# 3

# Fort George G. Meade

Anne Arundel County, Maryland
CERCLIS #MD9210020567

## Site Exposure Potential

Fort George G. Meade occupies approximately 5,500 ha in Anne Arundel County, Maryland, between Baltimore and Washington, D.C. (Figure 1). The Patuxent River, which drains the area, flows along the southern border of the facility. A tributary stream, the Little Patuxent River, flows through the facility and receives runoff from several waste sites (Figure 2). The Patuxent River enters the Chesapeake Bay approximately 100 km from Fort Meade.

In 1917 Congress authorized Fort Meade as a training facility. In 1988, the U.S. Army Base Realignment and Closure Act (BRAC) mandated the closure and / or realignment of approximately 3,600 ha encompassing the southernmost two-thirds of the installation (Figure 2). In 1991 the U.S. Army transferred 3,300 ha of the BRAC parcel to the Department of the Interior's Patuxent Wildlife Research Center for use as a wildlife refuge (ICF Kaiser 1997).

Table 1 lists waste sites that have been evaluated at Fort Meade, along with information about the dates of use and types of waste disposed at each site (ICF Kaiser 1997). The sites include six landfills, the Helicopter Hangar Area, the Defense Reutilization and Management Office (DRMO) Salvage Yard, the Fire Training Area, and the Ordnance Demolition Area. Materials

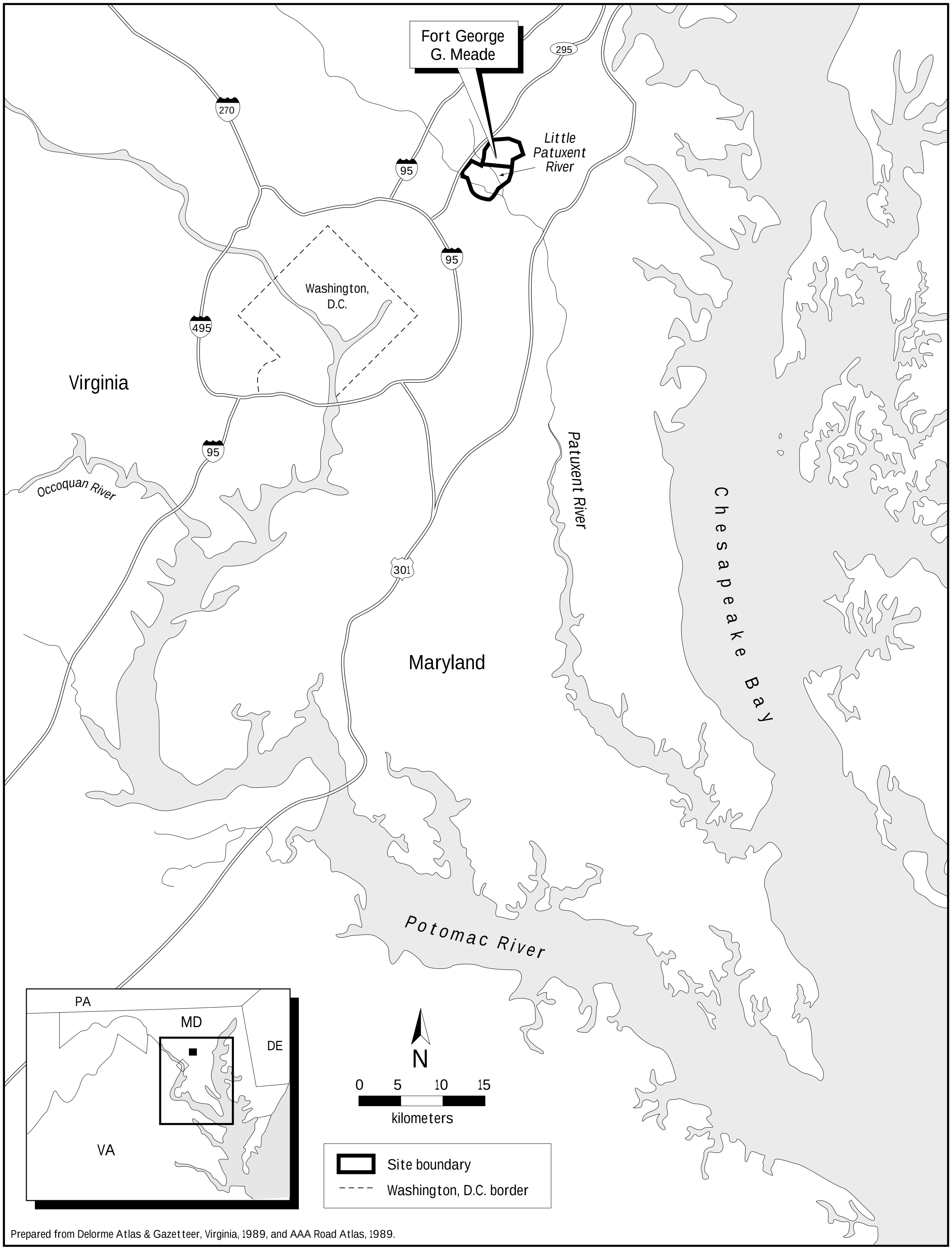


Figure 1. Location of Fort George G. Meade in Anne Arundel County, Maryland.

