EPA/ROD/R03-00/070
2000

EPA Superfund
Record of Decision:

NAVAL SURFACE WARFARE CENTER - DAHLGREN
EPA ID: VA7170024684
OU 04
DAHLGREN, VA
09/28/2000

SITE 10 - HIDEAWAY POND

NAVAL SURFACE WARFARE CENTER
DAHLGREN SITE
DAHLGREN, VIRGINIA

RECORD OF DECISION

September 2000

TABLE OF CONTENTS

SECTION **PAGE**

1.0 THE DECLARATION 1-1
1.1 SITE NAME AND LOCATION 1-1
1.2 STATEMENT OF BASIS AND PURPOSE 1-1
1.3 DESCRIPTION OF THE SELECTED REMEDY 1-1
1.4 STATUTORY DETERMINATIONS 1-2
1.5 ROD DATA CERTIFICATION CHECKLIST 1-3

2.0 DECISION SUMMARY 2-1
2.1 SITE NAME, LOCATION, AND DESCRIPTION 2-1
2.2 SITE HISTORY AND ENFORCEMENT ACTIVITIES 2-1
2.2.1 History of Site Activities 2-1
2.2.2 Previous Investigations 2-5
2.2.3 Enforcement Actions 2-7
2.3 COMMUNITY PARTICIPATION 2-8
2.4 SCOPE AND ROLE OF RESPONSE ACTIONS AT SITE 10 2-9
2.5 SITE CHARACTERISTICS 2-9
2.5.1 Sources of Contamination 2-10
2.5.2 Description of Contamination 2-10
2.5.3 Contaminant Migration 2-13
2.6 CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES 2-13
2.7 SUMMARY OF SITE RISKS 2-14
2.7.1 Human Health Risks 2-15
2.7.2 Environmental Evaluation 2-27
2.7.3 Ecological Risk Management 2-36
2.7.4 Summary, Conclusions, and Recommendations 2-42
2.7.5 Remedial Action Objectives (RAOs) 2-42
2.8 DESCRIPTION OF ALTERNATIVES 2-43
2.9 SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES 2-46
2.9.1 Threshold Criteria 2-46
2.9.2 Primary Balancing Criteria 2-47
2.9.3 Modifying Criteria 2-49
2.10 THE SELECTED REMEDY 2-50
2.10.1 Summary of the Rationale for the Selected Remedy 2-50
2.10.2 Description of the Selected Remedy 2-51
2.10.3 Summary of the Estimated Remedy Costs 2-53
2.10.4 Expected Outcomes of the Selected Remedy 2-53
2.11 STATUTORY DETERMINATIONS 2-55
2.11.1 Protection of Human Health and the Environment 2-55
2.11.2 Compliance with ARARs 2-55
2.11.3 Cost Effectiveness 2-56
2.11.4 Utilization of Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable 2-56
2.11.5 Preference for Treatment as a Principal Element 2-56
2.11.6 Five-Year Review Requirements 2-56
2.11.7 Documentation of Significant Changes 2-56

3.0 RESPONSIVENESS SUMMARY 3-1

TABLE OF CONTENTS

APPENDICES

A VIRGINIA CONCURRENCE LETTER
B CERTIFIED TRANSCRIPT OF PUBLIC MEETING
C TOXICITY PROFILE

LIST OF TABLES

NUMBER		PAGE
2-1	Medium-Specific Exposure Point Concentration Summary	2-16
2-2	Cancer Toxicity Data--Oral/Dermal	2-18
2-3	Non-Cancer Toxicity Data -- Oral/Dermal	2-19
2-4	Reasonable Maximum Exposure (RME) Summary of Receptor Risks and Hazards for COPCs - Base Workers	2-21
2-5	Reasonable Maximum Exposure (RME) Summary of Receptor Risks and Hazards for COPCs - Excavation/Construction Worker	2-23
2-6	Reasonable Maximum Exposure (RME) Summary of Receptor Risks and Hazards for COPCs - Hypothetical Future Adult Residential User	2-24
2-7	Reasonable Maximum Exposure (RME) Summary of Receptor Risks and Hazards for COPCs - Hypothetical Future Child Residential User	2-25
2-8	Reasonable Maximum Exposure (RME) Summary of Receptor Risks and Hazards for COPCs - Adult Recreational User	2-26
2-9	Screening-Level Ecological Risk Assessment Preliminary Chemicals of Concern - Surface Water	2-28
2-10	Screening-Level Ecological Risk Assessment Preliminary Chemicals of Concern - Sediment	2-29
2-11	Screening Hazard Quotients Using Maximum Concentrations Aquatic Food Chain Receptors - Conservative Inputs	2-30
2-12	PCOCS for Ecological Exposure After Screening	2-31
2-13	Baseline Ecological Risk Evaluation for Surface Water and Sediment	2-33
2-14	Ecological Risk Management for Sediment	2-39
2-15	Mercury Content for Background Locations and Hideaway Pond	2-40
2-16	Estimated Remedy Cost Components	2-53
2-17	Estimated Remedy Present Worth Costs	2-54

LIST OF FIGURES

NUMBER		PAGE
2-1	NSWCDL Location Map	2-2
2-2	Site Location Map	2-3
2-3	Site Map	2-4
2-4	Sample Location Map	2-11

1.0 THE DECLARATION

1.1 SITE NAME AND LOCATION

Site 10, Hideaway Pond
Naval Surface Warfare Center Dahlgren Site
Dahlgren, Virginia

1.2 STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for Site 10, Hideaway Pond at the Naval Surface Warfare Center Dahlgren Site (NSWCDL) Dahlgren, Virginia. This determination has been made in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by Superfund Amendments and Reauthorization Act of 1986 (SARA), and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record file for this site.

The Commonwealth of Virginia concurs with the selected remedy (see Appendix A).

ASSESSMENT OF THE SITE

The response action selected in this Record of Decision (ROD) is necessary to protect the public health, welfare, or the environment from actual or threatened releases of hazardous substances into the environment.

1.3 DESCRIPTION OF THE SELECTED REMEDY

The Navy will manage the remediation of Hideaway Pond as a single remedial action. The remedial action selected in this ROD addresses mercury contamination in fish associated with Site 10, Hideaway Pond.

The selected remedy for Site 10 is to use institutional controls to reduce risks associated with the consumption of fish and to provide mercury monitoring of fish tissue. It is anticipated that mercury levels

in fish will decrease over time because the residual concentrations detected in surface water and sediment are significantly less than risk-based concentrations.

The major components of the selected remedy are: 1) Institutional Controls and 2) Mercury Monitoring of Fish.

Recreational fishing in Hideaway Pond would continue; however, restrictions would prohibit the consumption of fish because of the potential presence of mercury. Fishing would be allowed on a catch-and-release basis only. Signs would be maintained at the pond prohibiting consumption of the fish.

An institutional control plan shall be developed and implemented for Site 10 as part of the remedial action and include: signs along the perimeter of the site and restrictions on the consumption of fish from Hideaway Pond.

The Navy shall also institute mercury monitoring of fish tissue to ensure remedial action objectives are being achieved. Monitoring of the fish through analytical testing will continue until acceptable concentrations are achieved in the fish. The acceptable concentration would be based on a human health-based concentration of 0.56 mg/kg and an ecological risk-based concentration of 0.48 mg/kg for mercury in fish. Additionally, a 5-year review will be conducted. The analysis shall be conducted bi-annually (every two years) for a period of five years or longer if human health or ecological risk-based concentrations for mercury in fish are not achieved. The bi-annual frequency was chosen because the fish tissue concentrations are near the RAOs and concentrations are expected to change gradually over time. Additional details of the monitoring program shall be developed in the Monitoring Plan.

1.4 STATUTORY DETERMINATIONS

The selected remedy for Site 10 is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, is cost-effective, and utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable. Because the concentrations of mercury in fish tissue are relatively low, the associated risks do not warrant fish destruction as a means of eliminating the risks. Also, the mercury contamination in Hideaway Pond sediment is very low (less than 1.0 ppm which is less than risk-based screening values). For these reasons, the Navy concluded that it was impracticable to treat the mercury in a cost-effective manner. Thus, the remedy in Site 10 does not satisfy the statutory preference for treatment as a principal element of the remedy. Because this remedy will result in hazardous substances remaining onsite (mercury in fish) above levels that allow for unlimited use and unrestricted exposure, a review will be conducted within five years after initiation of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

1.5 ROD DATA CERTIFICATION CHECKLIST

The following information is included in the Decision Summary section of this ROD. Additional information can be found in the Administrative Record file for NSWCDL Site 10.

- Chemicals of concern (COCs) and their respective concentrations.
- Baseline risk represented by the COCs.
- Cleanup levels established for COCs and the basis for the levels.
- Current and reasonably anticipated future land use assumptions used in the baseline risk assessment and ROD.
- Potential land use that will be available at the site as a result of the Selected Remedy.
- Estimated capital, operation and maintenance (O&M), and total present worth costs; discount rate; and the number of years over which the remedy cost estimates are projected.
- Key factors that led to selecting the remedy (i.e., a description of how the Selected Remedy provides the best balance of tradeoffs with respect to the balancing and modifying criteria, highlighting criteria key to the decision).

CAPT. Vaughn E. Mahaffey, USN
Commanding Officer
Naval Surface Warfare Center
Dahlgren, Virginia

9/28/00
Date

Abraham Ferdas, Director
Hazardous Site Cleanup Division
U.S. EPA - Region III

9/28/00
Date

This Page Intentionally Left Blank

2.0 DECISION SUMMARY

This ROD is issued to describe the Department of the Navy's (NAVY) and U.S. Environmental Protection Agency's (EPA) selected remedial action for Site 10, Hideaway Pond, at the NSWCDL, Dahlgren, Virginia (Figure 2-1). The Commonwealth of Virginia concurs with the selected remedy. The Department of the Navy is the lead agency and provides funding for site cleanups. Site 10 (Figure 2-2) is one of several Installation Restoration (IR) sites located at the NSWCDL facility.

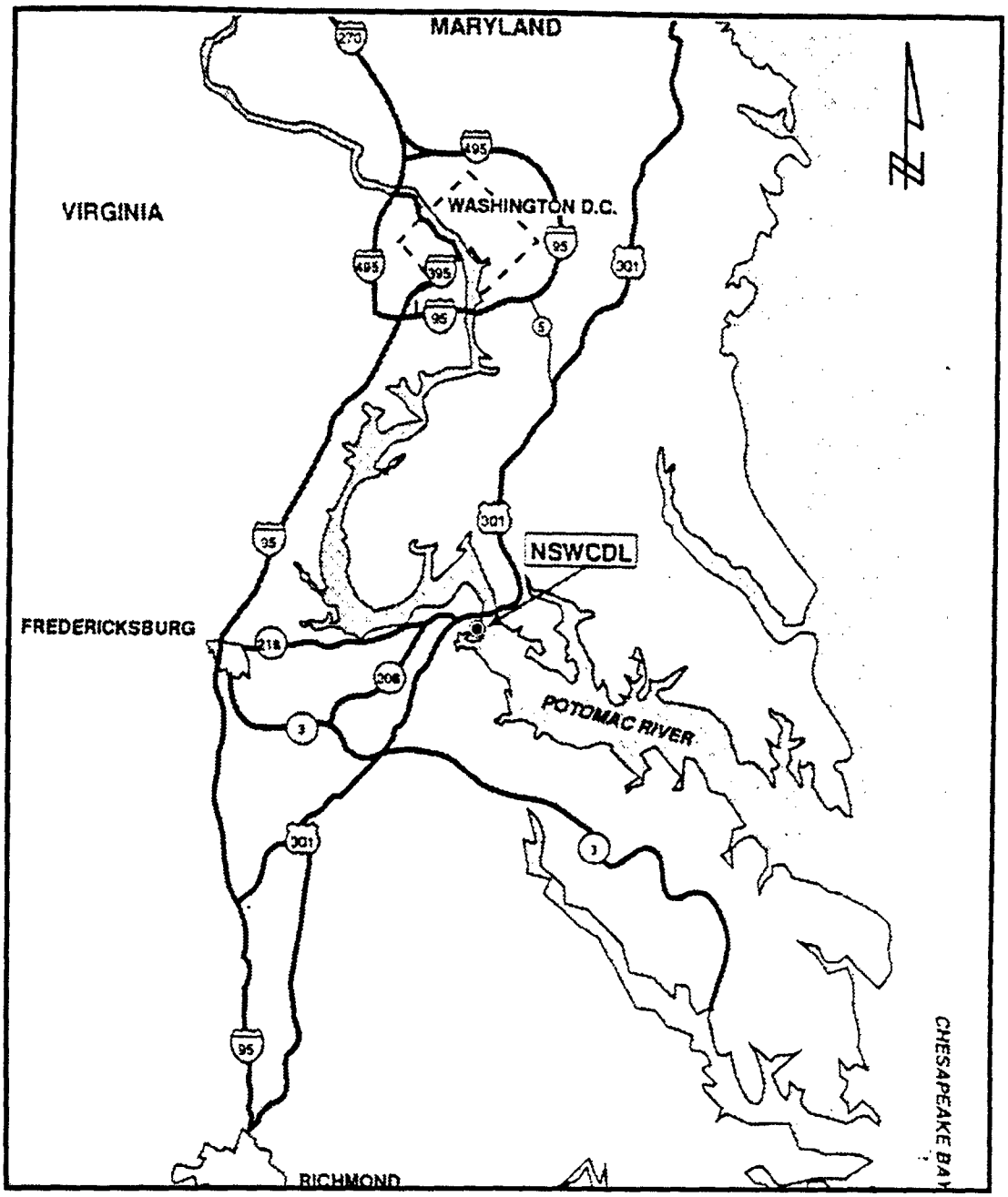
2.1 SITE NAME, LOCATION, AND DESCRIPTION

Hideaway Pond is approximately 15 acres in size. It is a manmade body of water created along a marshy drainage that flows in a southerly direction into Gambo Creek. Hideaway Pond is located in the northeast comer of NSWCDL approximately 1,500 feet west of the Potomac River and 2,000 feet south of U.S. Highway 301. The pond was originally formed behind a dam placed across a preexisting drainage course in 1953 (Figure 2-3). This dam provided road access across the drainage to other NSWCDL facilities adjacent to the Potomac River. In 1983 a new dam was constructed farther south of the old dam, and the area between it and the original dam was flooded. The old roadway and portions of the dam that formed the original pond were removed. Remnants of the older dam presently remain onsite. No structures are in the vicinity of Hideaway Pond. The pond is primarily used as a source of recreation (e.g., catch-and-release fishing and boating) for installation personnel and guests. A boat-launching area and a number of picnic tables and cooking grills are located along a portion of the southwestern shore. Bagby Road provides the main access to the site, with several unpaved, dirt roads leading to the pond in various locations along its perimeter.

2.2 SITE HISTORY AND ENFORCEMENT ACTIVITIES

2.2.1 History of Site Activities

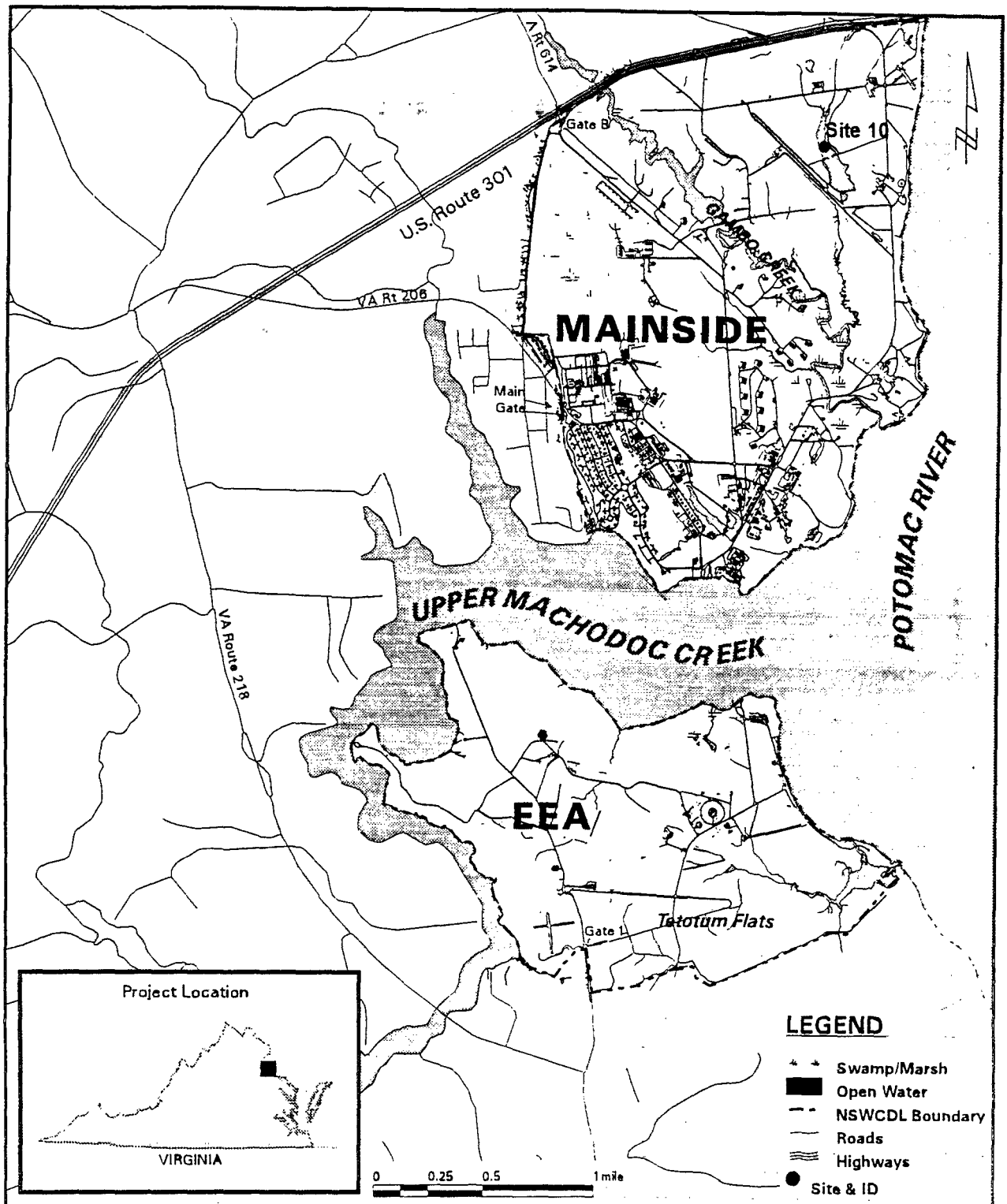
According to an U.S. Environmental Protection Agency (USEPA) study of aerial photographs, bridge and road building activities in the immediate vicinity of Hideaway Pond began during the late 1930s and early 1940s. In 1953 the bridge and road across the drainage were combined to form a dam that caused the stream to flood to the north. By 1981, flooding had begun south of the dam, and in 1983 a new dam was constructed approximately 400 feet north of Bagby Road. The area between the new dam and the original dam was flooded and the old roadway and dam that formed the original pond were largely removed.



