facility that meets the requirements of COMAR 26.13.05 (Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities).

2.7.2.2 Primary Balancing Criteria.

- Long-Term Effectiveness. In the long-term, with both alternatives, permanent restoration would be achieved through natural degradation and flushing of contaminants. The timeframe for natural restoration is expected to be well over 100 years due to the DNAPL contamination.

  The magnitude of the residual risk remaining from the untreated groundwater is expected to be of the same order for the two alternatives. The adequacy and reliability of institutional controls, which primarily are imposed to protect against exposure to the risks posed by untreated chemicals in groundwater, is considered high since the managing authority is the Army and the site is expected to remain a part of APG-EA.

- Reduction of Toxicity, Mobility, and Volume. Neither Alternative 1 nor 2 reduces toxicity, mobility, and volume because there is no treatment associated with these alternatives.

- Short-Term Effectiveness. Alternative 1 does not require any activity; therefore, there are no short-term adverse impacts that may be posed during the implementation period. Any adverse short-term effects associated with the implementation of Alternative 2 will be minimized to the maximum extent practicable through the use of protective measures. For example, site workers tasked with installing signs and collecting surface water and/or sediment samples will utilize all appropriate safety clothing and employ safe work practices.

- Implementability. Alternative 1 takes no time to implement because no action is

required. Alternative 2 could be set for implementation within several weeks notice, and could be completed within a month after initiation of the required activities. Implementability is high because the treatment of the groundwater is not required and use restrictions/prohibitions would be coordinated with personnel working at APG-EA. Time will be needed for the coordination of the use restrictions/prohibitions and the development of the Bush River monitoring program.

- Cost. The costs associated with Alternative 1 would be approximately $40,000 for the preparation of a each required 5-year review report. Alternative 2 has an estimated construction cost of $2,025, estimated annual O&M costs of $68,640, and estimated present-worth costs over 30 years (at a 5% discount rate) of $1,055,165. These estimated O&M and present-worth costs are based on an assumed monitoring program including 30 years of annual sampling of sediments and surface water.

2.7.2.3. Modifying Criteria.

- State/Support Agency Acceptance, MDE has not contested the TI Waiver, and thus has acknowledged the ability of the Army and USEPA to waive ARARs for groundwater. Consequently, the MDE has concurred with the selected remedy.

- Community Acceptance. Public input on the Institutional Controls Alternative has been favorable and supportive. The public's comments are summarized and discussed in the Responsiveness Summary (see Section 3.0 of this document).

2.7.3 The Selected Remedy

The selected remedy for the Beach Point Test Site is Alternative 2, Institutional Controls, because it best satisfies the threshold criteria of Overall Protectiveness of Human Health and the Environment. Compliance with groundwater ARARs is being waived due to the technical impracticability of restoring this groundwater. Other criteria are also well satisfied by this Alternative.

Implementation of Institutional Controls would involve prohibition of groundwater use, the posting of signs prohibiting unauthorized groundwater well installation and soil excavation, and inputting these restrictions/prohibitions into APG's GIS which is utilized in the development of APG's Real Property Master Plan. In addition, these restrictions/prohibitions would also be incorporated into any real property documents necessary for transferring ownership from the Army, in the unlikely event that the Army sells this property. The real property documents would also include a discussion of the NPL status of this site, as well as a description of the groundwater and very limited soil contamination at this site. The Director of DSHE will certify to USEPA on an annual basis that there have been no violations of the prohibitions. If a violation has occurred, a description of the violation and corrective actions to be taken will be provided. These safeguards are necessary in order to prevent exposure risks associated with contaminated groundwater and subsurface soils. This alternative also will include monitoring of the Bush River to determine whether significant increases in risk to the environment are occurring at this site.

Alternative 2 provides a high level of overall long- and short-term protection to human health and the environment.

Although Alternative 2 does not remove chemicals from the groundwater or soil, implementation of this alternative achieves substantial risk reduction for potential human exposure by prohibiting groundwater use, unauthorized groundwater well installation, and unauthorized soil excavation.

For Alternative 2, as is the case with Alternative 1, protection of the environment is not an issue since naturally discharging groundwater, as modeling has shown, is not likely to cause water quality standards to be exceeded or be toxic to benthic biota in the Bush River. Alternative 2 includes a monitoring program in order to ensure that risks to the environment are not increasing at this site.