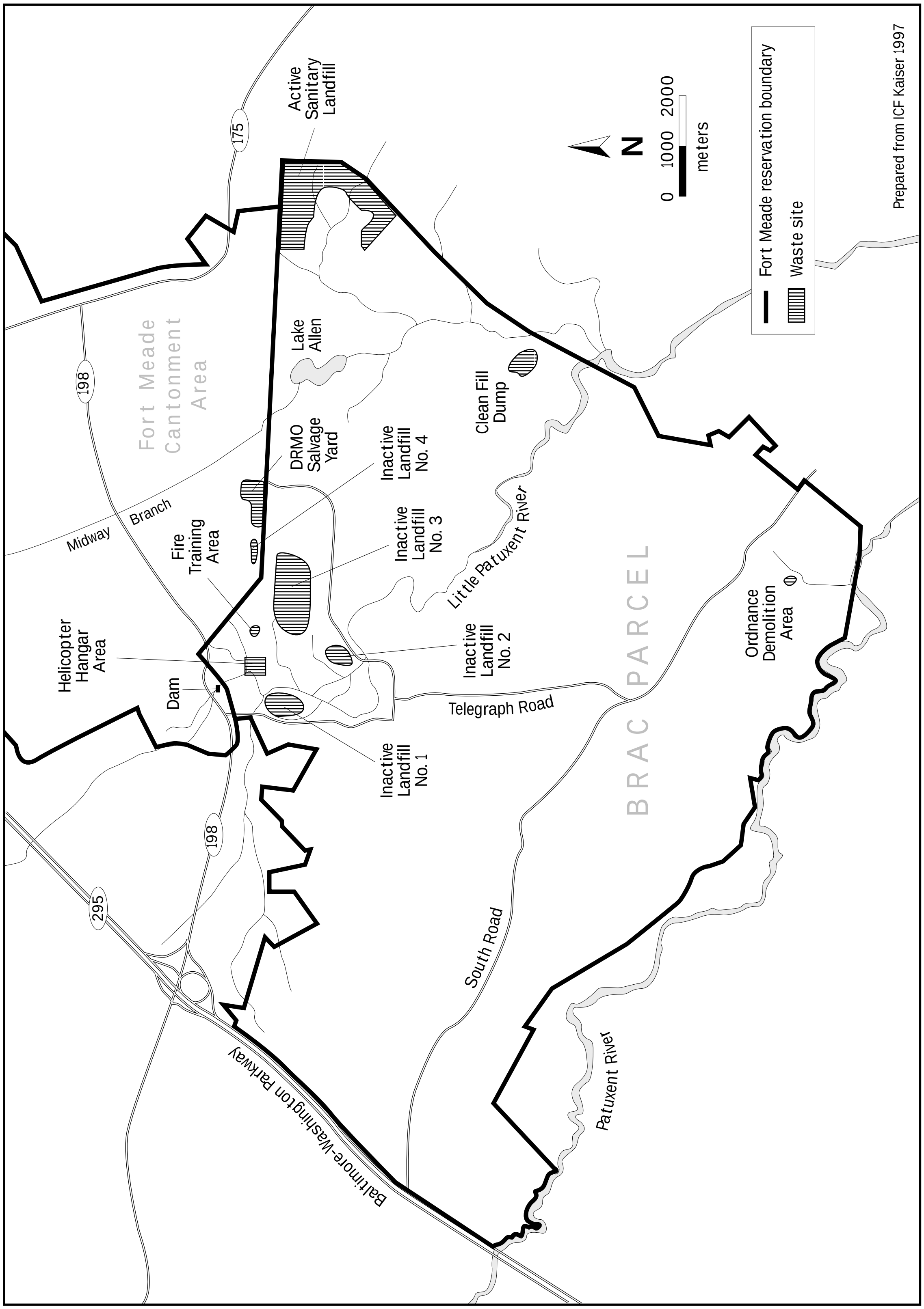


Figure 2. Detail of waste sites at Fort George G. Meade.