Source: NAVFAC, 1993

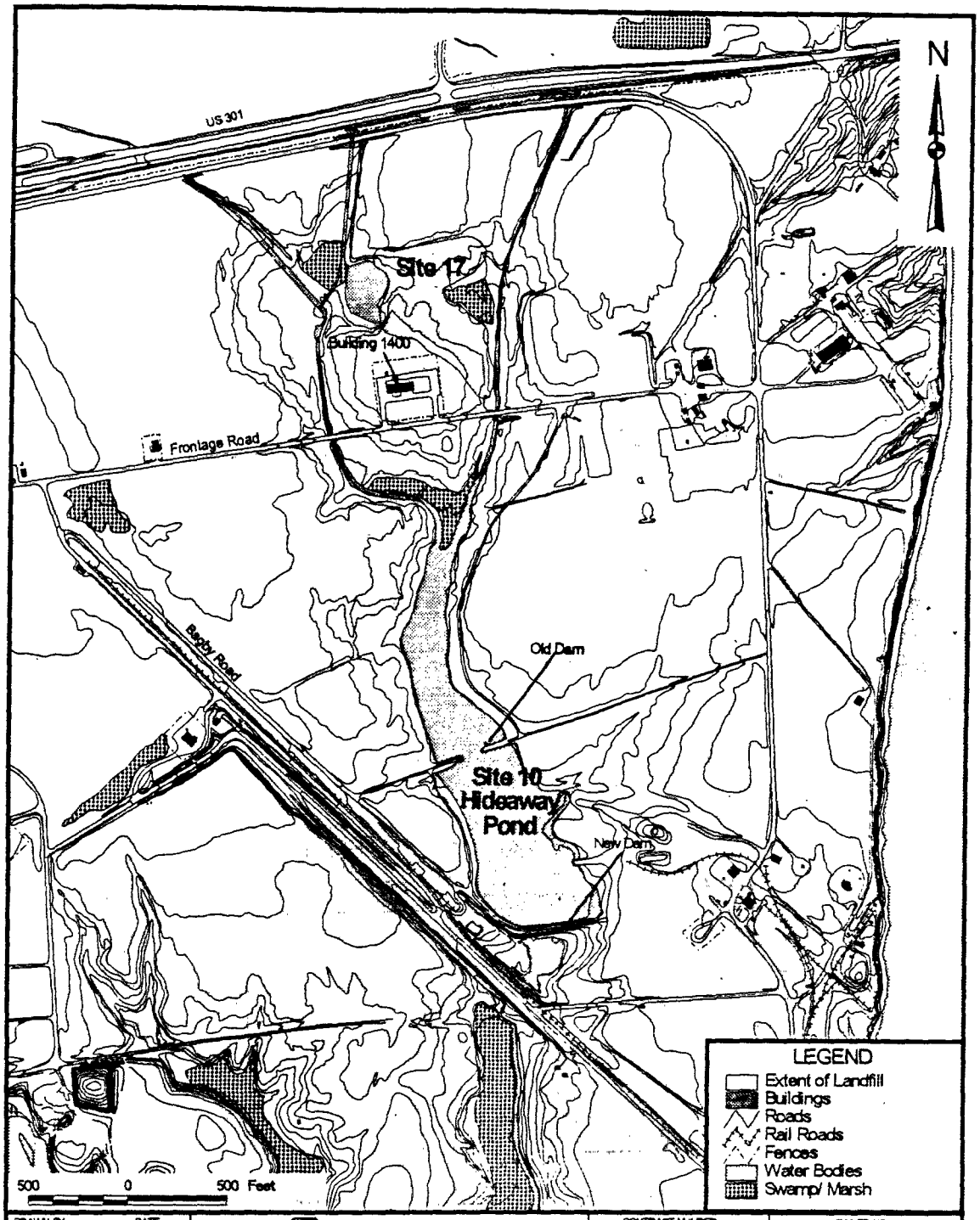
DRAWN BY TF — DATE June 99	Tetra Tech NUS, Inc.	CONTRACT NO. 7188-2501	OWNER NO CTO 261
CHECKED BY DM — DATE June 99	LOCATION MAP	APPROVED BY — DATE 06-08-99	
COST/SCHED-AREA		APPROVED BY — DATE	
0 10 20 Scale in Miles	NSWCDL DAHLGREN, VIRGINIA	DRAWING NO. Figure 2-1	REV 0

P:/Dahlgren/Site 17/Plts/location-0701.cdr



DRAWN BY TF — DATE June 99	Tetra Tech NUS, Inc.	CONTRACT NO. 7188-2501	OWNER NO. CTO 261
CHECKED BY DM — DATE June 99	SITE LOCATION MAP Site 10	APPROVED BY David Mal — DATE 06-08-99	
COST/SCHED-AREA		APPROVED BY — DATE	
SCALE AS SHOWN	NSWCDL DAHLGREN, VIRGINIA	DRAWING NO. Figure 2-2	REV 0

AML: /usr027/dahlgren/cto263/work_plot/plot-cto263-fig2-1 Map file: P:\dahlgren\base-wide\#cto246-bw-1004.cdr



DRAWN BY LR / DATE July 99	Tetra Tech NUS, Inc.	CONTRACT NUMBER 7188-2502	OWNER NO. CTO 261
CHECKED BY / DATE	SITE MAP SITE 10	APPROVED BY / DATE 7/29/00	
COST/SCHEDULE-AREA		APPROVED BY / DATE	
SCALE AS NOTED	NSWCDL DAHLGREN, VIRGINIA	DRAWING NO. Figure 2-3	REV 0

K:\GIPROJECT\DAHL SITE 17 AND 10.APR KLB

Other activities that occurred upstream (near the tributaries draining into Hideaway Pond) included the construction of Building 1400. Another area upstream of Hideaway Pond, just north of Building 1400 and south of U.S. Highway 301, was used for 8 years in the early 1970s as a sanitary landfill operation (Site 17, 1400 Area Landfill) following excavation activities associated with gravel mining. Two streams that flow south on either side of Site 17 merge and continue south into Hideaway Pond. Wastes at Site 17 include primarily municipal garbage which was deposited, compacted, and covered on a periodic basis.

Recreational fishing in Hideaway Pond was permitted until 1980, when NSWCDL requested that fish tissue samples be tested in an attempt to substantiate an anonymous report that Hideaway Pond might be contaminated with mercury. A catch-and-release policy was instituted after mercury was found in the fish. In 1990, the majority of the pond was drained in an attempt to change the fish community from dominance by gizzard shad to a bluegill-largemouth bass community. There were no special efforts made to remove all fish, however, most of the fish were either released downstream or perished at the site. The pond was subsequently refilled and restocked for catch-and-release only. At present, recreational fishing occurs on occasion; however, restrictions prohibit the consumption of fish because of the potential presence of mercury. Fishing is allowed on a catch-and-release basis only, and signs are posted at the pond prohibiting consumption of the fish. Analysis of the fish has continued on an annual basis.

2.2.2 Previous Investigations

Analysis of fish tissue samples from Hideaway Pond have been performed approximately annually since 1980 to monitor mercury levels. The U.S. Fish and Wildlife Service (USFWS), Office of Fishery Assistance (OFA) collected and analyzed fish tissue samples from 1980 to 1983. Fish tissue analyses conducted by OFA in August and October 1980 found mercury concentrations that exceeded the U.S. Food and Drug Administration (FDA) action level of 1.0 mg/kg. As a result of these initial findings, NSWCDL prohibited fishing at Hideaway Pond.

Subsequent testing in September 1981 by both the USFWS and NSWDOL (see discussion of Initial Assessment Study) showed that mercury concentrations in fish tissue had dropped lower than the FDA action level. Bottom sediment was also analyzed by the USFWS and found to contain mercury levels well below 1.0 mg/kg (with nearly all results less than 0.1 mg/kg on a dry weight basis).

In March 1982 the number of fish species tested by the USFWS was increased from two to eight, and six pond sediment samples were analyzed. Data from these analyses indicated lower mercury concentrations in the fish tissue and bottom sediment. The OFA recommended that Hideaway Pond be reopened for fishing, as long as the two largest species, chain pickerel (Esox niger) and largemouth bass (Micropterus salmoides), were used only as trophy fish and not for human consumption. These findings were corroborated by NSWCDL analyses.

In March 1983 mercury concentrations in all USFWS fish samples were less than the FDA action level. The recommendations of the 1982 study were reiterated in OFA's May 1983 report, and later that year NSWCDL reopened Hideaway Pond to recreation. Restrictions were placed to prohibit the consumption of chain pickerel more than 18 inches and largemouth bass more than 13 inches in length. NSWCDL analyses of fish tissue samples in 1983 found mercury levels less than 1 mg/kg in all species except chain pickerel. The 1983 report also notes that the suspected source of the mercury contamination was Site 17, the 1400 Area Landfill. Canisters of mercury were reported by employees to have been buried at Site 17, although there is no knowledge of the quantity of mercury involved. Efforts to locate the source of mercury have not been successful.

Mercury concentrations in most Hideaway Pond fish samples were less than the FDA action level in 1986, 1987, 1988, and 1989, with the exception of largemouth bass in 1986, 1988, and 1989 and white perch in 1988. The pond was drained in 1990 in an attempt to change the fish community from dominance by gizzard shad to a bluegill-largemouth bass community. The pond was subsequently refilled and restocked. Subsequent sampling results in 1991 through 1994 for the restocked fish population indicate mercury levels less than the FDA action level, with the exception of largemouth bass in 1992. The mercury concentration in the largemouth bass in 1994 was at the 1 mg/kg action level. No specific cause for these levels has been identified. Fishing is currently allowed on a catch-and-release basis.

An Initial Assessment Study (IAS) conducted in 1981 involved an onsite records review, site visit, and personnel interviews. The IAS recommended surface water and sediment sampling in Hideaway Pond and its two tributaries to identify the source of mercury contamination. The IAS also noted that a second phase would probably be required to refine initial results and would likely involve soil and groundwater sampling at Site 17.

A Confirmation Study conducted in 1983 consisted of the collection and analysis of surface water, sediment, and vegetation samples from Hideaway Pond, and groundwater and soil samples from Site 17. Pond and stream water samples were collected in November 1983 and analyzed for mercury to determine the existing exposure to aquatic life. Mercury was not detected in water samples from the two tributary streams nor from the pond.

Three additional water samples were collected in December 1983 from each of the two streams just upstream of Hideaway Pond and from the pond, near the dam, to determine whether any other contaminants had migrated from the Site 17 landfill toward the pond. Arsenic, barium, cadmium, chromium, lead, selenium, silver, fluoride, turbidity, nitrates, nitrites, alpha and beta radionuclides, and total coliform exceeded either Federal Drinking Water Standards or Virginia Surface Water Criteria levels. Pesticides or polychlorinated biphenyls (PCBs) were not detected in these samples.

Stream sediment samples were also collected and analyzed to determine the source, areal extent, and depth of mercury contamination and whether there was a continued active contribution to the mercury contamination of the site. The sediment samples were obtained in November 1983 (at depths up to 24 inches) from the streams and pond, including three locations upstream from Site 17.

Mercury was not detected in stream sediment collected upstream of the Site 17 landfill at two of the three locations. However, sediment from downstream locations in both tributary streams contained mercury. Mercury concentrations varied throughout the depths of the pond sediment.

Terrestrial flora samples were collected to determine contaminant migration and exposure to vegetation. Five composite samples were taken in November 1983 from the above ground portions of a variety of green plants near the pond and streams. Plant samples contained concentrations ranging from 0.6 to 7.6 mg/kg wet weight mercury. It was reported that plants may absorb mercury from contaminated soils through their root systems, or mercury may be deposited on the plant surface from particulates generated by industrial activities. The analytical procedures did not distinguish between mercury in the plant tissue and mercury on the surface of the plant.

It was concluded that mercury levels in the water, vegetation, and sediment of Site 10, Hideaway Pond, were not sufficiently high to warrant remedial action. Mercury was not detected in water samples but was detected at low levels in sediments. It was recommended that testing of fish tissue be continued to confirm the pattern of decreasing concentrations observed during 1980-1983. It was also recommended that NSWCDL maintain the restrictions on fish consumption that were imposed in 1982 until further tests of fish tissue samples could justify otherwise. It was also noted that the data provided evidence that Site 17 was a likely source of mercury contamination.

In 1991, ten surface water and eight sediment samples were collected from Hideaway Pond by NSWCDL to monitor the conditions at the pond. The water samples were analyzed for radiological parameters and selected metals. The sediment samples were analyzed for mercury only. Mercury was not detected in the water samples but was detected in the sediments.

2.2.3 Enforcement Actions

No enforcement actions have been taken at Site 10. The Navy has owned the property since 1918 and is identified as the responsible party.

2.3 COMMUNITY PARTICIPATION

In accordance with Sections 113 and 117 of CERCLA, the Navy provided a public comment period from July 20, 2000 through August 19, 2000 for the proposed remedial action described in the Feasibility Study and the Proposed Plan for Site 10.

The Feasibility Study and Proposed Plan were available to the public in the Administrative Record and information repositories maintained at the Smoot Memorial Library, King George, Virginia; the NSWCDL General Library, Dahlgren, Virginia; and the NSWCDL Public Record Room, Dahlgren, Virginia. Public notice was provided in *The Freelance Star* newspaper on July 20, 2000 and a public meeting was held in the King George Courthouse on August 9, 2000.

The Navy and NSWCDL have had a comprehensive public involvement program for several years. Starting in 1993, a Technical Review Committee (TRC) met on average twice a year to discuss issues related to investigative activities at NSWCDL. The TRC was composed of mostly governmental personnel; however, a few private citizens attended the meetings.

In the fall of 1994, the Navy converted the TRC into a RAB and eight to ten community representatives joined. The RAB is co-chaired by a community member and has held meetings approximately every 4 to 6 months. The RI/FS for Site 10 was discussed at the RAB meetings.

Community relations activities for the final selected remedy include:

- The documents concerning the investigation and analysis at Site 10 were placed in the information repository at the NSWCDL General Library and the Smoot Memorial Library.

- A newspaper announcement on the availability of the documents and the public comment period/meeting date was placed in *The Freelance* Star on July 20, 2000.

- The Navy established a 30-day public comment period starting July 20, 2000 and ending August 19, 2000 for review of the Proposed Remedial Action Plan.

- A Public Meeting was held August 9, 2000 to answer any questions concerning the Site 10 Proposed Plan.

2.4 SCOPE AND ROLE OF RESPONSE ACTIONS AT SITE 10

NSWCDL is divided into two areas, (1) Mainside, consisting of 2,677 acres, and (2) the Explosive Experimental Area consisting of 1,614 acres. NSWCDL has 71 sites that require investigation and potential cleanup. These sites were prioritized based on potential risk to humans and the environment. Remedies have been started at ten of eleven top priority sites. Site 10 is the last of these top priority sites to be addressed. Thirty-six of the remaining 60 sites require no further action based on risk. Investigations are ongoing or planned for the remaining sites. A list of all sites can be found in the current version of the Site Management Plan, which is located in the Administrative Record. The Site Management Plan contains location, description, contaminants of concern, and cleanup status of each site. Site 10 is included in the Site Management Plan.

Past releases from Site 17, 1400 Area Landfill, have resulted in contaminated surface water, sediment, and fish in Site 10, Hideaway Pond. It is expected that the remedy at Site 17, currently under construction, will reduce the movement of mercury from the landfill upstream to Hideaway Pond. The Navy will manage the remediation of Site 10 separately from Site 17. The selected Site 10 remedy is to use institutional controls to prevent the consumption of contaminated fish and to monitor the fish population for mercury. The proposed remedy would reduce the potential risk to people consuming fish from Hideaway Pond and establish target levels to protect the fish from mercury.

2.5 SITE CHARACTERISTICS

Hideaway Pond is a relatively shallow, manmade, 15 acre fresh water body situated to the northeast of Gambo Creek. The estimated area draining into the pond is 135 acres. The maximum depth of Hideaway Pond is approximately 8 to 12 feet, which occurs in the center of the new area near the pond discharge structure. The old portion of the pond has a maximum depth of 5 feet. The pH of the water is generally 6. Two small tributaries to Hideaway Pond drain a relatively small area north of the pond. These tributaries originate in the higher elevations northwest of the NSWCDL. Hideaway Pond and its two tributaries drain south into a small ponded area that eventually flows approximately 3,000 feet into Gambo Creek, which is part of the larger Gambo Creek drainage area in the northeast portion of NSWCDL. Gambo Creek eventually enters Upper Machodoc Creek near it's mouth at the Potomac River, approximately 1.1 miles south of U.S. Highway 301.

The topography surrounding Hideaway Pond and its tributaries is nearly level, low, and featureless. The elevation of the surface of the pond is approximately 10 feet above mean sea level (msl), and elevations range up to approximately 20 feet throughout the remaining drainage area. Based on existing U.S. Geological Survey (USGS) topographic data, the pond is approximately 2,500 feet in length and between 300 and 500 feet in width.