Alternative 2 can be implemented quickly even though some time will be needed for coordination of the use restrictions/prohibitions and the development of a monitoring program. The environmental program for monitoring the Bush River could be established in a reasonable period of time.

The costs associated with the implementation of Alternative 2 are estimated to be $1,055,165. These costs exceed those associated with Alternative 1; however, Alternative 2 will result in the mitigation of any potential risks associated with future exposures to groundwater and/or soil. MDE concurs with the selection of Alternative 2 as the remedy for this site. In addition, public input has been favorable and supportive.

2.7.4 The Statutory Determinations

The selected remedy discussed in Section 2.7.3 satisfies the requirements under Section 121 of CERCLA for protecting human health and the environment, utilizing permanent solutions, and cost-effectiveness. The other statutory requirements for: 1) complying with ARARs; 2) utilizing alternate treatment/resource recovery technologies to the maximum extent practicable; and 3) using treatment to address the principal threats at the site, could not be satisfied because of the technical impractibility associated with remediating and/or containing the DNAPL contamination at this site.

2.7.4.1 Protection of Human Health and the Environment.

The selected remedy, Alternative 2, offers mitigation of risks to humans associated with any potential future use of the Beach Point Test Site. Although the risk assessment results do not indicate an unacceptable level of risk to human health and the environment, some uncertainties with respect to the environment exist for some chemical concentrations in the Bush River. These potential risks to the environment will be addressed in Alternative 2 through a monitoring program of the Bush River. In addition, implementation of Alternative 2 does not result in the creation of any pathways leading to human exposure. Any adverse short-term effects associated with the implementation of this alternative will be minimized to the maximum extent practicable through the use of protective measures. For example, site workers tasked with installing signs and/or collecting samples for the monitoring program will utilize all appropriate safety clothing and employ safe work practices.

2.7.4.2 Compliance with ARARs.

There are no location-specific ARARs for the selected remedy at this site because no site disturbances (of, for example, the wetlands) will result from implementation of this remedy. The action-specific ARARs apply because workers involved in the sign installation and the monitoring program will need to comply with OSHA standards as appropriate. In addition, any samples collected as part of the monitoring program will need to be disposed of according to State RCRA requirements in the event that these samples are deemed hazardous waste. The action-specific ARARs that apply are listed and described in Table 11.

As previously discussed, Burton et al. (1994) found that surface water quality criteria likely will not be exceeded in the Bush River as a result of groundwater from the surficial aquifer discharging into the Bush River. Thus, the chemical-specific ARARs listed in Table 12 for surface water will be met at this site. In addition, these ARARs may have limited application in that they may be used as the standard against which analytical results from the monitoring program will be compared in order to assess compliance.

TABLE 11: Action-Specific ARARs

ARARs	Status	Requirement
OSHA-Occupational Safety and Health Standards (29 CFR 1910)	Applicable	These regulations specify general worker safety requirements. Among other things, these regulations specify the 8-hr time-weighted average concentration for various organic compounds. Training requirements for workers at hazardous waste operations are specified in 29 CFR 1910.120.
OSHA-Safety and Health Regulations for Construction (29 CFR 1926)	Applicable	This regulation specifics the type of safety equipment and procedures to be followed during site remediation.
COMAR 26.13.02-05	Applicable	The State RCRA regulations apply to the generation, transport, storage, treatment, and disposal of hazardous waste. CERCLA specifically requires (in Section 104(c)(3)(B)) that hazardous substances from remedial actions be disposed at facilities in compliance with Subtitle C of RCRA; COMAR 26.13.05 stipulates the requirements for a Hazardous Waste Disposal Facility in Maryland.

TABLE 12: Chemical-Specific ARARs for Surface Water

ARARs	Status	Requirement
COMAR 26-08.02.03-2	Applicable	This State regulation specifies the numerical criteria for toxic substances in surface waters.

In addition to the above-mentioned ARARs, the numerical water quality criteria listed in the AWQC publication (1986) also likely will be met for the surface waters at this site. The AWQC publication presents recommended numerical water quality criteria for some substances that are not listed in the above-mentioned State regulations. These criteria have not been promulgated, so they are not ARARs but rather TBCs.

With respect to groundwater, not all of the chemical-specific ARARs will be met within a reasonable timeframe; therefore, compliance with groundwater ARARs is waived due to the technical impracticability associated with remediating and/or containing the DNAPL contamination at this site. That is, using current technology, it is not technically feasible to restore the surficial aquifer at this site to MCLs by extraction and treatment because the DNAPL zone present in this aquifer cannot be 99% removed. Unremoved DNAPL pools, globules, and residual droplets serve as a continuing source for the dissolved phase. In addition, containment options, including both active and passive containment, were found to be technically impracticable for a number of reasons (see Section 2.7 for a detailed discussion). Federal and State groundwater ARARs to be waived are as follows:

- Federal Safe Drinking Water Act regulations applicable to drinking water supplies and systems establishing MCLs and MCLGs (40 CFR 141.11-12, 141.50-51, and 141.61-62);
- Title 26, Subtitle 04, Regulation of Water Supply, Sewage Disposal, and Solid Waste (COMAR 26.04.01) - these State regulations are based on the above-mentioned Federal drinking water standards;
- Annotated Code of Maryland, Title 9, Subtitle 3, Water Pollution Control, Section 9-302;
- Annotated Code of Maryland, Title 9, Subtitle 3, Water Pollution Control, Section 9-322; and,
- Annotated Code of Maryland, Title 4, Subtitle 4, Water Pollution Control and Abatement, Section 4-402.

These aforementioned citations of the Annotated Code of Maryland comprise the State's groundwater policies of: 1) prohibiting discharge of waste into any State waters without treatment or corrective action and 2) abating and controlling existing pollution.

2.7.4.3 Cost-effectiveness.

The selected remedy is cost-effective because it has been determined to provide overall effectiveness proportional to its costs (the estimated present-worth cost is $1,055,165). The selected remedy is more cost-effective than Alternative 1 (No Action) because the implementation of Alternative 2 results in the mitigation of any potential risks associated with future human exposures to groundwater and/or soil. In addition, implementation of Alternative 2 ensures the determination of any increases in risks to the environment at this site. Thus, the selected remedy provides the best balance of features that offer overall protection to human health and the environment.

2.7.4.4 Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable.

This remedy utilizes permanent solutions as currently available to the maximum extent practicable for this site. However, because treatment of the DNAPL contamination was not found to be technically practicable, this remedy does not satisfy the statutory preference for utilizing alternative treatment or resource recovery technologies to the maximum extent practicable. Specifically, innovative groundwater treatment technologies such as UV Oxidation and Air Stripping were considered in the FFS but were screened out because MCLs cannot be met if the DNAPL zone cannot be 99% removed. Further, it is technically infeasible to remove the DNAPL source at this site. The Beach Point FFS also screened out In-Situ Dehalogenation which combines the use of an impermeable barrier such as sheet piling to divert the groundwater to a permeable barrier containing iron filings. This process treats chlorinated organic compounds in the groundwater; however, PCA has been shown to be difficult to treat with iron filings. Also, the iron dechlorinates PCA to cis-1,2-DCE, which is also toxic (albeit less toxic than PCA). Moreover, the potential exists for leakage which results from the deformation and separation of the sheet piling as it is installed to a depth of 70 feet. Improper placement of the barrier may result in the movement of contaminated groundwater around or under the wall, as well as in the inadvertent disruption and mobilization of the DNAPL mass resting on the confining layer.

2.7.4.5 Preference for Treatment as a Principal Element.

The selected remedy for this site does not satisfy the CERCLA requirement for utilizing treatment as a principal element. The aforementioned justification for technical impracticability as discussed in Section 2.7.4.4 clarifies why this preference is not met at this site.

2.8 SUMMARY OF PERFORMANCE STANDARDS

- At least one sign will be posted at the Beach Point Test Site which will state the prohibition of unauthorized excavation and unauthorized groundwater well installation. The exact number of, location of, and wording for the signs will be determined during the workplan development phase and will be approved by USEPA and MDE prior to implementation.

- A prohibition on all groundwater uses will be imposed. All site restrictions will be inputted into APG's GIS, which is utilized in the development of APG's Real Property Master Plan. All use restrictions/prohibitions will be incorporated into any real property documents necessary for transferring ownership from the Army, in the unlikely event that the Army sells this property. The real property documents would also include a discussion of the NPL status of this site, as well as a description of the groundwater and very limited soil contamination at this site. In addition, the Director of DSHE will certify to USEPA on an annual basis that there have been no violations of the prohibitions. If a violation has occurred, a description of the violation and corrective actions to be taken will be provided.