The RI at Site 10 included a contamination assessment and risk assessment. The RI field investigation was developed based on the data from previous investigations of mercury detected in fish, surface water, and sediment at Hideaway Pond, as well as mercury detected in groundwater, surface water, and sediment at Site 17. The conceptual model for Site 10 includes Site 17 landfill as the potential source area, groundwater and surface water transport to the tributaries and migration via surface water and sediment to Hideaway Pond. Therefore, no soil samples or groundwater monitoring well installations were included in the RI at Site 10. The RI sampling program provided a basis for re-evaluating the mercury content of pond water and sediment and to compare these results with previous analyses and other available data. RI surface water and sediment samples were collected from the old and new section of the pond. Fish tissue analysis is ongoing at NSWCDL and the results were included in the risk assessments. The RI at Site 10 was completed in phases. Surface water and sediment sampling activities were completed in 1994. Additional surface water and sediment sampling activities, using a low-level mercury laboratory analysis method, was completed in 1996. The results of the RI are summarized below,

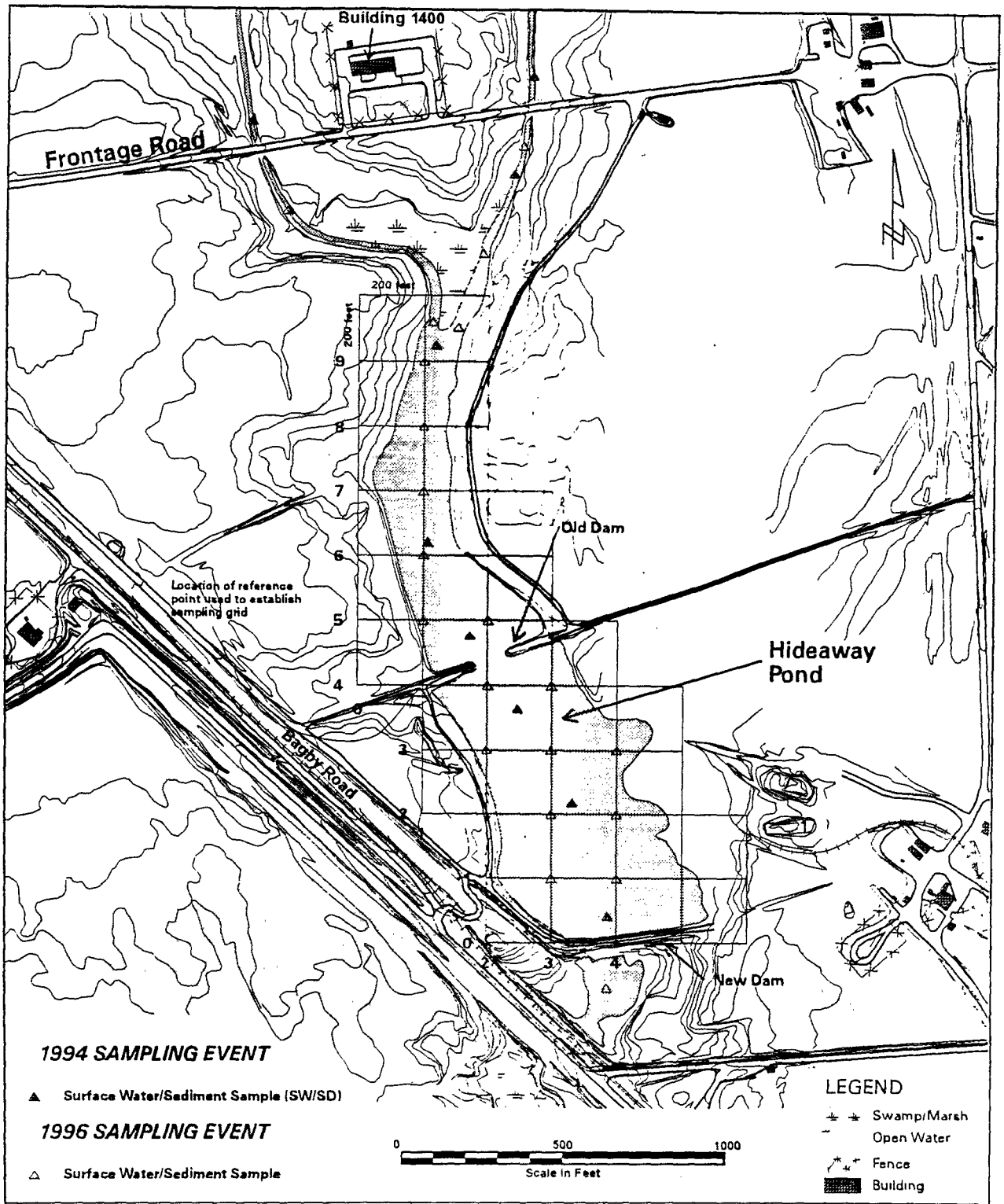
2.5.1 Sources of Contamination

Based on RI sampling results at Sites 10 and 17, a past source of surface water and sediment contamination at Site 10 is believed to be waste buried at Site 17. Mercury detected in fish at Site 10 is believed to be from contaminated surface water and sediment within Hideaway Pond. Site 17 is believed to be the original source of mercury.

2.5.2 Description of Contamination

The major concerns at Site 10 are associated with the migration of contaminants from the Site 17 landfill area. Surface water and sediment samples (see Figure 2-4) were analyzed for an expansive list of parameters including those representative of waste disposed at Site 17. This effort was performed to determine the nature and extent of contamination at Site 10. No COCs requiring remediation were identified in surface water and sediment based on the RI sampling effort. Mercury in fish tissue was the only significant COC.

When evaluating mercury concentrations in fish tissue, fish samples that had been collected between 1990 and 1999 were evaluated because they were representative of current conditions. The highest concentration was 2.49 mg/kg in largemouth bass in 1995. Average concentrations were 0.54 mg/kg for largemouth



DRAWN BY TF	DATE June 99	Tetra Tech NUS, Inc.	CONTRACT NO. 7188-2501	OWNER NO. CTO 261
CHECKED BY DM	DATE June 99	SAMPLE LOCATION MAP SITE 10	APPROVED BY	DATE 06-08-99
COST/SCHED-AREA			APPROVED BY	DATE
SCALE AS SHOWN		NSWCDL DAHLGREN, VIRGINIA	DRAWING NO Figure 2-4	REV 0

AML: /usr027/dahlgren/cto246/work_plot/plot-cto246-fs.aml

N:/dept/dahlgren/site10/fig6-2new2.cdr

bass and black crappie, 0.21 mg/kg for bluegill (excluding small fish sampled in 1999), and 0.11 mg/kg for channel catfish. Mean concentrations grouped by length and weight were 0.02 mg/kg (fish # 120 mm) and 0.29 mg/kg (fish # 0.8 kg), respectively.

Although mercury was identified as a COC in fish collected from Hideaway Pond, none of the surface water concentrations detected in Hideaway Pond and downstream of the pond exceeded the Federal Ambient Water Quality Criteria (FAWQC) standard of 0.012 Fg/L for mercury. The highest mercury concentration (0.01069 Fg/L) was detected in the surface water immediately downstream of Hideaway Pond. The lowest concentration (0.00511 Fg/L) was detected in the western section of the new portion of Hideaway Pond. Mercury concentrations detected in the remainder of the surface water samples were of the same order of magnitude. No trends were evident in the distribution of mercury in surface waters. There was no evidence of significant concentrations of mercury-contaminated water being released downstream of Hideaway Pond.

Mercury was detected in sediment samples collected from Hideaway Pond. Sample results ranged from 11.29 Fg/kg to 124.57 Fg/kg. Based on the data, no apparent source areas or hot spots were identified. Generally, the samples collected along the centerline of the pond were highest, but the gradients were not consistent and the relative difference among such low concentrations was insignificant. For comparison purposes, the data were evaluated against the effects-range low (ER-L) concentration for bottom-dwelling organisms, which is 150 Fg/kg. ER-Ls concentrations represent the 10th percentile of "apparent effects" associated with sediment toxicants by compiling biological effects for a specific toxicant. All sediment results were less than 150 Fg/kg.

Surface water and sediment samples collected from Hideaway Pond were compared with samples collected from tributaries of Hideaway Pond, both upstream and downstream of Site 17, in order to evaluate Site 17 as a source of mercury contamination in Hideaway Pond. Five surface water samples taken adjacent to and downstream of Site 17 exceeded the FAWQC standard of 0.012 Fg/L for mercury. No sediment samples exceeded the ER-L concentration of 150 Fg/kg. The pattern of mercury concentrations indicates Site 17 has been releasing mercury to surface water and sediment which is transported downstream to Site 10, Hideaway Pond.

In summary, Site 17 appears to be a source of mercury contamination in Hideaway Pond. Site 10 mercury concentrations in the surface water and sediment do not exceed the FAWQC and ER-L, respectively. Mercury concentrations in fish tissue are of significant concern.

2.5.3 Contaminant Migration

No disposal activities were reported at Hideaway Pond; however, Site 17 was identified as an upstream source of contaminants. The primary COC at Site 10 was mercury in fish tissue. The RI sampling data indicated generally low concentrations of mercury were present in surface water and sediments.

Mercury exists in both organic and inorganic forms and may occur as elemental mercury or ionic mercury. Elemental mercury is very dense and has a vapor pressure that increases rapidly with small increases in temperature. Dissolution is unlikely because mercury in all its forms has a strong tendency to sorb to nearly every available surface, including sediments and organic matter. However, changes in chemical conditions in sediments and surface water have a strong effect on dissolution. In soils and surface waters, some forms of mercury partition to particulates, and in soils and sediments. Sorption is one of the most important controlling pathways for transporting mercury. The tendency to sorb makes mercury immobile under most environmental conditions.

However, under certain conditions, mercury is known to associate with suspended solids and colloidal matter in aquatic systems, thus making it capable of mobility. Mercury may be released from the sediments of Hideaway Pond via seasonal storm events strong enough to scour and transport bottom sediments. However, major erosion-causing storm events are unlikely to occur, given the flat topography of the watershed and the controlled discharge from the pond. These factors combined, result in slow-moving waters and shallow gradients, which are not conducive to erosional processes.

Mercury in its elemental state is very insoluble in water. In some of its ionic forms, however, it is very soluble in water. Bacterial and abiotic chemical processes can methylate mercury ions in both water and geologic materials. Many animals and certain plants can readily acquire methyl mercury. Methyl mercury is more easily absorbed by fish and other aquatic fauna, either directly through the gills or by ingestion of contaminated aquatic plants and animals. The most significant concern is for mercury to bioaccumulate into aquatic species, particularly in the form of methyl mercury. Methyl mercury quickly enters the aquatic food chain and thereby begins the process of bioaccumulation and biomagnification in fish and other ecological receptors.

2.6 CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES

Site 10 is located in the northeast portion of the Mainside, just south of Frontage Road and east of Bagby Road. Site 10 consists of a manmade body of water created along a marshy drainage, which flows in a southerly direction into Gambo Creek. Land within a half-mile radius of Hideaway Pond is mainly undeveloped and wooded. Buildings are located approximately 700 ft. to the southeast and 1,000 ft. east of Site 10.

Recreational fishing and boating are allowed on the pond. All fishing is catch-and-release as per base fishing rules. The pond is mainly used as a source of recreation for installation personnel and guests. Site conditions suggest that recreational fishing is done from boats, as opposed to the shore. Picnic areas are located along several roads within a half-mile radius of Site 10. Access to Hideaway Pond from Bagby Road is unrestricted. Nearby roads are used by base personnel for jogging and bike riding. Based on land use, activities potentially exposing humans to contamination at Site 10 include hunting, fishing, and boating. Maintenance activities are generally restricted to the picnic area and exposure to contamination in the pond is unlikely.

Site 10 is currently a natural resource area and is anticipated to remain a natural resource area in the future. The mission of the base is currently expanding and future potential for base closure and conversion to residential land use is considered to be minimal.

The watertable (or Columbia) aquifer surrounding Hideaway Pond is a thin water-bearing zone underlain by a laterally persistent clay confining layer (or Upper Confining Unit). Shallow groundwater at the base is known to discharge to adjacent shallow water bodies such as Hideaway Pond. The watertable aquifer at the base is generally of poor quality because of high, naturally occurring concentrations of some metals (i.e., iron and manganese) according to a USGS study. Poor water quality, coupled with the thin saturated thickness and locally high percentages of fine grain sediments, diminishes the potential use of the watertable aquifer as an industrial or potable water source. The USGS study reports a regionally persistent clay layer below the Columbia Aquifer which appears to be continuous throughout the base. Although a vertically downward gradient is present between the watertable and the first confined aquifer (beneath the clay confining unit), the ratio of median horizontal hydraulic conductivity of the Columbia aquifer to median vertical hydraulic conductivity of the upper confining unit is approximately 2,600:1. The ratio indicates that under natural flow conditions, most water in the Columbia aquifer discharges to adjacent surface water bodies.

2.7 SUMMARY OF SITE RISKS

The human health and ecological risks associated with exposure to contaminated media at Site 10 were evaluated in the Addendum RI Report. Mercury in fish tissue was the only COC determined to warrant remedial action. Risks associated with the ingestion of mercury contaminated fish tissue is considered a potential risk to human receptors. Risk to piscivorous fish is considered moderate due to average fish tissue concentrations of mercury near the lower toxicity threshold.

2.7.1 Human Health Risks

The baseline risk assessment estimates risks at the site if no remedial action is taken. It provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action. This section of the ROD summarizes the results of the baseline risk assessment for this site.

Identification of Chemicals of Potential Concern

Table 2-1 presents the chemicals of potential concern (COPCs) and exposure point concentration (EPC) for each of the COPCs detected in sediment, surface water, and fish tissue (i.e., the concentration that will be used to estimate the exposure and risk from each COPC in the sediment, surface water, and fish tissue). The table includes the range of concentrations detected for each COPC, as well as the frequency of detection (i.e., the number of times the chemical was detected in the samples collected at the site), the EPC, and how the EPC was derived. Due to the limited amount of sample data available for each COPC, the maximum concentration was used as the default exposure point concentration.

Exposure Assessment

Adult recreational users, base workers, construction workers, and on-site residents (adults and children) were the potential receptors evaluated in the quantitative risk assessment. Base workers were evaluated for current and future conditions. Recreational users, construction workers, and on-site residents were evaluated for future conditions only. Although the potential for the site to be converted to residential land use is minimal, potential risks to future on-site residents were quantified for purposes of completeness. All potential receptors were evaluated for exposure to surface water and sediment. Under the current and future land use scenarios considered at Site 10, the exposure routes were incidental ingestion and dermal contact with surface water and sediment. Ingestion of fish was evaluated for adult recreational users. Child recreational users are not evaluated separately for exposure to fish contamination. It is assumed that child recreational users eat less fish than adult recreational users; however, their lesser body weight makes the exposure scenario similar to the adult recreational exposure scenario. The risk assessment considered recreational receptors under future conditions only, because currently a fish catch-and-release program is maintained. Human exposure to groundwater was not considered a potential exposure pathway for Site 10. Therefore, pathways associated with these media were not quantitatively evaluated.

TABLE 2-1

MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
SITE 10
NWSCDL, DAHLGREN, VIRGINIA

Exposure Point	Chemical of Potential Concern	Units	Minimum Concentration	Maximum Concentration	Frequency of Detection	Exposure Point Concentration	EPC Units	Statistical Measure
Ingestion and dermal contact with chemicals in surface water	Iron	mg/L	1.28	2.5	6/6	2.5	mg/L	Maximum
Ingestion and dermal contact with chemicals in sediment	Aluminum	mg/kg	14,600	25,600	6/6	25,600	mg/kg	Maximum
	Chromium	mg/kg	25.1	33.4	2/6	33.4	mg/kg	Maximum
	Iron	mg/kg	17,900	29,100	6/6	29,100	mg/kg	Maximum
	Manganese	mg/kg	197	363	6/6	363	mg/kg	Maximum
	Benzo(a)pyrene	mg/kg	0.12	0.18	2/6	0.18	mg/kg	Maximum
Ingestion of chemicals in fish tissue[(1)]	Arsenic	mg/kg	NA	NA	NA	0.114[(2)]	mg/kg	NA
	Mercury	mg/kg	NA[(2)]	NA[(2)]	NA[(2)]	1.468[(2)]	mg/kg	NA[(2)]

1 Theoretical concentrations were calculated for arsenic using maximum surface water concentrations and chemical-specific bioconcentration factors. Actual mercury concentrations in fish tissue were used in the quantitative evaluation.
2 Data set consists of less than 10 samples. Maximum concentrations were used to evaluate the reasonable maximum exposure (RME).
NA = Not Applicable

Toxicity Assessment

Table 2-2 summarizes carcinogenic risk information which is relevant to the COPCs in all media evaluated. Cancer slope factors (CSFs) have been developed by USEPA's Carcinogenic Assessment Group for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. CSFs are multiplied by the estimated intake of a potential carcinogen, in mg/kg-day, to provide an upperbound estimate of the excess lifetime cancer risk associated with exposure at that intake level. The term "upper bound" reflects the conservative estimate of the risks calculated from the CSFs. Use of this approach makes underestimation of the actual cancer risk highly unlikely. Cancer slope factors are derived from the results of human epidemiological studies or chronic animal bioassays to which animal-to-human extrapolation and uncertainty factors have been applied.

Table 2-3 summarizes non-carcinogenic risk information which is relevant to the COPCs in all media evaluated. Reference doses (RfDs) have been developed by the USEPA for indicating the potential for adverse health effects from exposure to chemicals exhibiting noncarcinogenic effects. RfDs, which are expressed in units mg/kg-day, are estimates of lifetime daily exposure levels for humans, including sensitive individuals. Estimated intakes of chemicals from environmental media (e.g., the amount of a chemical ingested from contaminated drinking water) can be compared with the RfD. RfDs are derived from human epidemiological studies or animal studies to which uncertainty factors have been applied (e.g., to account for the use of animal data to predict effects on humans). These uncertainty factors help ensure that the RfDs will not underestimate the potential for adverse noncarcinogenic effects to occur.

Risk Characterization

For carcinogens, risks are generally expressed as the incremental probability of an individual's developing cancer over a lifetime as a result of exposure to the carcinogen. Excess lifetime cancer risk is calculated from the following equation:

$$\text{Risk} = \text{CDI} \times \text{SF}$$

Where:

Risk = a unitless probability (e.g., 2×10^{-5}) of an individual's developing cancer
CDI = chronic daily intake averaged over 70 years (mg/kg-day)
SF = slope factor, expressed as $(\text{mg/kg-day})^{-1}$.