- A monitoring plan for the Bush River will be developed and implemented, and will include the sampling and analyses of affected media, such as sediments and surface water. Analyses could include both chemical analyses as well as bioassessments; however, the specifies of the monitoring program (i.e., media sampled, target analytes, number of samples, frequency and location of sampling, and deliverables) will be determined during the workplan development phase and will be approved by USEPA and MDE prior to implementation.

- A 5-year review will be conducted in order to evaluate continuing protectiveness of human health and the environment. Each required 5-year review will culminate in the preparation of a report. Specifically, the effectiveness of the selected remedy will be reviewed, and a determination will be made as to whether adverse changes in risk have occurred at this site. Determination of increases in risk will involve an in-depth evaluation of the monitoring data. At that point in time, the 5-year review report may recommend the continuation of the monitoring program for another 5 years (until the next review), a continuation of the monitoring program with changes in the protocol, or a cessation of the monitoring program. In addition, the effectiveness of the signs and use restrictions will be evaluated and changes may be recommended at that time.

3.0 THE RESPONSIVENESS SUMMARY

The final component of the ROD is the Responsiveness Summary. The purpose of the Responsiveness Summary is to provide a summary of the public's comments, concerns, and questions about the groundwater at APG's Beach Point Test Site and the Army's responses to these concerns.

During the public comment period, written comments were received by APG.

APG held a public meeting on May 20, 1997 to formally present the Proposed Plan and to answer questions and receive comments. The transcript of this meeting is part of the administrative record for the site. All comments and concerns summarized below have been considered by the Army and USEPA in selecting the final clean-up remedy for the Beach Point Test Site.

This responsiveness summary is divided into the following sections:

3.1 OVERVIEW

At the time of the public comment period, the Army had endorsed a preferred alternative for the clean-up of the groundwater at the Beach Point Site. APG proposed: 1) prohibitions on groundwater use and unauthorized excavation and 2) monitoring of the Bush River surface water and sediments. USEPA concurred with the preferred alternative, and MDE stated that it would finalize its position after reviewing public comments. The State's final position is as follows: MDE has not contested the TI Waiver, and thus has acknowledged the

ability of the Army and USEPA to waive ARARs for groundwater. Consequently, the MDE has concurred with the selected remedy. With the exception of one comment, public input on the preferred alternative has been favorable and supportive.

3.2 BACKGROUND ON COMMUNITY INVOLVEMENT

Citizens' involvement in the Beach Point Site has encompassed numerous discussions at Restoration Advisory Board (RAB) meetings (formerly Technical Review Committee (TRC) meetings) and comments by the APG Superfund Citizens Coalition (APGSCC). APGSCC is the recipient of two Technical Assistance Grants from USEPA. In a recent RAB meeting, a citizen questioned whether APG had thoroughly investigated all available technologies for remediating this site. He was assured that a thorough evaluation was conducted, and that this site is technically infeasible to clean- up.

APGSCC raised several concerns prior to the finalization of the Proposed Plan. These issues primarily focused on the overall readability of the Proposed Plan, MDE's nonconcurrence at that time on the preferred alternative, and the BLRA. These concerns either were addressed in a written response to APGSCC and/or through editorial changes to the Proposed Plan.

APG has maintained an active public involvement and informatiom program. Highlights of the community's involvement with respect to this site and APG's activities during the last two years are as follows:

- APG began discussing possible clean-up methods for the Beach Point Test Site at TRC meetings in January 1993. Dates of other TRC/RAB meetings where APG presented information on the Beach Point Site are May 1995, November 1995, April 1996, and February 1997.

- APG released the Proposed Plan for the Beach Point Site for public comment on May 7. Copies were available to the public at APG's information repositories at the Aberdeen and Edgewood Branches of the Harford County Library, and the Miller Library at Washington College in Chestertown, Maryland.

- A 45-day public comment period on the Proposed Plan ran from May 7 to June 20.

- APG issued a press release to APG's media list which announced the availability of the Proposed Plan, the dates of the public comment period, and the date and time of the public meeting. In addition, a story appeared in the APG News.

- APG placed newspaper advertisements announcing the public comment period and meeting in The Aegis, the Cecil Whig, The Avenue, and the Kent County News.

- APG prepared and published a fact sheet on the Proposed Plan. APG mailed copies of this fact sheet to over 2,590 citizens and the elected officials on its Installation Restoration Program mailing list. The fact sheet included a form which citizens could use to send APG their comments.

- On May 20, APG held a public meeting at the Edgewood Senior Center in Edgewood, Maryland. Representatives of the Army, USEPA, and the MDE presented information on the site and their respective positions on the proposed clean-up alternatives.

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

Comments raised during the Beach Point public comment period on the FFS and the Proposed Plan are summarized below. The comments are categorized by source.

COMMENTS FROM QUESTIONNAIRE INCLUDED WITH FACT SHEET

As part of its fact sheet on the Proposed Plan, APG included a questionnaire that residents could return with their comments. APG received 7 completed returns, and copies of them have been placed in APG's administrative record. Responses on the completed returns were:

6	Agree with Proposed Plan - No Written Comment Provided
1	Disagrees with Proposed Plan
0	Have no preference.

The commenter who disagreed with the Proposed Plan is an Edgewood resident, and this comment is summarized and discussed as follows.

Comment 1: Both Alternatives 1 and 2 seem quite similar. Selecting Alternative 2 (institutional Controls)

for this site results in ignoring the problem and trying to prevent the use of contaminated resources.

Response: APG understands this citizen's concern with respect to not selecting a remedy that incorporates pump and treat and/or containment technologies at this site. APG conducted a thorough evaluation of treatment and containment technologies for the FFS. The TI Waiver summarizes additional investigations into containment options (see Appendix J of the FFS). The specific conditions of this site result in the technical impracticability of remediating this site to all groundwater standards, as well as effectively containing the DNAPL zone. That is, current technology does not offer a solution for remediating this site and/or containing the DNAPL zone because a significant amount of pooled DNAPL contamination exists 70 feet from the ground surface and most likely undemeath the Bush River. Technical problems posed include: removing the DNAPL zone to a 99% level; clearing UXO from the Bush River in an attempt to institute containment measures; multiple preferential flow paths within the aquifer; and cyclical tidal effects on groundwater flow patterns. After finalization of the ROD, a 5-year review will be conducted which will evaluate continuing protectiveness of human health and the environment. Specifically, the effectiveness of the selected remedy will be reviewed, and a determination will be made as to whether adverse changes in risk have occurred at this site.

COMMENTS FROM RAB MEMBERS

As part of its efforts to involve the public in decisions as early as possible, APG provided RAB members with drafts of the Proposed Plan. One member provided comment to APG and concurred with the preferred alternative of Institutional Controls. Another member commented on the Final FFS and stated that he concurred with the selection of Institutional Controls as the "most appropriate measure to implement until further technological advances" would allow for compliance with MCLs. Following review of the Final Proposed Plan, the RAB representative from the Baltimore County Department of Environmental Protection and Resource Management stated that he agreed with "the proposed alternative to prohibit excavations and impose groundwater use restrictions in the Canal Creek Study Area." These comments have been placed in APG's administrative record.

COMMENTS AT MAY 20,1997 PUBLIC MEETING

No oral or written comments were presented at the May 20 public meeting on the Proposed Plan. A full transcript of the meeting is part of APG's administrative record.

COMMENTS FROM APGSCC

In August 1996, APGSCC submitted comments on a working draft of the Beach Point Proposed Plan. As previously stated, APGSCC's comments primarily focused on the overall readability of the Proposed Plan, MDE's nonconcurrence at that time on the preferred alternative, and various clarifications on techniques and methodologies employed in the development of the BLRA. These comments, as well as APG's written response to them, have been placed in the administrative record.

COMMENTS FROM MARYLAND DEPARTMENT OF THE ENVIRONMENT

During the public comment period, MDE submitted one minor editorial comment on the Proposed Plan. MDE also submitted two comments on the TI Waiver. These comments have been placed in APG's administrative record.

Comment 1: On page 16, first column, and first line of the Proposed Plan, MDE requested a change to the title of Subtitle 4. The title of Subtitle 4 is "Water Pollution Control and Abatement" rather than "Water Pollution Control and Containment" as stated in the Proposed Plan.

Response: APG will provide an errata to the Beach Point Test Site Final Proposed Plan which reflects this change.