TABLE 2-2

CANCER TOXICITY DATA -- ORAL/DERMAL
SITE 10
NSWCDL, DAHLGREN, VIRGINIA

Chemical of Potential Concern	Oral CSF	Oral to Dermal Adjustment Factor	Adjusted Dermal Cancer Slope Factor[1]	Units	Weight of Evidence/ Cancer Guideline Description	Source	Date[2]
Arsenic	1.5	NA	NA	$(mg/kg\text{-}day)^{-1}$	A	IRIS	4/13/00
Benzo(a)pyrene	7.3	NA	NA	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	4/13/00

1 CSFdermal = CSForal/(Oral to Dermal Adjustment Factor)
2 Date of IRIS

Notes:
CSF = Cancer Slope Factor
IRIS = Integrated Risk Information System, on-line database search (USEPA, April 2000)
N/A = Not Applicable

EPA Group:
A - Human carcinogen
B1 - Probable human carcinogen - indicates that limited human data are available
B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans
C - Possible human carcinogen
D - Not classifiable as a human carcinogen
E - Evidence of noncarcinogenicity

TABLE 2-3

NON-CANCER TOXICITY DATA -- ORAL/DERMAL
SITE 10
NSWCDL, DAHLGREN, VIRGINIA

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD	Oral RfD Units	Oral to Dermal Adjustment Factor	Adjusted Dermal RfD[1]	Dermal RfD Units	Primary Target Organ	Combined Uncertainty/ Modifying Factors	Sources of RfD: Target Organ	Dates of RfD: Target Organ[2]
Aluminum	chronic	1.0E+00	mg/kg-day	0.05	5.00E-02	mg/kg-day	Immune System	300	NCEA	4/13/00
Arsenic	chronic	3.0E-04	mg/kg-day	NA	NA	mg/kg-day	Vascular	3	IRIS	4/13/00
Chromium	chronic	3.0E-03	mg/kg-day	0.025	7.50E-05	mg/kg-day	None	1,000	IRIS	4/13/00
Iron	chronic	3.0E-01	mg/kg-day	1	3.00E-01	mg/kg-day	Liver, Blood, GI Tract		NCEA	4/13/00
Manganese	chronic	1.4E-01	mg/kg-day	0.06	8.40E-03	mg/kg-day	CNS	1	IRIS	4/13/00
Mercury (methyl)	chronic	1.0E-04	mg/kg-day	NA	NA	mg/kg-day	CNS	10	IRIS	4/13/00

1 RfD dermal = RfDoral x (Oral to Dermal Adjustment Factor)
2 Dates of IRIS or NCEA

Notes: RfD = Reference dose
CNS = Central Nervous System
IRIS = Integrated Risk Information System, on-line database search (USEPA, April 2000)
NCEA = USEPA National Center for Environmental Assessment (USEPA RBC Table, April 2000)
NA = Not Applicable

These risks are probabilities that usually are expressed in scientific notation (e.g, $1x10^{-6}$). An excess lifetime cancer risk of $1x10^{-6}$ indicates that an individual experiencing the reasonable maximum exposure estimate has a 1 in 1,000,000 chance of developing cancer as a result of site-related exposure. This is referred to as an "excess lifetime cancer risk" because it would be in addition to the risks of cancer individuals face from other causes such as smoking or exposure to too much sun. The chance of an individual developing cancer from all other causes has been estimated to be as high as one in three. EPA's generally acceptable risk range for site-related exposures is 10^{-4} to 10^{-6}.

The potential for noncarcinogenic effects is evaluated by comparing an exposure level over a specified time period (e.g., life time) with a RfD derived for a similar exposure period. An RfD represents a level that an individual may be exposed to without deleterious effects. The ratio of exposure to toxicity is called a hazard quotient (HQ). An HQ<1 indicates that a receptor's dose of a single contaminant is less than the RfD, and that toxic noncarcinogenic effects from that chemical are unlikely. The Hazard Index (HI) is generated by adding the HQ's for all chemical(s) of concern that affect the same target organ (e.g., liver) or that act through the same mechanism of action within a medium or across all media to which a given individual may reasonably be exposed. An HI<1 indicates that, based on the sum of all HQ's from different contaminants and exposure routes, toxic noncarcinogenic effects from all contaminants are unlikely. An HI>1 indicates that site-related exposure may present a risk to human health.

The HQ is calculated as follows:

Non-cancer HQ CDI/RfD

where:

CDI = Chronic daily intake
RfD = Reference dose.

CDI and RID are expressed in the same units and represent the same exposure period (i.e., chronic, subchronic, or short-term).

Current and Future Base Worker. The cumulative noncancer HI (Table 2-4) for ingestion of and dermal contact with surface water and sediment at Site 10 under industrial land use conditions is 0.021, which is less than 1 indicating little or no risk to human receptors. The cumulative ingestion and dermal contact cancer risk is 4.6×10^{-7}, under a "reasonable maximum exposure" (RME) scenario (Table 2-4). This cancer risk is below the USEPA's acceptable target risk range of 1×10^{-6} to 1×10^{-4}.

TABLE 2-4

REASONABLE MAXIMUM EXPOSURE (RME)
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - BASE WORKERS
SITE 10
NWSCDL, DAHLGREN, VIRGINIA

Scenario Timeframe: Current / Future
Receptor Population: Base Workers
Receptor Age: Adult

				Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
Medium	**Exposure Medium**	**Exposure Point**	**Chemical**	**Ingestion**	**Inhalation**	**Dermal**	**Exposure Routes Total**	**Chemical**	**Primary Target Organ**	**Ingestion**	**Inhalation**	**Dermal**	**Exposure Routes Total**
Surface Water	Water	Surface Water	Iron[1]				NA	Iron	Liver, Blood, GI Tract	1.6E-02		7.5E-04	1.7E-02
Sediment	Sediment	Sediment	Aluminum					Aluminum	Immune System	2.5E-02		2.8E-02	5.3E-02
			Chromium					Chromium	None	1.1E-02		2.4E-02	3.5E-02
			Iron					Iron	Liver, Blood, GI Tract	9.5E-02		5.2E-03	1.0E-01
			Manganese					Manganese	CNS	2.5E-03		2.3E-03	4.9E-03
			Benzo(a)pyrene	4.6E-07			4.6E-07	Benzo(a)pyrene	None				
						Total Risk Across Surface Water	NA	Total Hazard Index Across All Media and All Exposure Routes					2.1E-01
						Total Risk Across Sediment	4.6E-07						
						Total Risk Across All Media and All Exposure Routes	4.6E-07						

Total Immune System HI =	5.3E-02
Total Liver HI =	1.2E-01
Total Blood HI =	1.2E-01
Total Gastrointestinal HI =	1.2E-01
Total CNS HI =	4.9E-03

1 Iron is not considered a carcinogen
NA = Not Applicable
CNS = Central nervous system
GI = Gastrointestinal

Future Construction Work. The cumulative noncancer HI (Table 2-5) for ingestion of and dermal contact with surface water and sediment at Site 10 under the RME scenario is 0.072, which is less than 1 indicating little or no risk to human receptors. The cumulative ingestion and dermal contact cancer risk is 8.8×10^{-8} under the RME scenario (Table 2-5), and this is less than the USEPA's acceptable target risk range of 1×10^{-6} to 1×10^{-4}.

Future Resident. The highest cumulative noncancer HI (Table 2-6 and 2-7) for ingestion of and dermal contact with surface water and sediment at Site 10 under the hypothetical residential land use conditions is 1.2 for a child under the RME scenario which exceeds unity (1.0). However, no adverse health effects are anticipated for the assumed exposure conditions because the HI for each primary target organ is less than one, as summarized in Table 2-7. It should be noted that potential receptors were assumed to be exposed to maximum concentrations in surface water and sediment, representing a worst case scenario. Also, the primary contributor to this risk was iron and the RfD for iron is based on recommended daily intakes rather than adverse health effects. Consequently the risk associated with iron is overestimated.

The total highest residential incremental lifetime cancer risk (Tables 2-6 and 2-7) is 1.3×10^{-6} under a RME scenario for a child and is within the acceptable target risk range of 1×10^{-6} to 1×10^{-4}.

Future Adult Recreational User. The cumulative noncancer HI (Table 2-8) for ingestion of fish from Site 10 is 5.6 for reasonable maximum exposure (RME) scenario. The HI for the RME exceeds one primarily as a result of the ingestion of methyl mercury in fish tissue. The HI indicates that adverse health effects may be anticipated with ingestion of fish contaminated with methyl mercury.

The incremental lifetime cancer risk (Table 2-8) is 2.6×10^{-5} under a RME scenario. Although the incremental cancer risk slightly exceeded 1×10^{-6}, it is within USEPA's target risk range of 1×10^{-4} to 1×10^{-6}.

Uncertainty Analysis

The major sources of uncertainty specific to conditions at Site 10 include:

- The ingestion rates used to represent the average and RME cases were default guidance values that were applied to the exposure frequency. These rates are based on an assumption that a recreational user is frequently consuming fish from the pond. This assumption does not necessarily reflect actual activity patterns and may result in overestimation of the health risk.

TABLE 2-5

REASONABLE MAXIMUM EXPOSURE (RME)
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - EXCAVATION / CONSTRUCTION WORKER
SITE 10
NWSCDL, DAHLGREN, VIRGINIA

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

				Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
Medium	**Exposure Medium**	**Exposure Point**	**Chemical**	**Ingestion**	**Inhalation**	**Dermal**	**Exposure Routes Total**	**Chemical**	**Primary Target Organ**	**Ingestion**	**Inhalation**	**Dermal**	**Exposure Routes Total**
Surface Water	Water	Surface Water	Iron[1]				NA	Iron	Liver, Blood, GI Tract	1.6E-02		7.5E-04	1.7E-02
Sediment	Sediment	Sediment	Aluminum					Aluminum	Immune System	1.2E-01		2.8E-02	1.5E-01
			Chromium					Chromium	None	5.2E-02		2.4E-02	7.6E-01
			Iron					Iron	Liver, Blood, GI Tract	4.6E-01		5.2E-03	4.6E-01
			Manganese					Manganese	CNS	1.2E-02		2.3E-03	1.5E-02
			Benzo(a)pyrene	8.8E-08			8.8E-08	Benzo(a)pyrene	None				
						Total Risk Across Surface Water	NA					Total Hazard Index Across All Media and All Exposure Routes	7.2E-01
						Total Risk Across Sediment	8.8E-08						
												Total Immune System HI =	1.5E-01
						Total Risk Across All Media and All Exposure Routes	8.8E-08					Total Liver HI =	4.8E-01
												Total Blood HI =	4.8E-01
												Total Gastrointestinal HI =	4.8E-01
												Total CNS HI =	1.5E-02

1 Iron is not considered a carcinogen
NA = Not Applicable
CNS = Central nervous system
GI = Gastrointestinal

TABLE 2-6

REASONABLE MAXIMUM EXPOSURE (RME)
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - HYPOTHETICAL FUTURE ADULT RESIDENTIAL USER
SITE 10
NWSCDL, DAHLGREN, VIRGINIA

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Water	Water	Surface Water	Iron(1)				NA	Iron	Liver, Blood, GI Tract	2.3E-02		1.1E-03	2.42E-02
Sediment	Sediment	Sediment	Aluminum					Aluminum	Immune System	3.5E-02		8.1E-02	1.2E-01
			Chromium					Chromium	None	1.5E-02		7.1E-02	8.6E-02
			Iron					Iron	Liver, Blood, GI Tract	1.3E-01		1.5E-02	1.5E-01
			Manganese					Manganese	CNS	3.6E-03		6.9E-03	1.0E-02
			Benzo(a)pyrene	6.2E-07			6.2E-07	Benzo(a)pyrene	None				
						Total Risk Across Surface Water	NA					Total Hazard Index Across All Media and All Exposure Routes	3.9E-01
						Total Risk Across Sediment	6.2E-07						
												Total Immune System HI =	1.2E-01
						Total Risk Across All Media and All Exposure Routes	6.2E-07					Total Liver HI =	1.7E-01
												Total Blood HI =	1.7E-01
												Total Gastrointestinal HI =	1.7E-01
												Total CNS HI =	1.0E-02

1 Iron is not considered a carcinogen
NA = Not Applicable
CNS = Central nervous system
GI = Gastrointestinal

TABLE 2-7

REASONABLE MAXIMUM EXPOSURE (RME)
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - HYPOTHETICAL FUTURE ADULT CHILD RESIDENTIAL USER
SITE 10
NWSCDL, DAHLGREN, VIRGINIA

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child (0 - 6 years)

				Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
Medium	Exposure Medium	Exposure Point	Chemical	Ingestion	Inhalation	Dermal	Exposure Routes Total	Chemical	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Water	Water	Surface Water	Iron[1]				NA	Iron	Liver, Blood, GI Tract	6.4E-02		6.5E-03	7.0E-02
Sediment	Sediment	Sediment	Aluminum					Aluminum	Immune System	2.0E-01		4.4E-02	2.4E-01
			Chromium					Chromium	None	8.5E-02		3.8E-02	1.2E-01
			Iron					Iron	Liver, Blood, GI Tract	7.4E-01		8.3E-03	7.5E-01
			Manganese					Manganese	CNS	2.0E-02		3.7E-03	2.4E-02
			Benzo(a)pyrene	1.3E-06			1.3E-06	Benzo(a)pyrene	None				
						Total Risk Across Surface Water	NA					Total Hazard Index Across All Media and All Exposure Routes	1.2E+01
						Total Risk Across Sediment	1.3E-06						
						Total Risk Across All Media and All Exposure Routes	1.3E-06					Total Immune System HI =	2.4E-01
												Total Liver HI =	8.2E-01
												Total Blood HI =	8.2E-01
												Total Gastrointestinal HI =	8.2E-01
												Total CNS HI =	2.4E-02

1 Iron is not considered a carcinogen
NA = Not Applicable
CNS = Central nervous system
GI = Gastrointestinal

TABLE 2-8

REASONABLE MAXIMUM EXPOSURE (RME)
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - ADULT RECREATIONAL USER
SITE 10
NWSCDL, DAHLGREN, VIRGINIA

Scenario Timeframe: Future
Receptor Population: Recreational User
Receptor Age: Adult

				Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
Medium	**Exposure Medium**	**Exposure Point**	**Chemical**	**Ingestion**	**Inhalation**	**Dermal**	**Exposure Routes Total**	**Chemical**	**Primary Target Organ**	**Ingestion**	**Inhalation**	**Dermal**	**Exposure Routes Total**
Surface Water	Water	Surface Water	Iron[1]				NA	Iron	Liver, Blood, GI Tract	1.1E-02		1.3E-03	1.3E-02
Sediment	Sediment	Sediment	Aluminum					Aluminum	Immune System	1.8E-02		4.0E-02	5.8E-02
			Chromium					Chromium	None	7.6E-03		3.5E-02	4.3E-02
			Iron					Iron	Liver, Blood, GI Tract	6.6E-02		7.6E-03	7.4E-02
			Manganese					Manganese	CNS	1.8E-03		3.4E-03	5.2E-03
			Benzo(a)pyrene	3.2E-07			3.2E-07	Benzo(a)pyrene	None				
Fish Tissue	Fish Tissue	Fish Tissue	Arsenic	2.6E-05			2.6E-05	Arsenic	Vascular	1.4E-01			1.4E-01
			Mercury					Mercury	CNS	5.2E+00			5.2E+00

Total Risk Across Surface Water	NA
Total Risk Across Sediment	3.2E-07
Total Risk Across fish tissue	2.6E-05
Total Risk Across All Media and All Exposure Routes	2.7E-05

Total Hazard Index Across All Media and All Exposure Routes	5.6E+00
Total Immune System HI =	5.8E-02
Total Liver HI =	8.7E-02
Total Blood HI =	8.7E-02
Total Gastrointestinal HI =	8.7E-02
Total CNS HI =	5.2E+00
Total Vascular HI =	1.4E-01

1 Iron is not considered a carcinogen
NA = Not Applicable
CNS = Central nervous system
GI = Gastrointestinal

Health Risk Assessment Summary

Potential receptors evaluated at Site 10 include base workers, construction workers, residents, and recreational users. The estimated incremental lifetime cancer risks for all potential receptors were either less than 1×10^{-6} or within the EPA target risk range of 1×10^{-4} to 1×10^{-6} . The estimated HI for the RME scenario exceeds the noncarcinogenic limit of 1.0 due to ingestion of mercury in fish. Therefore, potential health hazards are associated with ingestion of mercury in fish at Site 10. A toxicity profile for mercury is included in Appendix C.

2.7.2 Environmental Evaluation

The intent of the baseline ecological risk assessment (ERA) was to characterize potential receptors and to estimate the potential hazard or risk to environmental receptors. Habitat mapping, wetlands characterization, terrestrial habitat/wildlife characterization, and macroinvertebrate (e.g., clam) inventories were performed in order to characterize the biota (plants and animals) and habitats associated with Site 10. Samples were collected from surface water and sediment in Hideaway Pond as well as locations upstream and downstream of the pond. Macroinvertebrate community samples were taken from locations within the pond. Mercury analysis of fish tissue from Hideaway Pond was performed by NSWCDL in most years from 1981 through 1999.

Identification of Ecological COCs

Surface water and sediment data were initially screened to identify COPCs. Tables 2-9 and 2-10 summarize the screening-level ecological risk assessment for surface water and sediment, respectively. In addition, all detected chemicals underwent a screening using simple food chain models and estimates of potential effects to wildlife from ingesting site contaminants, as summarized in Table 2-11. Each of the COPCs identified after the initial screening was re-evaluated, as summarized in Table 2-12, in order to develop a final list of COPCs.

The baseline assessment included comparison of mean concentrations to screening levels and to preliminary remediation goals (PRGs) calculated from the screening-level food chain models. In these models, a dose was calculated from body weight, contaminant concentrations, and ingestion rates. The dose was divided by a reference oral toxicity value, the low observed adverse effect level (LOAEL) or no observed adverse effect level (NOAEL) to obtain a HQ. For screening, the NOAEL HQ, being most conservative, was used to determine whether the food chain pathways was potentially at risk. To derive a PRG, the HQ is set to equal one and the equation solved for sediment concentration. LOAEL PRGs were calculated in this step because a low risk may be acceptable. The baseline assessment also included an

TABLE 2-9

SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT
PRELIMINARY CHEMICALS OF CONCERN - SURFACE WATER
SITE 10 - HIDEAWAY POND
NSWCDL, DAHLGREN, VIRGINIA

Chemical	Frequency of Detection	Range of Detection (ug/L)		Location of Maximum	EPA Region 3 Screening Level (ug/L)	Maximum Hazard Quotient	Selected as PCOC (Y/N?)	Notes
		Min.	Max.					
Volatile Organic Compounds								
Acetone	1/3	100	100	SW10-3	9,000,000	1.1E-05	N	
Metals and Inorganic Compounds								
Aluminum	6/6	410	636	SW10-2	25	25	Y	
Arsenic	4/6	2.3	2.6	SW10-6	48	0.054	N	As^{+5} assumed[(1)]
Barium	6/6	24.4	29.7	SW10-5	10,000	0.0030	N	
Calcium	6/6	6020	6690	SW10-5	NA	NA	N	Nutrient
Iron	6/6	1280	2500	SW10-2	320	7.8	Y	
Lead	6/6	1.8	2.8	SW10-1	3.2	0.88	N	Depends upon water hardness (chemistry)
Magnesium	6/6	1620	1870	SW10-5	NA	NA	N	Nutrient
Manganese	6/6	110	169	SW10-5	14,500	0.012	N	
Mercury	2/6	0.22	0.255	SW10-4	0.012	21	--	Less reliable data
Mercury, Low level	19/19	0.00511	0.01069	SW10-10	0.012	0.89	N	More reliable data - clean techniques used
Potassium	6/6	2390	2710	SW10-5	NA	NA	N	Nutrient
Sodium	6/6	6170	7020	SW10-1	NA	NA	N	Nutrient

NA = None Available
1 Screening value for Total As Is 874 ug/L.