Comment 2: MDE noted that the surficial aquifer at the Beach Point Test Site was assigned a Class IIB designation, and therefore is a potential source of usable groundwater. Page J-88, Section 3.4 of the TI Waiver should be amended to reflect this information.

Response: APG recognizes that the following statement in Section 3.4 of the TI Waiver is not correct: "The aquifer unit at the site is not a potential source of drinking water..." APG acknowledges MDE's position on classifying this groundwater resource as a Class IIB potential drinking water source; however, the TI Waiver correctly states that this groundwater resource would require significant amounts of treatment prior to use as drinking water (even if it were not contaminated with DNAPLs). In addition, the amount of water that can be obtained from the aquifer is low. Corrected language will be included in an errata to the Final Beach Point Test Site FFS Technical Impracticability Evaluation.

Comment 3: MDE requests that Title 9, Subtitle 3, Section 9-322 be added to the list of Annotated Code of Maryland citations presented in Section 4-1 on page J-109 of the TI Waiver. This citation, along with Title 4, Subtitle 4, Section 4-402 and Title 9, Subtitle 3, Section 9-302 comprise the State's groundwater

policy.

Response: APG included Title 9, Subtitle 3, Section 9-322 as an ARAR to be waived in the Final Proposed Plan for this site, but the TI Waiver was finalized prior to the decision to waive this ARAR. An effata to the Final Beach Point Test Site FFS Technical Impracticability Evaluation will reflect the addition of this citation (Title 9, Subtitle 3, Section 9-322) to the list of citations which the comprise State's groundwater policy.

<IMG SRC 97090Q>

4.0 REFERENCES

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5.0 LIST OF ACRONYMS

APG - Aberdeen Proving Ground
APGSCC - Aberdeen Proving Ground Superfund Citizen's Coalition
ARAR - Applicable or Relevant and Appropriate Requirement
AWQC - Ambient Water Quality Criteria
BGS - Below Ground Surface
BLRA - Baseline Risk Assessment
CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act
CFR - Code of Federal Regulations
COMAR - Code of Maryland Regulation
COPC - Chemical of Potential Concern
CSF - Cancer Slope Factor
DCE - Dichloroethene
DERP - Defense Environmental Restoration Program
DNAPL - Dense Non-aqueous Phase Liquid
DSHE - Directorate of Safety, Health and Environment
EA - Edgewood Area
EEQ - Environmental Effects Quotient
ERA - Ecological Risk Assessment
ER-M - Effects Range-Median
FFS - Focused Feasibility Study
GIS - Geographical Information System
HCDD - Hexachlorodibenzodioxin
HI - Hazard Index
HQ - Hazard Quotient
MCL - Maximum Contaminant Level
MCLG - Maximum Contaminant Level Goal
MDE - Maryland Department of the Environment
NCP - National Oil and Hazardous Substances Pollution Contingency Plan
NEPA - National Environmental Policy Act
NPL - National Priorities List
O&M - Operation and Maintenance
OCDD - Octochlorodibenzodioxin
OSHA - Occupational Safety and Health Administration
PAH - Polynuclear Aromatic Hydrocarbon
PCA - Tetrachloroethane
PCB - Polychlorinated biphenyl
PCE - Tetrachloroethene
ppb - parts per billion
ppm - parts per million
RA - Risk Assessment
RAB - Restoration Advisory Board
RBC - Risk-Based Concentration
RCRA - Resource Conservation and Recovery Act
RFA - RCRA Facility Assessment
RfD - Reference Dose
RI - Remedial Investigation
RME - Reasonable Maximum Exposure
ROD - Record of Decision
SARA - Superfund Amendments and Reauthorization Act
SVOC - Semi-volatile Organic Compound
SWMU - Solid Waste Management Unit
TBC - To Be Considered
TCA - Trichloroethane
TCE - Trichloroethene
TI - Technical Impracticability
TNT - Trinitrotoluene
TRC - Technical Review Committee
TRV - Toxicity Reference Value
USAEC - U.S. Army Environmental Center
USAEHA - U.S. Army Environmental Health Agency
USEPA - U.S. Environmental Protection Agency
USGS - U.S. Geological Survey
UST - Underground Storage Tank
UV - Ultraviolet
UXO - Unexploded Ordnance
VOC - Volatile Organic Compound