TABLE 2-10

SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT
PRELIMINARY CHEMICALS OF CONCERN - SEDIMENT
SITE 10 - HIDEAWAY POND
NSWCDL, DAHLGREN, VIRGINIA

Chemical	Frequency of Detection	Range of Detection (mg/kg)		Location of Maximum	BTAG EPA Region 3 Screening Level (mg/kg)	Maximum Hazard Quotient	Selected as PCOC (Y/N?)	Notes
		Min.	Max.					
Volatile Organic Compounds								
2-Butanone	1/6	0.09	0.09	SD10-1(94)	NA	NA	Y	
Acetone	2/6	0.22	0.30	SD10-1(94)	NA	NA	Y	
Semivolatile Organic Compounds								
Benzo(a)pyrene	2/6	0.12	0.18	SD10-3(94)	0.43	0.42	N	
Bis(2-Ethylhexyl)phthalate	1/6	3.2	3.2	SD10-5(94)	1.3	**2.48**	Y	
Pyrene	1/6	0.068	0.068	SD10-3(94)	0.665	0.1	N	
Miscellaneous Compounds								
Phenols	5/6	1.6	70.9	SD10-1(94)	0.42	**168.81**	Y	
Metals and Inorganic Compounds								
Aluminum	6/6	14,600	25,600	SD10-4(94)	NA	NA	Y	
Arsenic	1/6	6.2	6.2	SD10-4(94)	57	0.11	N	As^{+3} assumed[(1)]
Barium	6/6	124	203	SD10-4(94)	NA	NA	Y	
Beryllium	6/6	1.3	2.7	SD10-4(94)	NA	NA	Y	
Calcium	6/6	1,330	4,480	SD10-4(94)	NA	NA	N	Nutrient
Chromium	2/6	25.9	33.4	SD10-4(94)	260	0.13	N	
Cobalt	3/6	12.9	37.8	SD10-4(94)	NA	NA	Y	
Copper	5/6	18.6	29.6	SD10-4(94)	34	0.87	N	
Iron	6/6	17,900	29,100	SD10-1(94)	NA	NA	Y	
Lead	6/6	24.7	42.7	SD10-4(94)	46.7	0.91	N	
Magnesium	6/6	1,210	1,910	SD10-4(94)	NA	NA	N	Nutrient
Manganese	6/6	197	363	SD10-4(94)	NA	NA	Y	
Mercury, Low level	19/19	0.011	0.12	SD10-3,2	0.15	0.83	N	
Nickel	1/6	19.7	19.7	SD10-4(94)	20.9	0.94	N	
Potassium	6/6	1,030	1,680	SD10-1(94)	NA	NA	N	Nutrient
Selenium	1/6	1.4	1.4	SD10-1(94)	NA	NA	Y	
Vanadium	6/6	29.3	46.4	SD10-4(94)	NA	NA	Y	
Zinc	6/6	82.9	168	SD10-4(94)	150	**1.12**	Y	

NA = None Available
1 Screening value for Total As is 8.2 mg/kg.

TABLE 2-11

SCREENING HAZARD QUOTIENTS USING MAXIMUM CONCENTRATIONS
AQUATIC FOOD CHAIN RECEPTORS - CONSERVATIVE INPUTS
SITE 10 - HIDEAWAY POND
NSWCDL, DAHLGREN, VIRGINIA

Ecological Contaminant of Concern	Heron		Raccoon		Mink	
	NOAEL HQ_n	LOAEL HQ_1	NOAEL HQ_n	LOAEL HQ_1	NOAEL HQ_n	LOAEL HQ_1
Volatile Organic Compounds						
2-Butanone	N/A	N/A	N/A	N/A	N/A	N/A
Acetone	N/A	N/A	2.66E-03	5.33E-04	1.56E-02	3.12E-03
Semivolatile Organic Compounds						
Benzo(a)pyrene	5.28E-03	5.28E-04	8.47E-03	4.23E-03	4.96E-02	2.48E-02
Bis(2-Ethylhexyl)phthalate	N/A	N/A	1.08E-02	1.08E-03	6.32E-02	6.32E-03
Pyrene	2.00E-03	2.00E-04	3.20E-03	1.60E-03	1.87E-02	9.36E-03
Miscellaneous Compounds						
Phenols	N/A	N/A	6.94E-02	6.94E-03	4.06E-01	4.06E-02
Metals and Inorganic Compounds						
Aluminum	**6.85E+01**	**6.85E+00**	**1.57E+02**	**3.13E+01**	**9.17E+02**	**1.83E+02**
Arsenic	**5.51E+00**	5.51E-01	3.79E-02	7.59E-03	2.22E-01	4.44E-02
Barium	2.86E-01	1.43E-01	**1.24E+00**	2.48E-01	**7.27E+00**	**1.45E+00**
Beryllium	N/A	N/A	1.27E-01	6.35E-02	7.44E-01	3.72E-01
Chromium	**9.80E+01**	**9.80E+00**	**1.57E+00**	7.85E-01	**9.20E+00**	**4.60E+00**
Cobalt	**1.11E+01**	**1.11E+00**	**1.78E+00**	8.89E-01	**1.04E+01**	**5.21E+00**
Copper	**3.70E+00**	3.70E-01	**1.81E+00**	1.81E-01	**1.06E-01**	**1.06E+00**
Iron	**8.54E+01**	**8.54E+00**	**1.37E+03**	**6.84E+00**	**8.02E+03**	**4.01E+03**
Lead	**4.18E+01**	**4.18E+00**	**1.74E+01**	**1.74E+00**	**1.02E+02**	**1.02E+01**
Manganese	1.07E-01	1.07E-02	**1.71E+01**	**8.54E+00**	**1.00E+02**	**5.00E+01**
Mercury	**3.67E+00**	3.67E-01	1.53E-01	1.53E-02	8.95E-01	8.95E-02
Nickel	7.47E-02	5.40E-02	1.93E-02	1.93E-03	1.13E-01	1.13E-02
Selenium	8.22E-01	4.11E-01	**3.42E+00**	8.56E-01	**2.00E+01**	**5.01E+00**
Vanadium	**1.20E+00**	1.20E-01	**1.42E+01**	**1.42E+00**	**8.31E+01**	**8.31E+00**
Zinc	**3.55E+00**	3.55E-01	4.11E-01	5.01E-02	**2.41E+00**	2.93E-01

TABLE 2-12

PCOCS FOR ECOLOGICAL EXPOSURE AFTER SCREENING
ECOLOGICAL RISK ASSESSMENT
SITE 10 - HIDEAWAY POND
NSWCDL, DAHLGREN, VIRGINIA

Chemical	Surface Water	Sediment	Results of Food Chain Modeling
Volatile Organic Compounds			
2-Butanone		X	Aquatic tox. data not found
Acetone		D	Mammalian HQs<1
Semivolatile Organic Compounds			
Benzo(a)pyrene		E	All HQ<1
Bis(2-Ethylhexyl)phthalate		D	Mammalian HQs<1
Pyrene		E	All HQ<1
Miscellaneous Compounds			
Phenols		X	Aquatic tox. data not applicable to mixtures
Metals and Inorganic Compounds			
Aluminum	X	X	All HQ>1
Arsenic		A	Most HQ>1
Barium		X	Some mammalian HQs>1
Beryllium		X	Mink NOAEL HQ>1
Chromium		A	All HQ>1
Cobalt		X	Most HQ>1
Copper		A	Most HQ>1
Iron	X	X	All HQ>1
Lead		A	All HQ>1
Manganese		X	Mink NOAEL HQ>1
Mercury		A	Heron NOAEL HQ>1
Nickel		E	All HQ<1
Selenium		X	Mammalian HQs>1
Vanadium		X	Most HQ>1
Zinc		X	Some HQ>1

X = Retained as a PCOC for food chain effects and direct toxicity.
D = Food chain pathway eliminated. PCOC retained for potential direct toxicity.
E = Eliminated from further consideration. Maximum concentration < screening level.
A = Added as a PCOC for food chain effects.

evaluation of probable bioavailability (likelihood of chemical uptake by plants or animals) under site conditions. Table 2-13 presents this information for each of the Preliminary Chemicals of Concern (PCOCs) identified in sediment and surface and surface water. If the mean exposure concentration exceeded the screening level and the LOAEL PRG, and bioavailability considerations did not preclude it, the contaminant was labeled as a COC in Table 2-13.

Exposure Assessment

Hideaway Pond, located in the northeast portion of NSWCDL is a man-made body of water created along a marshy drainage, which drains into Gambo Creek. It was formed behind a dam placed across the drainage, providing road access to other NSWCDL facilities adjacent to the river. The pond, fed by an eastern and western tributary to the north, is approximately 15 acres in size and is 10-12 feet deep at the dam. Hideaway Pond is also a recreational body of water; catch and release fishing is permitted. Possible impacts at this site may be related to 1) an upstream landfill (Site 17) and 2) clearing and excavation activities which have occurred upstream.

The topography surrounding Hideaway Pond and its two tributaries is nearly level, low, and featureless. The pond is formed by an earthen dam and is partially bisected by the remains of a former dam that impounded a smaller pond. The estimated area draining into this site is 135 acres, and this site is within the 100-year floodplain.

Fish identified in Hideaway Pond (Site 10) include chain pickerel, brown bullhead, channel catfish, white perch, bluegill, pumpkinseed, warmouth, golden shiner, bluntnose minnow, mosquitofish, largemouth bass, and black crappie. Studies initiated in 1980 by the Navy have demonstrated that fish tissues in Hideaway Pond contain detectable levels of mercury. These data do not exhibit any strong species-specific trends, although mercury concentrations for most species were apparently elevated in 1988. In 1990, the majority of the pond was drained and most of the fish removed. The pond was subsequently refilled and restocked for catch-and-release only. Investigations to identify the potential sources of mercury in Hideaway Pond have focused on Site 17, the 1400 Area Landfill.

Since no disposal activities took place at Hideaway Pond, investigations to identify potential upstream sources of mercury and other contaminants found in Hideaway Pond have focused on Site 17 (the 1400 Area Landfill). Ingestion of contaminated sediments and surface water by aquatic biota in the Hideaway Pond and the potential biomagnification (chemical concentrations increase up the food chain) of these contaminants in terrestrial and aquatic foodchains is the primary concern at Hideaway Pond. Other potential environmental release mechanisms for the contaminants present in the sediments of Hideaway Pond include dissolution

TABLE 2-13

BASELINE ECOLOGICAL RISK EVALUATION FOR SURFACE WATER AND SEDIMENT
SITE 10 - HIDEAWAY POND
NSWCDL, DAHLGREN, VIRGINIA

CHEMICAL	DETECTION FREQUENCY	BTAG SCREENING LEVEL	MODEL[1] LOAEL PRG	RANGE OF DETECTIONS	MEAN	MEAN > SL	MEAN > LOAEL PRG	NOTES	COC
Surface Water (ug/L)									
Aluminum	6/6	25	NP	410-636	492	Y	NP	Not available at usual pH	N
Iron	6/6	320	NP	1280-2500	2025	Y	NP	Not available at usual pH	N
Sediment (mg/kg)									
2-Butanone	1/6	NA	NA	0.09	0.027	NA	NA		Y
Acetone	2/6	NA	153	0.222-0.3	0.129	NA	N		Y
Bis(2-Ethylhexyl)phthalate	1/6	1.3	559	3.23	0.813	N	N		N
Phenols	5/6	0.42	NA	7.06-70.9	29.2	Y	NA		Y
Aluminum	6/6	NA	59	14600-25600	19483	NA	Y	Not available at usual pH	N
Arsenic	1/6	57	4.58	6.2	3.23	N	N		N
Barium	6/6	NA	156	124-203	142	NA	N		Y
Beryllium	6/6	NA	16.5	1.3-2.7	1.72	NA	N		Y
Chromium	2/6	260	3.71	25.9-33.4	18.1	N	Y	Bioavailability 10 percent or less	N
Cobalt	3/6	NA	30.6	12.9-37.8	15.9	NA	N		Y
Copper	5/6	34	30.6	18.6-29.6	19.9	N	N		N
Iron	6/6	NA	1528	17900-29100	23708	NA	Y	Not available at usual pH	N
Lead	6/6	46.7	4.6	24.7-42.7	29.7	N	Y	Bioavailability 10 percent or less	N
Manganese	6/6	NA	2689	197-363	256	NA	N	Not available at usual pH	N
Mercury	19/19	0.15	0.371	0.011-0.125	0.065	N	N	Has biomagnified in fish tissue	Y
Selenium	1/6	NA	0.3	1.4	0.8	NA	Y		Y
Vanadium	6/6	NA	6.1	29.3-46.4	34.7	NA	Y		Y
Zinc	6/6	150	516	82.9-168	107	N	N		N

[1]Screening-level food chain model.
Means are calculated using 1/2 the reported detection limit for values reported as not detected.
SL = Screening level
NP = Not Performed. Ingested water is often not a significant exposure route for wildlife.
NA = Toxicity Data not found for applicable pathway.

into the surface water and erosional events strong enough to transport contaminated bottom sediments downstream. The flat topography of the watershed and the slow-moving waters in Hideaway Pond are not considered to be conducive to erosional processes transporting contaminated bottom sediments downstream. However, mercury present in Hideaway Pond surface water may be carried downstream. No soil or groundwater samples were collected during the RI at Site 10 because contaminants are believed to have been transported via surface water/sediment to Hideaway Pond.

The exposure pathways consisted of ingestion of surface water, sediments, and food by aquatic receptors in Hideaway Pond, as well as direct contact with surface water and sediments. In addition, aquatic plants may take up contaminants through roots or photosynthetic surfaces. Terrestrial receptors associated with Hideaway Pond may be exposed to contaminants via ingestion of contaminated food and surface water, incidental ingestion of sediment, and by direct contact with surface water and sediment. The organisms most likely to be receptors include fish, fish-eating mammals, amphibians, reptiles, and fish-eating birds. Because of the natural setting of Site 10 and the variety of nearby habitats, Site 10 is likely to have a diversity of wildlife.

Ecological Effects Assessment

The maintenance of wildlife populations (ecological receptor populations) serves as the assessment endpoint for Site 10. As a result, receptor survival and subsequent reproductive success, as well as possible food chain exposure, were selected as measurement endpoints.

The screening-level assessment identified preliminary COCs associated with food chain exposure for wildlife and with direct toxicity to plants and invertebrates. Exposure assumptions were refined in a baseline assessment that identified the following COCs for sediment:

- 2-Butanone
- Acetone
- Phenols
- Barium
- Beryllium
- Cobalt
- Mercury
- Selenium
- Vanadium

The potential for both direct toxicity and food chain effects from these COCs exists (Table 2-13). Several became COCs based on lack of screening levels or oral toxicity data.

The level of risk to mammals and birds feeding on fish depends on assumptions about the size and type of fish they are eating, and the fraction of their diet that comes from Site 10. At maximum concentrations of mercury in fish tissue, there are potential risks to the fish themselves as well as to the mammals and birds that may consume them. At average tissue concentrations, risks to birds and mammals appear to be acceptable. At average fish tissue concentrations, there is potential risk to piscivorous fish. If fish tissue concentrations of mercury increase significantly with time risks to birds and mammals could increase to unacceptable levels.

Based on elevated concentrations and risk levels for mercury in fish tissue, Site 17 appears to be a past source for the COC. Given that no disposal activities were known to have taken place at Hideaway Pond, investigations to identify potential upstream sources of mercury and other contaminants found in Hideaway Pond focused on Site 17. Uptake of mercury from direct contact with, and ingestion of, surface water and sediments by aquatic organisms in Hideaway Pond, its biomagnification in aquatic foodchains, and risk from consuming fish from Hideaway Pond were the primary concerns.

Uncertainty Analysis

The major sources of uncertainty specific to conditions at Site 10 include:

- A great detail of uncertainty exists about the source of mercury in Hideaway Pond. When fish in the pond were found to have elevated mercury levels, Site 17 was a suspected source because it is upstream of Site 10. There were accounts of elemental mercury being placed in the landfill at Site 17. Although soil sampling and test pit excavations have failed to locate a primary source there, some elevated levels of mercury were detected in the groundwater, surface water, and sediments. This is not the case in Site 10, where the best data indicate no mercury concentrations exceed screening levels for surface water and sediment. A potential source of contaminants, especially mercury, is atmospheric deposition. Mercury from this source is very likely to be the cause of elevated mercury concentrations in fish inhabiting remote lakes. Lakes and ponds in more populated areas may have higher mercury loadings from the atmosphere. Another potential source of mercury is the soil inundated when the pond was expanded in 1983; fish in new impoundments often have high levels of mercury. These fish can take 15 to 30 years to return to background levels, with omnivorous species falling in the lower end of this range and piscivores taking the longest time to lose excess mercury. The lowering of the water level in the pond in 1990 may have had a similar effect.

- The threshold values used in this risk assessment reflect impacts to individual organisms. Impacts to populations, communities, and higher levels of ecological organization associated with this site may not be as significant. For example, loss of individuals from small areas need not affect their populations or the larger community. Losses resulting from contamination at Site 10 may be a small fraction of population mortality. However, risks to higher levels of ecological organization may be increased by bioaccumulative chemicals.

2.7.3 Ecological Risk Management

According to USEPA guidance, consideration of background concentrations is a risk management issue. The issue is important because it is difficult to justify costs and habitat destruction for remediation to levels that are within or below the range of background concentrations. Therefore, comparisons between site concentrations and background levels were made to help decide if remediation is warranted for each COC. Except for mercury data in fish tissue, Dahlgren Mainside background values were used in all cases. Mean and maximum site levels were compared to mean and maximum background concentrations; if the site values were at or below the background maximum for a COC, that chemical was not considered for remediation.

Other factors were considered to decide if remediation is warranted for any of the COCs. Because remediation may be costly and destructive to the existing environment, additional issues were considered during the Feasibility Study (FS) process, including:

- The frequency and magnitude of site concentrations above supplemental guidelines,
- The likelihood that contamination from the chemical has an identifiable source,
- The chemical's status as a common laboratory contaminant, and
- Problems with the chemical's analytical technique.

2.7.3.1 Supplemental Guidelines for Sediment

Unlike surface waters, draft national criteria have been established for only a few contaminants in sediments. The current lack of sediment criteria is largely a result of difficulties associated with 1) the identification of biologically available concentrations of sediment contaminants and 2) the variability of data correlating sediment concentrations with perceived effects. Biological availability of some organic chemicals have been addressed by equilibrium partitioning (EqP) models using Chronic Ambient Water Quality Criteria (CAWQC). The EqP approach assumes the applicability of water quality criteria to

sediment-dwelling organisms. Correlations between sediment concentrations and effects are the basis of the other approach used for developing toxicity values.

Supplemental guidelines for metals were based on the effects approach or the background approach and are presented in the Ecological Risk Assessment of Addendum RI Report for Site 10. Both EqP modeling and effects data were used for organic compounds; the choice depended on the availability of water quality criteria and/or partition coefficients for EqP modeling, and the availability of data for the effects approach. EqP was used for the volatile organic compounds (VOCs) where effects data were not available. Effects data were used for phenols.

Effects Data

A statistical value served as the supplemental guideline for mercury. "Apparent effects" data sets for various sediment toxicants were developed by compiling biological effects data (e.g., reductions in benthic (bottom dwelling) populations associated with the presence of a contaminant) for a specific toxicant. Although the apparent effects database is founded predominantly on the effects of toxic materials on marine and estuarine organisms, "Effects Range-Low" (ER-L) and the "Effects Range-Median" (ER-M) values have been adopted as useful guidelines for marine, estuarine, and freshwater sediments.

Although not intended for use as ecological screening criteria, effects range (ER) levels are often used due to a lack of alternatives. ER-Ls were set as levels below which detrimental effects are rarely observed and were used for screening values in the risk assessment. ER-Ms are levels above which detrimental effects may be expected. Use of an ER-M as a supplemental guideline helps establish a range of risk. Concentrations above ER-M are more often than not associated with detrimental effects, so it is useful to know how the range of site concentrations compares to such a value.

To help establish a range of risk, ER values were used for those metals that had them. Based on a limited comparison, levels above ER-Ls may be considered to cause chronic toxicity, and concentrations above ER-Ms may be acutely toxic. See the effects data discussion in the Ecological Risk Assessment of the Addendum RI Report for Site 10 for more details.

Equilibrium Partitioning

Equilibrium partitioning (EqP) involves the tendency for certain organic compounds to adhere to organic matter, rather than dissolve in water. EqP modeling addresses the relationships among sediment-water concentrations and bulk sediment concentrations of these organic compounds relative to the amount of total organic carbon (TOC) present in sediments. See the equilibrium partitioning discussion in the Ecological Risk Assessment of the Addendum RI Report for Site 10 for more details.

Use of Sediment Guidelines

Supplemental guidelines are used in order to establish a range of risk useful for making decisions about management of the site. The ER values have some probabilities associated with them, based on their statistical derivation and subsequent validation studies. It is likely that if several contaminants in a sample exceed ER-Ms, the sediment would be toxic (acute or chronic).

Because they are based on water quality criteria or equivalent values, the supplemental guidelines based on EqP also have associated risk levels. It may be assumed that 95 percent of the native populations would be protected from chronic toxicity, indicating a lower risk level than the supplemental guidelines based on ER. However, there is a great deal of uncertainty associated with assumptions made in the EqP approach, so supplemental guidelines based on EqP were used in the same way as those based on ER.

2.7.3.2 Background Contaminant Concentrations

Background water and sediment data were collected from Gambo Creek at upstream locations during the 1994 sampling event (Table 2-14). These background data were used to evaluate sediment data from all the IR sites. Low-level mercury samples, although taken in surface water and sediment at Site 10, were not taken at background locations. Three surface water and sediment samples collected from locations upstream of Site 17 and described in the 1995 Draft Final RI Report, were not considered representative of site background conditions for earlier reports. However, sediment concentrations did not seem to be too high to use as background and were included in the Site 10 Ecological Risk Assessment developed for the Addendum RI Report. Because the samples were from a freshwater source, the Site 17 results were considered more appropriate than the tidally influenced Gambo Creek results for Site 10 data comparison.

Comparison to background data was also considered for the mercury in fish tissue data because the atmosphere can be a significant source of mercury. When atmospheric loading of mercury is a source, additional factors influencing mercury content of fish in a lake include 1) the size of the watershed in relation to the size of the lake, 2) retention of mercury in the watershed, and 3) the quantity of wetlands in the watershed, especially near the lake. In keeping with the studies listed in Table 2-15, the sunfish included in the average for Hideaway Pond did not include largemouth bass or black crappie. Although in the sunfish family, these two species are atypical of sunfishes in being primarily piscivorous. As the Table 2-15 shows, mercury concentrations in Hideaway Pond sunfish were within the range of background values.

TABLE 2-14

ECOLOGICAL RISK MANAGEMENT FOR SEDIMENT
SITE 10 - HIDEAWAY POND
NSWCDL, DAHLGREN, VIRGINIA

Chemical	Detection Frequency	BTAG Screening Level	Model[1] LOAEL PRG	Suppl. Guide-line	Range of Detections	MEAN	MEAN/Maximum Background	
							Gambo Creek	Site 17
Sediment (mg/kg)								
2-Butanone	1/6	NA	NA	0.624	0.09	0.027	ND	ND
Acetone	2/6	NA	153	0.022	0.222-0.3	0.129	ND	ND
Phenols	5/6	0.42	NA	0.42	7.06-70.9	29.2	ND	ND
Barium	6/6	NA	156	60	124-203	142	77.1/78.5	27.7/46.2
Beryllium	6/6	NA	16.5	1.14	1.3-2.7	1.72	2.25/2.5	0.27/0.53
Cobalt	3/6	NA	30.6	50	12.9-37.8	15.9	39.5/40.1	2.2/3.9
Mecury	19/19	0.15	0.371	0.71	0.011-0.125	0.065	ND	ND
Selenium	1/6	NA	0.3	1	1.4	0.8	ND	0.42/0.71
Vanadium	6/6	NA	6.1	37	29.3-46.4	34.7	36.7/39.4	18.9/37.6

[1]Screening-level food chain model.
SUPPL. GUIDELINE: Supplemental guidelines are describein Section 5 of the Ecological Risk Assessment in the Addednum RI Report for Site 10.
Means are calculated using 1/2 the reported detection limit for values reported as not detected.
NA = Toxicity Data not found for applicable pathway.

TABLE 2-15

MERCURY CONTENT FOR BACKGROUND LOCATIONS AND HIDEAWAY POND
SITE 10 - HIDEAWAY POND
NSWCDL, DAHLGREN, VIRGINIA

Sunfish

Data Set Description	Mean Mercury (ppm)	Notes
6 Ontario lakes	0.25	Wren and Stokes (1988)
16 s. Ontario lakes	0.20	Wren and MacCrimmon (1983)
23 MD ponds	0.09	Pinkney et al. (1997)
3 GA sites – Wood Stork diet	0.15	Gariboldi et al. (1998)
Hideaway Pond	0.17	since 1990

Piscivore

Data Description	Species	Mean Mercury (ppm)	Notes
8 WI lakes	Walleye	0.37	Lathrop et al. (1991); similar mean length and alkalinity class for LMB in HP
35 MI lakes (Upper Penin.)	Largemouth Bass	0.43	Grieb et al. (1990); mean is for 4 year old fish
255 Ontario lakes	Walleye	0.58	Wren et al. (1991); mean standardized to 41 cm fish
42 n. MN lakes	Walleye	0.39	Sorenson et al. (1990); mean standardized to 39 cm fish
23 MD ponds	Largemouth Bass	0.20	Pinkney et al. (1997)
Hideaway Pond	Largemouth Bass	0.54	Median length = 27 cm; alkalinity – 0.2 meq/L; LMB data 1990-1999

LMB = Largemouth Bass
HP = Hideaway Pond
Note: See the Ecological Risk Assessment in the Addendum RI Report for Site 10 for references cited in the Table.

For piscivores, most data were available for largemouth bass and walleye. Because of the need to understand the factors related to high mercury levels in these fish and the importance placed on these relationships, reported tissue concentrations were sometimes grouped or standardized. Table 2-15 includes mercury concentrations in piscivores, grouped or standardized using fish length, fish age, and alkalinity (a measure of the lake's acid-neutralizing capacity). As presented in the Ecological Risk Assessment, data is reported by total length and lake acid-neutralizing capacity. The mean mercury content of largemouth bass in Hideaway Pond was at the upper end of the range of piscivore mercury concentrations in the background water bodies.

2.7.3.3 Management Discussion

The VOCs, 2-butanone and acetone, were identified as COCs but determined not to be food chain risks and should not be considered for remediation. The data for phenols were ambiguous. Phenolic detections were based on a colorimetric procedure, an analytical procedure which compares the sample solution against a standard color chart. The results based on this analytical procedure can be affected by other compounds in the sample, which can cause interference in the color comparison. In addition, there were no corroborating data from the gas chromatograph/mass spectrographic (GC/MS) results. Therefore, phenols do not appear to be present.

Barium and beryllium were detected at concentrations higher than background concentrations. Neither is a significant food chain risk, and both are without an apparent source. Based on these factors, the uncertain or low level of risk associated with sediment toxicity is considered acceptable and barium and beryllium should not be remediated. Cobalt upgradient concentrations (Site 17) tended to be higher than Site 10 concentrations, however, cobalt does not appear to be a significant food chain risk. Considering these factors, the uncertain risk associated with sediment toxicity is acceptable and cobalt should not be remediated at Site 10. Selenium was identified in one of six samples, had no known source, and had background levels comparable to the site concentrations. Considering these factors, the low level of risk from food chain exposure is considered acceptable and selenium should not be remediated. Site concentrations for vanadium were similar to background levels and there appeared to be an acceptable risk level from direct toxicity. Considering these factors, the low level of risk from food chain exposure is considered acceptable and vanadium should not be remediated. Furthermore, Site 17, a possible source for some of these contaminants, is currently being remediated.

Mercury was retained as a COC in sediment because of concern for the mercury content of fish tissue. No adverse effects to the bottom-dwelling animals (benthos) from mercury were expected because all concentrations were below the screening level (Table 2-14). Remediation for mercury may be considered if fish tissue concentrations increase.

2.7.3.4 Interpretation and Recommendation

With the possible exception of mercury, none of the COCs appear to require remediation. If mercury concentrations in fish tissue increase, remediation of mercury may be considered.

2.7.4 Summary, Conclusions, and Recommendations

Mercury was determined to be the primary concern at Hideaway Pond because of its continued presence in fish tissue samples: however, it was not considered a concern in surface water and sediment. Human health risk under a recreational adult scenario may represent unreasonable risk. Risks to piscivorous fish may represent unreasonable risk.

The response action selected in this Record of Decision is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

2.7.5 Remedial Action Objectives (RAOs)

Based on an evaluation of site conditions, risks, and legal requirements, remedial action objectives (RAOs) were indentified to protect human and ecological receptors. These RAOs are to:

- Prevent the fish population from accumulating mercury in fish tissue above 0.48 mg/kg: and
- Prevent humans from eating fish with mercury concentrations above 0.56 mg/kg.

These acceptable mercury levels were determined from the human health and ecological risk assessments.

The RAOs were developed for fish tissue based on a human health HI of 1.0 (0.56 mg/kg) and on the "lowest effect level" for fish (0.48 mg/kg). The "lowest effect level" for fish was developed to prevent harmful effects in fish themselves. Calculations of the risk-based RAOs are provided in the FS Report.

Based on potential ingestion of mercury-contaminated fish, a RAO has been developed for Site 10 fish to address the primary exposure pathways. The RAO is to prevent methyl mercury in fish from accumulating in human and ecological receptors.

2.8 DESCRIPTION OF ALTERNATIVES

A detailed analysis of the possible remedial alternatives for Site 10 was included in the Site 10 FS Report. The detailed analysis was conducted in accordance with the USEPA document entitled *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA* and the NCP.

A summary of the remedial alternatives that were developed to address contamination associated with Site 10 is presented below.

Alternative 1 - No Action

The no action alternative is required to be evaluated under CERCLA. Under this alternative, no actions would be taken to reduce the toxicity, mobility, or volume of the contaminated fish at Site 10. Alternative 1 serves as a baseline against which the effectiveness of other alternatives is measured.

The following costs are associated with Alternative 1:

Capital Cost ($):	None
Operating/Maintenance (O&M) Cost ($/Yr):	$4,000 every 5 years for review required by CERCLA
Present Worth ($):	$15,550 (Estimated administrative cost of 5-year review of remedial action over a 30-year period)
Time to Implement:	0 months

Alternative 2 - Catch-and-Release Program with Monitoring (Fish); Institutional Controls

Under Alternative 2, recreational fishing in Hideaway Pond would be allowed to continue; however, restrictions would prohibit the consumption of fish because of the potential presence of mercury. Fishing would be allowed on a catch-and-release basis only. Signs would be maintained at the pond prohibiting consumption of the fish. Monitoring of the fish through analytical testing would continue until acceptable mercury concentrations are achieved in fish. Mercury concentrations are expected to decline over time. The acceptable concentration level would be based on the acceptable human health (0.56 mg/kg) and ecological risk-based concentration (0.48 mg/kg) for mercury in fish. Additionally, a 5-year review would be conducted.

The Navy shall be responsible for implementing and maintaining the institutional controls. An institutional control plan would be developed for Site 10 as part of the remedial action and include signs along the perimeter of the site and prohibition of the consumption of fish from Hideaway Pond.

The Navy shall institute fish monitoring to ensure RAOs are being achieved. The analysis shall be conducted on a bi-annual frequency (every two years) for a period of five years or longer if human health or ecological risk based concentrations for mercury in fish are not achieved. Additional details of the monitoring program shall be developed in the Monitoring Plan.

There are no Applicable or Relevant and Appropriate Requirements (ARARs) associated with this alternative as there are no laws. to address mercury levels in fish. However, the Food and Drug Administration (FDA) limit of 1.0 ppm methyl mercury in fish and EPA Region III Risk-Based Concentrations are "To Be Considered" (TBC).

The following costs are associated with Alternative 2:

Capital Cost ($):	None
Operating/Maintenance (O&M) Cost ($/Yr):	$7,500 – every 2 years (Monitoring Program) $4,000 – additional cost every 5 years for review required by CERCLA
Present Worth ($):	$48,400
Time to Implement:	6 months

Alternative 3 - Drain Pond, Remove Fish, Restock Fish, and Monitor (Fish); Institutional Controls

Under Alternative 3, Hideaway Pond would be drained to the extent possible and all fish would be removed. The pond would then be refilled, restocked with fish, and monitoring of fish would continue similar to Alternative 2. To drain the pond, sluice gates would be opened within the dam and the pond allowed to drain. Any water remaining with the pond would be minimal, and the fish contained therein would be removed. The institutional controls and fish monitoring would be the same as for Alternative 2.

Applicable or Relevant and Appropriate Requirements (ARARs) associated with this alternative (draining and restocking the pond) include: Clean Water Act (CWA); Virginia Water Quality Standards (VR680): Protection of Wetlands and Floodplains (Executive Order 11990 and 11988): Federal Water Pollution

Control Act (40 CFR 116.3); Commonwealth of Virginia Erosion and Sediment Control Regulations (4VAC50-30); and Commonwealth of Virginia Water Protection Permit Regulations (9VAC25-210). The Food and Drug Administration (FDA) limit of 1.0 ppm methyl mercury in fish and EPA Region III Risk-Based Concentrations are "To Be Considered" (TBC) for the protection of humans.

The following costs are associated with Alternative 3:

Capital Cost ($):	$15,000
Operating/Maintenance (O&M) Cost ($/Yr):	$7,500 every 2 years (Monitoring Program) $4,000 additional cost every 5 years for review required by CERCLA
Present Worth ($)	$63,400
Time to Implement:	12 months

Expected Outcomes of Each Alternative

Under Alternatives 2 and 3, human exposure to mercury contaminated fish would be controlled through a fish catch-and-release program until mercury levels detected in fish reach acceptable concentrations. Fish monitoring would be maintained until acceptable mercury concentrations are achieved. Under Alternative 2, acceptable mercury concentrations are expected to be achieved within 5 to 10 years. Under Alternative 3, acceptable mercury concentrations are expected to be achieved within 5 years, however, monitoring would likely need to be maintained for 10 to 15 years because it would take several years to re-establish a stable fish population.

Under Alternative 3, the pond habitat and balance of the animal communities within it would be severely altered as a result of draining the pond removing fish, and re-stocking fish. The existing stability and balance within the pond would not be re-established for 10 to 15 years.

Under Alternative 1, acceptable mercury concentrations would likely be attained within 5 to 10 years, however, there would be no means to verify that the acceptable concentrations were attained. In addition,

human exposure to mercury contaminated fish would likely occur, since the existing fish catch-and-release program would not be maintained.

2.9 SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

The remedial alternatives described in Section 2.8 were evaluated in the FS against nine criteria identified in the NCP, as presented below.

2.9.1 Threshold Criteria

Overall Protection of Human Health and the Environment

Overall protection of human health and the environment addresses whether each alternative provides adequate protection of human health and the environment and describes how risks posed through each exposure pathway are eliminated, reduced, or controlled, through treatment, engineering controls, and/or institutional controls.

Under Alternatives 2 and 3, potential risks to human receptors would be controlled by implementing the catch-and-release program, thereby preventing human consumption of mercury-contaminated fish. Risks to ecological receptors would be assessed bi-annually by monitoring the mercury concentrations in fish every two years. Although the potential risk to ecological receptors is not expected to increase with time, additional remedial actions could be implemented, if warranted. Institutional controls would prevent consumption of contaminated fish to protect potential human receptors. Alternative 1 does not control potential risks associated with human and ecological receptors ingesting mercury-contaminated fish from Hideaway Pond. No institutional controls would be implemented under Alternative 1.

Compliance with ARARs and TBCs

Section 121(d) of CERCLA and NCP §300.430(f)(1)(l)(B) require that remedial actions at CERCLA sites, at a minimum, attain legally applicable or relevant and appropriate Federal and State requirements, standards, 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 cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal environmental or State environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site. Only those State standards that are

identified by a state in a timely manner and that are more stringent than Federal requirements may be applicable. Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal environmental or State environmental or facility siting laws. Although these requirements while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, they address problems or situations similar to those encountered at a CERCLA site. 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.

Compliance with ARARs addresses whether a remedy will meet all of the applicable or relevant and appropriate requirements of other Federal and State environmental statutes or provides a basis for invoking a waiver.

There are no ARARs associated with Alternative 2. Alternative 3 would meet ARARs by implementation of a work plan that ensures Federal and State Laws are addressed. Both Atlematives 2 and 3 would meet TBCs (i.e., the FDA limit of 1.0 ppm for methyl mercury in fish and EPA Region III RBCs).

ARARs and TBCs would be met under Alternatives 2 and 3 but not under Alternative 1. Remediation goals would likely be met under Alternatives 1 and 2 as natural processes are expected to reduce the concentration of mercury in fish over time. Under Alternative 3, remediation goals would be met upon removal of the fish from the pond. Under Alternatives 2 and 3, fish would be monitored so that it could be verified that mercury concentrations in the fish reach an acceptable risk-based concentration. If the remediation goals are not met, additional remedial action could be implemented in the future. Under Alternative 1, fish would not be monitored so that it could not be verified that mercury concentrations in the fish reach an acceptable risk-based concentration; nor could it be determined whether additional remedial action is warranted in the future.

2.9.2 Primary Balancing Criteria

Reduction of Toxicity, Mobility, or Volume through Treatment

Reduction of toxicity, mobility, or volume through treatment refers to the anticipated performance of the treatment technologies that may be included as part of a remedy.

None of the alternatives incorporate treatment technologies, however, Alternative 3 would reduce the volume of mercury in fish potentially available for exposure to receptors through the removal of the

contaminated fish from the pond. Alternatives 1 and 2 would not reduce toxicity, mobility, or volume of mercury.

Long-term Effectiveness and Permanence

Long-term effectiveness and permanence refers to expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time, once clean-up levels have been met. This criterion includes the consideration of residual risk that will remain onsite following remediation and the adequacy and reliability of controls.

Alternatives 2 and 3 would provide adequate controls (catch-and-release program) to manage the potential risks associated with mercury-contaminated fish. Long-term effectiveness and permanence is ensured because (1) the fish monitoring and catch-and-release programs would not be removed or modified until monitoring data indicate that the residual risk is acceptable and (2) the Navy will annually review, inspect, and report on the institutional controls. Alternative 1 may not be effective in the long term, because without monitoring the fish, it would not be possible to prove either that natural processes have reduced the mercury concentration in fish to acceptable levels or that a need exists for remedial action in the future. In addition, no institutional controls would be implemented under Alternative 1.

Short-term Effectiveness

Short-term effectiveness addresses the period of time needed to implement the remedy and any adverse impacts that may be posed to workers, the community and the environment during construction and operation of the remedy until cleanup levels are achieved.

Alternative 2 could be implemented within 6 months. Alternative 3 could be implemented within 12 months. Alternative 1 could be implemented immediately.

Alternative 2 is effective in minimizing short-term impacts because the fish monitoring and the catch-and-release programs have already been in effect for several years. Alternative 1 could have significant short-term impacts because the catch-and-release program might not continue, thereby potentially exposing people to mercury-contaminated fish. Alternative 3 would have significant short-term impacts because draining the pond would severely alter habitat in the pond and the balance of the animal communities in it.

Implementability

Implementability addresses the technical and administrative feasibility of a remedy from design through construction and operation. Factors such as availability of services and materials, administrative feasibility, and coordination with other governmental entities are also considered.

Alternative 2 is easily implemented because the fish tissue monitoring and catch-and-release programs have already been in effect for several years. Alternative 1 is readily implementable. Alternative 3 is implementable, but is technically more difficult to implement because fish must be removed from the pond. It is unlikely that all the fish can be readily removed. In addition, it is significantly more difficult to monitor the trends in fish mercury concentration because it will likely take several years to re-establish a stable fish population.

Cost

Estimated 30-year net present worth value of the capital costs and operation and maintenance costs incurred over the life of the project are approximately $15,500, $48,400 and $63,400 for Alternatives 1, 2, and 3, respectively.

2.9.3 Modifying Criteria

State Acceptance

The Virginia Department of Environmental Quality, on behalf of the Commonwealth of Virginia, has reviewed the information available for this site and concurs with this ROD and the selected remedy. A copy of the concurrence letter from the Commonwealth of Virginia is attached as Appendix A.

Community Acceptance

Community acceptance summarizes the public's general response to the alternatives described in the Proposed Plan and the Feasibility Study. No written comments were received during the thirty-day comment period that began on July 20 and ended on August 19, 2000. Minutes of the public meeting are presented in Appendix B. Questions raised by members of the community are addressed in the Responsiveness Summary presented in Section 3.0. During the public meeting, the community expressed its support for the proposed remedy.

2.10 THE SELECTED REMEDY

Alternative 2 is the selected remedial alternative, using a fish catch-and-release program with monitoring to address mercury-contaminated fish. Based on available information and the current understanding of site conditions, Alternative 2 provides the best balance with respect to the nine NCP evaluation criteria.

2.10.1 Summary of the Rationale for the Selected Remedy

Alternative 2, Monitoring with Catch-and-Release Program, is the selected remedy because it effectively prevents potential human exposure to mercury-contaminated fish and minimizes short-term impacts to the environment. Implementation of Alternative 2 will minimize the impacts to the habitat of the pond area, thereby maintaining the function it currently provides in the ecosystem while monitoring continues so that additional measures can be implemented if the mercury concentrations do not decrease as anticipated. In addition, it will strike a balance between protection of existing resources, monitoring remediation effectiveness throughout the system and monitoring risk levels. Alternative 2 also complements remediation efforts that are being implemented upstream at Site 17.

Compared with Alternative 3, Alternative 2 is significantly easier to implement and to monitor the trends of fish with mercury concentrations. It would likely take years to re-establish a stable fish population under Alternative 3 because nearly all fish would initially be removed from the pond. Also, unlike Alternative 3, Alternative 2 would not after the pond habitat and its function in the ecosystem. Because the concentrations of mercury in fish tissue are relatively low, the associated risks do not warrant fish destruction as a means of eliminating the risks. Also, the mercury contamination in Hideaway Pond sediment is very low (less than 1.0 ppm which is less than risk-based screening values). For these reasons, the Navy concluded that it was impracticable to treat the mercury in a cost-effective manner. Thus, the remedy at Site 10 does not satisfy the statutory preference for treatment as a principal element of the remedy. Based on available information and the current understanding of site conditions, Alternative 2 appears to provide the best balance of the nine National Contingency Plan evaluation criteria.

Based on information currently available the Navy believes Alternative 2 meets the threshold criteria and provides the best balance of tradeoffs among the other alternatives with respect to the balancing and modifying criteria. The Navy expects Alternative 2 to satisfy the following statutory requirements of CERLCA §121 (b):

- Protection of human health and the environment;

- Compliance with applicable or relevant and appropriate Federal and Commonwealth of Virginia regulatory requirements; and

- Cost effectiveness. Alternative 2 will cost approximately $48,400 and gives the best value for short term effectiveness, long term effectiveness and permanence.

- Utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable. Alternative 2 utilizes permanent solutions.

Although it was impracticable to use alternative treatment technologies or to treat the chemicals of concern in a cost-effective manner because of the nature of the contamination, Alternative 2 provides institutional controls that prevent human exposure to the contaminated fish. The monitoring program provides a means to implement additional measures, should fish concentrations unexpectedly increase thereby increasing risks to piscivorous fish. These elements of the remedy meet the statutory requirement for permanent solutions.

The remedy does not satisfy the statutory preference for treatment as a principal element of the remedy because it was impracticable to treat the chemicals of concern in a cost-effective manner.

2.10.2 Description of the Selected Remedy

The selected alternative will address the ingestion of mercury-contaminated fish at Site 10 by using the fish catch-and-release and fish monitoring programs to determine when the fish tissue concentrations decrease to acceptable levels. Institutional controls shall be implemented to prevent consumption of contaminated fish.

Performance Standards

The selected remedy shall achieve all RAOs within the boundaries of Site 10 and shall meet all ARARs and TBCs. The following components of the selected remedy shall be evaluated as specific performance standards.

Fish Monitoring

A fish monitoring plan shall be developed and implemented within 18 months of execution of the ROD. Fish sampling and analyses shall be conducted bi-annually (every 2 years) for a period of five years or longer if human health or ecological risk based concentrations for mercury in fish are not achieved. The

bi-annual frequency was chosen because the fish tissue concentrations are near the RAOs and concentrations are expected to change gradually over time. Additional details of the monitoring program including the size, type, and number of fish, shall be determined in the Monitoring Plan. The Monitoring Plan must be approved by the USEPA and the Commonwealth of Virginia.

Fish samples shall be collected in years 1, 3, and 5. Year 1 shall start after acceptance of the Monitoring Plan. After completing the five-year monitoring program, the mean (95% UCL) fish tissue concentration for each year will be evaluated as follows.

The mean fish tissue concentration for Largemouth Bass greater than one pound will be compared to the human health RAO of 0.56 mg/kg. If the mean concentration for the most recent year is greater than the RAO, the institutional controls and monitoring program will be continued and the new fish tissue data evaluated every 2 years. If the mean concentrations are less than the RAO for two or more consecutive sample sets, all remedial action (including monitoring) related to human health receptors will be discontinued.

The mean fish tissue concentration for all fish sizes and species will be compared to the ecological low trigger value (LTV) of 0.48 mg/kg and high trigger value (HTV) of 3.52 mg/kg. The LTV and HTV correspond respectively to the 5th and 50th percent probability of chronic effects in fish. If the mean concentrations exceed the HTV in the two most recent sample sets, a more aggressive remedial action will be developed for implementation; however, the mean concentration is not expected to exceed the HTV based on the data collected to date. If the mean concentrations are less than the LTV for the two most recent sample sets, all remedial action (including monitoring) related to ecological receptors will be discontinued. If the most recent mean concentration is between the HTV and the LTV, the monitoring program will continue and the new fish tissue data will be evaluated every 2 years.

Institutional Controls

Institutional controls shall be implemented to prohibit/prevent fish consumption. An institutional control plan shall be developed within 18 months for Site 10 as part of the remedial action and include signs along the perimeter of the site indicating prohibition of the consumption of fish from Hideaway Pond and notation of this restriction in NSWCDL fishing regulations and base master plan. The Navy shall review, inspect, and report on institutional controls annually to ensure the continued effectiveness of the remedy. Details shall be specified in the institutional control plan.

2.10.3 Summary of the Estimated Remedy Costs

The estimated cost components for the selected remedy are provided in Table 2-16. The estimated present worth costs for the selected remedy are summarized in Table 2-17 based on a discount rate of 7 percent. No capital costs are associated with the remedy. Annual operation and maintenance costs were estimated for a 20-year period.

2.10.4 Expected Outcomes of the Selected Remedy

Exposure to mercury-contaminated fish is controlled through the fish catch-and-release program and institutional controls. It is anticipated that the mercury concentrations in fish will decline to acceptable levels within a 20-year period due to natural processes. During that period, Site 10 will continue to serve as a valuable natural resource area that provides a variety of habitats and food sources to the existing ecosystem as well as a recreation area for base personnel. Land use is not expected to change after mercury concentrations in fish achieve acceptable levels and the fish catch-and- release program is ended.

TABLE 2-16

ESTIMATED REMEDY COST COMPONENTS[(1)]
SITE 10, HIDEAWAY POND
NSWCDL, DAHLGREN, VIRGINIA

Item	Item Cost Bi-Annually	Item Cost per 5 Years	Notes
Sampling	$1,000		Collect 20 fish samples per sampling period, plus travel, living, and shipping.
Fish Analysis	$2,500		Twenty fish samples per sampling period, includes blanks & duplicates for each medium.
Sampling Report	$4,000		Ten hours per sampling report plus other direct cost.
Site Review		$4,000	Prepare Site Conditions Report for Years 5, 10, 15, 20
TOTALS`	$7,500	$4,000	

1 Costs estimates are within +50 to –30 percent accuracy.

TABLE 2-17

ESTIMATED REMEDY PRESENT WORTH COSTS
SITE 10, HIDEAWAY POND
NSWCDL, DAHLGREN, VIRGINIA

Year	Capital Costs	Annual Costs	Total Year Costs	Annual Discount Rate at 7%	Present Worth
0	$0		$0	1.000	$0
1		$7,500	$7,500	0.935	$7,013
2		$0	$0	0.873	$0
3		$7,500	$7,500	0.186	$6,120
4		$0	$0	0.763	$0
5		$11,500	$11,500	0.713	$8,200
6		$0	$0	0.666	$0
7		$7,500	$7,500	0.623	$4,673
8		$0	$0	0.582	$0
9		$7,500	$7,500	0.544	$4,080
10		$4,000	$4,000	0.508	$2,032
11		$7,500	$7,500	0.475	$3,563
12		$0	$0	0.444	$0
13		$7,500	$7,500	0.415	$3,113
14		$0	$0	0.388	$0
15		$11,500	$11,500	0.362	$4,163
16		$0	$0	0.339	$0
17		$7,500	$7,500	0.317	$2,378
18		$0	$0	0.296	$0
19		$7,500	$7,500	0.277	$2,078
20		$4,000	$4,000	0.258	$1,032
			TOTAL PRESENT WORTH		**$48,442**

The purpose of this response action is to control risks posed by the ingestion of fish from Hideaway Pond. The results of the baseline human health risk assessment indicate that existing conditions at Site 10 pose an excess lifetime non-cancer HI of 5.6 from ingestion of mercury-contaminated fish. This remedy shall address all fish contaminated with mercury in excess of 0.56 mg/kg that would correspond to an estimated non-cancer risk level HI of 1.0. The results of the baseline ecological risk assessment indicate existing conditions at Site 10 pose a moderate risk to piscivorous fish, with average concentrations of mercury near the lower toxicity threshold. This remedy shall address fish contaminated with mercury in excess of 0.48 mg/kg that corresponds to a five percent probability of chronic effects in fish. The RAOs for fish were determined through a site-specific risk analysis. Fish shall be monitored to ensure that cleanup levels are achieved.

2.11 STATUTORY DETERMINATIONS

Remedial actions must meet the statutory requirements of Section 121 of CERCLA as discussed below. Remedial actions undertaken at Natonal Priority List (NPL) sites must achieve adequate protection of human health and the environment comply with ARARs of both Federal and state laws and regulations, be cost-effective, and use, to the maximum extent practicable, permanent solutions and alternative treatment or resource recovery technologies. Also, remedial alternatives that reduce the volume, toxicity, and/or mobility of hazardous waste as the principal element are preferred. The following discussion summarizes the statutory requirements that are met by the selected remedial alternative.

2.11.1 Protection of Human Health and the Environment

The selected remedy controls potential risks to human receptors by implementing the catch-and-release program, thereby preventing human consumption of mercury-contaminated fish. Institutional controls also prevent human consumption of contaminated fish. Potential risks to ecological receptors would be assessed by monitoring the mercury concentrations in the fish. Should the potential risk to ecological receptors increase with time, additional remedial actions could be implemented.

2.11.2 Compliance with ARARs

The selected remedy will meet all identified ARARs/TBCs. Fish will be monitored to verify mercury concentrations in the fish reach an acceptable risk-based concentration. If the remediation goals are not met, additional remedial action could be implemented in the future.

2.11.3 Cost-Effectiveness

The selected remedy is cost-effective because it provides overall effectiveness proportional to the cost. The selected alternative would minimize short-term environmental impacts, provide long-term protection of human health and the environment, and meet all identified ARARs.

2.11.4 Utilization of Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable

The selected remedy uses a long-term solution, a fish catch-and-release program with fish monitoring. It is an appropriate remedy for the mercury-contaminated fish. Use of an alternative treatment technology is not applicable to Site 10.

2.11.5 Preference for Treatment as a Principal Element

The selected remedial action does not use treatment technologies because the concentrations of mercury in fish tissue are relatively low and the associated risks do not warrant fish destruction as a means of eliminating the risks. Also, the mercury contamination in Hideaway Pond sediment is very low (less than 1.0 ppm which is less than risk-based screening values). For these reasons, the Navy concluded that it was impracticable to treat the mercury in a cost-effective manner.

2.11.6 Five-Year Review Requirements

Because this remedy will result in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within five years after initiating remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

2.11.7 Documentation of Significant Changes

The selected remedy was the preferred alternative in the Proposed Remedial Action Plan and was presented at the public meeting held on August 9, 2000.

No significant changes were made to the preferred remedial action alternative in the Proposed Plan.

3.0 RESPONSIVENESS SUMMARY

No written comments, concerns, or questions were received by the Navy, USEPA, or the Commonwealth of Virginia during the public comment period from July 20, 2000 to August 19, 2000. A public meeting was held on August 9, 2000 to present the Proposed Plan for Site 10 and to answer any questions on the Proposed Plan and on the documents in the information repositories. A 30-minute presentation was provided during which questions were addressed. A copy of the certified transcript from the Public Meeting is included in Appendix B.

A summary of the questions with expanded responses follows.

1. What are the levels of mercury in the water, and in the sediments?

The range of concentrations of mercury detected in surface water, in Hideaway Pond, are 5.11-10.69 ng/L (one ng/L, nano-gram/liter, is approximately equal to one part per trillion). These results indicate that none of the levels detected were above Federal Ambient Water Quality Criteria (AWQC) or Virginia CAWQC standard of 12.0 ng/L for mercury.

The range of concentrations of mercury detected in sediment, in Hideaway Pond, are 11.29 – 124.57 µg/kg (one µg/kg micro-gram/kilogram liter, is approximately equal to one part per billion). For comparison purposes, the data were all below the effects-range low (ER-L) concentration for bottom-dwelling organisms, which is 150 µg/kg. ER-L – the level below which no harmful effects are expected.

2. What is the general trend of these levels?

The levels of mercury in surface water samples detected in Hideaway Pond are similar to concentrations detected in Site 17 surface water samples. No trends were evident in the distribution of mercury in surface waters.

Based on sediment data, no apparent source areas or hot spots can be identified. Generally the samples collected along the centerline of the pond are highest, but the gradients are not consistent and the relative difference between such low concentrations is insignificant.

Mercury concentration in fish tissue has been collected over about 15 years; however, the number, type, and size of fish collected, as well as analysis protocols (fillet vs whole body), have not been consistent. Also, draining and restocking the pond in the early 1990s introduced an additional complexity in assessing this data for trends. Nevertheless, based on this data it does appear that mercury levels in fish tissue are declining over time. The monitoring program in the selected remedy is to verify this and to establish when they will be so low as to no longer be of concern.

3. How often do you analyze water and sediment samples?

Surface water and sediment samples were analyzed in 1986 for a Confirmation Study, in 1991 as part of the follow-on sampling, in 1994 for a Remedial Investigation and 1996 for a Phase I Remedial Investigation. Because past surface water and sediment analyzes are below risk-based screening criteria (see #1 above), future sampling will focus only on mercury and fish tissue.

4. Is Hideaway Pond still receiving contamination?

It is possible that Site 17 is contributing mercury to Hideaway Pond. However, Site 17 is currently undergoing remediation which should control the source.

5. Do you have data indicating how long it takes for fish to accumulate mercury in Hideaway Pond?

No. Data suggests mercury accumulates in fish over their lifetime. Only large (old) fish have accumulated enough mercury to cause concern.

APPENDIX A
VIRGINIA CONCURRENCE LETTER

COMMONWEALTH of VIRGINIA

James S. Gilmore, III
Governor

John Paul Woodley, Jr.
Secretary of Natural Resources

DEPARTMENT OF ENVIRONMENTAL QUALITY
Street address: 629 East Main Street, Richmond, Virginia 23219
Mailing address: P.O. Box 10009, Richmond, Virginia 23240
Fax (804) 698-4500 TDD (804) 698-4021
http://www.deq.state.va.us

Dennis H. Treacy
Director

(804) 698-4000
1-800-592-5482

September 28, 2000

Mr. Abraham Ferdas, Division Director
Hazardous Site Cleanup Division (3HS00)
U.S. Environmental Protection Agency, Region III
1650 Arch Street
Philadelphia, PA 19103-2029

Re: Record of Decision for Site 10, Naval Surface Warfare Center, Dahlgren, Virginia

Dear Mr. Ferdas:

The Virginia Department of Environmental Quality staff has reviewed the Record of Decision (ROD) for Site 10, Hideaway Pond, at the Naval Surface Warfare Center, Dahlgren, Virginia. We concur with the selected remedial alternative as outlined in the ROD dated September 2000.

Should you have any questions concerning this letter, please feel free to contact Dave Gillispie at (804) 698-4209.

Very truly yours,

Erica S. Dameron

Erica S. Dameron
Director, Office of Remediation Programs

cc: Ryan Mayer, ChesDiv
Ann Swope, NSWC Dahlgren
Bruce Beach, EPA Region III
Karen Jackson Sismour, VDEQ
Jon Terry, VDEQ NRO
Durwood Willis, VDEQ
Dave Gillispie, VDEQ

APPENDIX B

CERTIFIED TRANSCRIPT OF PUBLIC MEETING

NAVAL SEA SYSTEMS COMMAND

NAVAL SURFACE WARFARE CENTER
DAHLGREN DIVISION

PUBLIC MEETING

WEDNESDAY, AUGUST 9, 2000, 7:00 P.M.
KING GEORGE COUNTY COURTHOUSE
KING GEORGE, VIRGINIA

PROPOSED REMEDIAL ACTION PLAN
Site 10, Hideaway Pond
Site 3, Ordnance Burn Structure
Site 44, Rocket Motor Pit

USEPA Region III
Hazardous Site Cleanup Division
Federal Facilities Section
Mr. Bruce Beach
1650 Arch Street, Philadelphia, Pennsylvania 18107

Virginia Department of Environmental Quality
Mr. David Gillispie
629 East Main Street, Richmond, Virginia 23219

Public Affairs Office
Commander, Naval Surface Warfare Center
Ms. Jennifer Wilkins
17320 Dahlgren Road, Mail Code CD06, Dahlgren, Virginia 22448

Reported by: Lola Gail Serrett

August 9, 2000:

CAPTAIN WILLIAM SNYDER: I'm not going to get up front and do a big speech, but it's nice to have at least some turnout from the county interested in what we do over there at Dahlgren. We do a lot of good work trying to restore what the Navy showed a little bit of neglect in the past decades. Bill and his group have worked with some of our contractors and technical people to try to restore and recover some of the things done earlier. As everybody else in the government is aware, our budget is certainly shrinking as we speak, but we learn to work smarter, not harder, and use our available assets in a wiser manner.

So, as a great Naval officer said, what time is the seven o'clock meeting supposed to start? It's seven o'clock, so we're going to start. And I ask throughout, since we have such a small crowd, any questions as we go, please speak up and we'll answer them on the spot or get you an answer, certainly, before the end of the week

if we have an e-mail or a phone number, whatever we need to do. Plenty of handouts in the back if anybody needs them. And with no further ado, I'll turn it over to our environmentalists. Enjoy.

MR. RYAN MAYER: Good evening. My name is Ryan Mayer. I'm the Remedial Project Manager for Dahlgren. Tonight, we have a public meeting. We'll be presenting two of our proposed remedial action plans. These two plans actually have three sites; 3/44 is one of the proposed plans; and Site 10, Hideaway Pond, is the second. We'll be presenting a summary of -- sort of a synopsis of these sites tonight. We advertised these two proposed plans in The Free Lance Star and Westmoreland News. We have a public comment period that started July 20th through August 19th for Site 10. Site 10 is a thirty day public comment period. In the same newspapers, we also advertised Site 3/44, starting July 20th through September 2nd. These sites have a forty-five day public comment period.

We'll answer any questions tonight that you all have. If you have any written comments you'd like to submit, on the information sheets, there's some point of contacts on the ninth page there, which has got some point of contacts and phone numbers to submit comments to. There's also more detailed information. We did bring some reports tonight, but the majority of our reports are in our administrative record and in the back of the proposed plans are three locations where you can review the reports.

We do have a court reporter here tonight. Because it's a public meeting, we'll be recording everyone's comments, our presentation. If you have a question that you'd like to ask during the presentation, feel free to ask it. We do ask that you give your name before you ask questions so we can record it.

So, without further ado, I'll turn it over to Dave Misenhimer. Dave is on our contract team. He's been performing a lot of these

investigations and designs for Dahlgren. His firm also helps to oversee some of the contractors during the construction part, as well. Dave.

MR. DAVE MISENHIMER: Okay. Can we turn this machine on? As Ryan said, there's two proposed plans that are in the back of the room. You can pick them up. We've got plenty of them available for everybody. One deals with Site 10 and the other deals with Site 3/44. There are also handouts that are basically copies of the slides that you'll see presented through my presentation so you can follow along with the slides. And my presentation is not designed to be a lot of detail, but if you have any questions or you want further detail, I'll be happy to give more detail. So, as Ryan had said, jump in any time you have a question or a comment. Okay.

CAPTAIN WILLIAM SNYDER: Can you still see your notes?

MR. DAVE MISENHIMER: Yeah. Is that okay for everybody? Okay. We'll start out with

Site 3/44 and, basically, 3/44 is a combination of two sites and the reason we combined them is because they are located very close to each other and the types of activities that occurred there were very similar. Site 3 is known as the Ordnance Burn Structure and Site 44 the Rocket Motor Pit. This map is also in the proposed plan and it shows the location of Site 3/44 being here on Mainside.

Also, there's another site just north of Site 3/44, known as Site 12. The reason I point that out is that that’s a site that is currently being remediated. The soil and groundwater is being remediated and has been under remediation for the last couple of years and the contaminants that are of concern there are degreasers. These are chemicals that were used to degrease -- remove grease from machinery and were placed on Site 12 to ignite other materials that were burned there.

At Site 3/44, the types of activities that occurred there were -- at Site 3, it

was basically burning explosives and waste products that were related to the development of the explosives. And these materials were wastewater treatment sludges and spent carbon that was used in treating wastewater contaminated with explosives. These materials were burned on what are called burn pans, which were placed either on the surface of the soil or in steel boxes.

Site 44 was an area where waste rocket motors were burned and Site 44 is a pit about five feet deep -- at least, it was -- about five feet deep and a width of twenty-four feet by thirty-six feet in length. Around the sides and ends of the pit were steel plates and, as I said, rocket motors, the propellant in the rocket motors was burned in those pits.

In 1998, there was a removal action completed and that basically consisted of removing soil that had been contaminated by these operations. As you can see on this aerial photo that -- also a proposed plan -- there's a silt

fence, here, outlined. Within in this silt fence is the area where soil was removed that had been contaminated by -- contaminated as a result of past operations. It covers approximately a half acre area and the depth of soil that was excavated varied from -- anywhere from six inches to twenty-four inches. A total of twenty-one hundred tons of soil was removed from this area.

As you can see from the aerial photo, this area is pretty flat. Over here to the west is Gambo Creek. It's about four hundred feet to the west of Site 3/44. The area within the silt fence is now grass covered. The area outside is pretty much brush. Groundwater in this area, surficial groundwater is about five to ten feet below the surface. The surficial aquifer is about twenty feet in thickness. And below the surficial aquifer is a clay layer, which prevents any of the surficial aquifer -- the groundwater from percolating into aquifers that are used for drinking water in the area. This surficial aquifer generally

flows in a south southwesterly direction toward Gambo Creek.

When the soil was removed, there were certain contaminants that were associated with that soil. These are listed here; aluminum, arsenic, iron, nickel, magnesium -- I should say manganese -- and vanadium. When the removal action was completed, samples were taken of the soil that remained and tested for these metals, as well as several -- quite a few others, and compared to residential health based numbers, which are determined to be safe levels for these contaminants, and it was found that, after the soil was removed, there was no human health risk that was -- that it was an acceptable human health risk.

Also, groundwater was tested at this site and analyzed for a whole host of potential contaminants and those contaminants were then evaluated in a human health risk assessment, as well, and it was determined that, although the groundwater is contaminated, the contaminants are

not coming from Site 3/44; rather, the contamination that is in the groundwater is from the adjacent site I mentioned earlier, Site 12, where you've got degreasing chemicals in the groundwater.

In addition to looking at human health risks, ecological risks or potential ecological risks evaluated and, in all cases, were found to be acceptable for the soil and groundwater. Based on that analysis, it was determined that our preferred alternative would be to have no further action both -- for both, the soil and the ground-water.

And that's pretty much my presentation on these sites, Site 3/44. If there are questions, I'd be glad to entertain them right now. Okay. No questions.

Let me go to my next slide show here. The next site I'm going to talk about is Site 10, known as Hideaway Pond. Hideaway Pond is also located within Mainside, up here in the northern portion of Mainside. It is also located near a site

known as Site 17, the 1400 Area Landfill, which is also undergoing remediation as we speak. In the case of Site 17, the landfill is being covered and provisions are being made to prevent any contaminants that may be present at Site 17 from being released. And one of the contaminants that is of particular concern is potential movement of mercury from Site 17 to groundwater and surface water into Hideaway Pond.

In looking at this aerial, there are tributaries, two tributaries that feed into Hideaway Pond, which flow past Site 17. Ultimately, Site 10 discharges to a stream which goes into Gambo Creek and, ultimately, to the Potomac River, which is about a mile downstream. Site 10 was originally created -- the pond was originally created in 1953 and then expanded in the early 1980s. It's currently a fifteen acre pond. It encompasses an area of about twenty-five hundred feet long and the width varies anywhere from three hundred to five hundred feet.

In 1980, there was an anonymous report to the Navy that there may be mercury in the fish. Subsequently, the Navy sampled the fish and they did detect mercury in the fish. After sampling on a couple of other occasions, they decided it would be wise to implement a catch-and-release program. And that was implemented in 1983; has been in place since then. What that does is they post signs around the pond warning people that the fish may be contaminated and that you should not take them home and eat them; rather, you should just throw them back in the pond. And, again, early on, Site 17, the 1400 Area Landfill, was thought to be a potential source.

This next aerial photograph is also in the proposed plan and Site 10, the original pond, is this area, here. There's the original dam, the old dam. The new dam is located here to the south and this is the new portion -- or newer portion of the pond. One tributary comes up here, it flows past Site 17 on the east. Second tributary

comes up in this direction and flows past Site 17 on the west. This picture of Hideaway Pond was taken by standing on the new dam and looking north, so you can get an idea of what it looks like.

In evaluating Site 10, mercury in fish has been the major concern and since the early 1980s, the Navy has been collecting fish samples and analyzing them for mercury. And over the years, it has become evident that the levels of mercury in the fish is declining. Consequently, when we looked at the potential risks -- again, we looked at human health risk and ecological risks -- and came up with alternatives, it was determined that it appears the mercury concentrations are declining. We expect within the next five years or so that the mercury levels will be within acceptable levels in terms of human health risks and ecological risks; therefore, the preferred alternative is to continue with the catch-and-release program to prevent people from eating the fish until we're sure the concentrations of mercury in the fish are

acceptable; and to continue monitoring the fish to make sure what has been occurring continues to occur and we do get to that point where the risks is negligible.

So, in a nutshell, what we're saying is the preferred alternative is to continue with the catch-and-release program, keep the signs posted around the pond to warn people not to eat the fish, monitor the fish to insure that the concentrations of mercury continue to decline and reach a point where it is an acceptable concentration and make sure that all these requirements are maintained until we get to that point via institutional controls. That's my presentation on Site 10. Are there questions about Site 10?

MR. BOB FESCALDO: I think -- I might have missed it, but I -- what are the levels of mercury in the water there now?

MR. DAVE MISENHIMER: The levels of mercury in the water -- basically, what we looked at are what are acceptable in terms of water quality

and our levels in the pond were on order of magnitude more of -- or more than on order of magnitude less than those levels. We're talking very low levels, which are point one two parts per trillion, I think is the number. I'd have to look that up.

MR. RYAN MAYER: But it's on order of magnitude under the requirements.

MR. BOB FESCALDO: How about in the water? Is there more concentrated stuff in the muck?

MR. DAVE MISENHIMER: There, again, we looked at the sediment -- I assume that's what you're talking about?

MR. BOB FESCALDO: Yes, the muck.

MR. DAVE MISENHIMER: And, again, we do have criteria that we looked at to determine whether or not it's a concern and, again, it was below those criteria. And that was the reason why the alternative that was preferred here is not to muck around in the sediment and stir up whatever

might be there and do something in that way.

MR. BOB FESCALDO: And how often -- how often do you analyze the water samples and the sediment samples?

MR. RYAN MAYER: Well, in the past, we've probably gone through multiple rounds of sampling surface waters. Generally, in the past, though, they've analyzed for mercury in fish almost every year for the past ten years, maybe. The levels that we're getting in the sediment and the surface water are so low -- in fact, they're -- I believe they're below the screening criteria. And if it weren't for the fact that we had all this monitoring -- or this fish monitoring data, we probably wouldn't be doing this study at all. So, there's something going on in the system there that the fish are accumulating mercury.

MR. BOB FESCALDO: Yeah. What I -- what I was trying to get at is, you know, if you take samples from the sediment and things -- in the water, do they stay the same or are they going down?

You know, you don't have additional contaminants coming in? That's what I was getting at. Is there -- there's no additional contamination coming in there. Is that an accurate statement?

MR. RYAN MAYER: The mercury that we're finding in Hideaway Pond, we're tracking from, basically, Site 17. You can just see a mercury trail up to that landfill. And on the east -- as Dave was saying, there's an eastern and western tributary. The eastern tributary is where most of that mercury -- at least, the remnants of it seem like they're coming from. Since we're involved with remediation on that site now, we expect the mercury --

MR. BOB FESCALDO: (interjecting) You're not noticing any increases in Hideaway Pond from whatever source?

MR. RYAN MAYER: Right.

MR. BOB FESCALDO: That's, kind of, all of I'm getting at here. At this point -- that's fine. Because the -- Hideaway Pond is -- has the

potential to be a concentrator of stuff. Okay. And that's, kind of, what I'm looking at. It's not concentrated there? You know, you're doing good things, making progress and all that good stuff. And that's it. Biological systems concentrate mercury and a whole bunch of other things, heavy metals, you know, all those kinds of things. But it's one of the -- one of the things you worry about if you're putting fertilizer down, you know, on fields out there.

CAPTAIN WILLIAM SNYDER: Does it do any good to know how long a fish has been in the water and then check his mercury level? Maybe get a little bit more accurate reading?

MR. RYAN MAYER: Well, in our monitoring that has been done to date, we don't necessarily do that, but what we do is we look at different size fish and that --

CAPTAIN WILLIAM SNYDER: (inter-jecting) What I was going to say or what I was leading to was if we were to stock a certain

quantity of fish that were tagged with particular numbers and tell anybody who catches a tagged fish turn it in for a five dollar reward, we know exactly when that fish entered the water and know what exactly what his mercury level was over a specific period of time, I think your data would be a lot more worthwhile.

MR. RYAN MAYER: Well, one thing that we've noticed in tracking the weight, species and concentration of mercury is that the tables are pretty linear in terms of concentrations of mercury and the size of the fish; especially in bass. I mean, it's almost linear. So, if you have a certain size bass that you catch, you can pretty much figure out what the mercury concentration is going to be. And as it gets larger, it's going to be a lot less. So, from all those years of data, we can pretty much figure out what the levels are going to be in certain sizes of fish.

MR. BOB FESCALDO: You say it's ten years of data?

MR. RYAN MAYER: It's ten years of data.

MR. BOB FESCALDO: You started -- it was first detected in 1980.

MR. RYAN MAYER: Well, actually, there's about twenty years of data. What we've been looking at in particular are the last ten because we know, in the early 90s, the fish -- the pond was drained and a lot of the fish went downstream as a result of draining the pond. So, the data that has been accumulated since that occurred is really what we're focusing on. And that's, like, about ten years worth of data. But the Navy has been taking samples since the early 80s almost on a yearly basis.

MR. BOB FESCALDO: Do we have any idea, between Site 17 and Site 10, how much of that is getting any further than --

MR. RYAN MAYER: You mean going further downstream? Well, we did test water beyond the pond and we did detect some there, but, again,

as you go further down the stream from Site 17, the levels trail off tremendously. And as I said earlier, there's criteria that you go by in evaluating whether or not there's a concern and once you get below Site 17 -- maybe I can show you that in this aerial photograph. We took samples along this tributary and along this tributary and we gridded the pond off and took numerous samples in the pond and then we took some samples down here, downstream of the spill-over.

What we found was, along this tributary, here, close to Site 17, the landfill, we were exceeding those criteria slightly. Once you got down to this area, here, just north of the pond, we were below the criteria and once we were in the pond, we were below the criteria and that follows downstream. So, there was an obvious tailing off of the concentration in the surface water. On this other tributary, we never did exceed the criteria. But again, the pattern was the same.

So, that's why we suspect that