Table 1. Description of hazardous waste sites at FGGM.

| Site Name | Dates | History of Use | Potential Migration Pathway |
|---|---|---|---|
| Inactive Landfill 1 | 1950-1964 | Used as an unlined sanitary landfill. No information has been found regarding the types of material disposed. | Drainage is towards the Little Patuxent River. Eastern portions of the site are wetlands in the 100-year floodplain of the river. Shallow groundwater discharges to the wetlands and Little Patuxent River. |
| Inactive Landfill 2 | 1950s to 1980s | Operated as an unlined rubble-disposal facility. | Border of the landfill is approximately 75 m from the LIttle Patuxent River and drainage is towards the river. The area between IAL2 and the river includes wetlands within the 100-year floodplain. Groundwater flows radially from the site, following topography, and then towards the Little Patuxent River. |
| Inactive Landfill 3 | Late 1940s and 1950s | Used as a sanitary and "leaf-dump" landfill. The Tipton Army Airfield was constructed over the fill area in 1963. | Runoff is conveyed from the site by drainageways towards the Little Patuxent River. An extensive stormwater collection system beneath the airfield directs water to french drains that lead to the Little Patuxent River. Groundwater flow is generally southwest towards the river. |
| Inactive Landfill 4 | 1950s to 1970s | Used primarily as a rubble disposal area. | A low-gradient drainage swale runs through the center of the site, conducting surface water runoff towards the Little Patuxent River. Groundwater flows to the west and southwest towards the Little Patuxent River. |
| Clean Fill Dump | 1972 to 1985 | Used for disposal of miscellaneous debris such as stumps, trees, logs, concrete, construction debris, old appliances, and soil. Other materials that may have been disposed here include garbage, food wastes, cans, bottles, ash, and possible hazardous materials. Uncontrolled dumping continued in marshy areas outside the main dump perimeter after 1985. | Landfill is drained by several unnamed streams and drainage swales, generally toward the Little Patuxent River, about 350 m to the south. Groundwater flows towards the river. |
| Active Sanitary Landfill | 1958 to present | Used for disposal of sanitary wastes as well as petroleum wastes, pesticide wastes, and sewage sludges in three unlined cells. | Most of the landfill's surface water runoff flows into two retention ponds at the western boundary. These ponds discharge into a small stream that enters a tributary to the Little Patuxent River about 4 km from the landfill. Groundwater flow follows the topography of the site. |
| Helicopter Hangar Area | NA | Materials used or stored in this area include JP-4 fuel, hydraulic and lubricating oils, detergents, and solvents. | The Little Patuxent River is about 20 m northwest of the site. There are two outfalls from the HHA into the Little Patuxent River. Groundwater flows to the northwest. |
| Defense Reutilization and Management Office (DRMO) Salvage Yard | NA | Used as a storage area for a variety of equipment, including discarded vehicles, electrical transformers, electronic equipment, heating and cooling units, pipes, dumpsters, and scrap metals. | Located about 500 m from a tributary to Lake Allen, and about 1 km from the Little Patuxent River. Information on surface water runoff was not available. Groundwater flows from the site to the east and northeast. |
| Fire Training Area | 1979 to present | Used for fire training. Fires are set using aviation fuel or gasoline and extinguished with either water or aqueous foam composed primarily of pressurized biological proteins. | Information on surface runoff or groundwater flow pathways from the site was not available. The site is located about 400 m from the Little Patuxent River. |
| Ordnance Demolition Area | NA | Used for demolition of obsolete ordnance. | A stream near the eastern berm of the site flows southward for about 750 m to the Patuxent River. Direction of groundwater flow is to the southwest. |

used or disposed at these sites included municipal and domestic waste, pesticides, electrical transformers, solvents, PCBs, inert material, and waste oils and lubricants.

Surface water and groundwater are potential pathways for contaminant migration from the site. The Little Patuxent River flows southeast across Fort Meade along a broad, flat river valley with extensive wetlands. In general, much of the terrain at Fort Meade is low-lying. Approximately half of the BRAC parcel has been identified as wetlands, including portions of Inactive Landfill 1 (IAL1), Inactive Landfill 2 (IAL2), and the Clean Fill Dump. The Little Patuxent River flows near the borders of the Helicopter Hangar Area, IAL1, IAL2, and the Clean Fill Dump. Several unnamed tributaries also flow across Fort Meade. Table 1 describes surface water pathways for each of the identified waste sites.

There are groundwater aquifers at Fort Meade within several geologic formations consisting of unconsolidated sands, clays, and silts. There are three distinct aquifers at the site (the upper Patapsco, the lower Patapsco, and the Patuxent) separated by confining layers. Because the underlying formations dip towards the east and are progressively exposed, the surficial deposits vary. The regional groundwater flow is to the southeast, but local flow in the surficial deposits generally mirrors the topography. Soils within the BRAC parcel are primarily loamy and clayey underlain by an unstable clay of low permeability. Groundwater studies at the site indicate that the shallow sands aquifer is probably discharging to the Little Patuxent River (ICF Kaiser 1997).

## NOAA Trust Habitats and Species

The primary habitats of concern to NOAA are surface water, stream bottom, and associated riparian zones of the Little Patuxent River, its tributaries, and the Patuxent River. Anadromous and catadromous fish species that use the streams are the resources of concern to NOAA (EA Engineering 1992; Table 2).

The Little Patuxent River is a medium-sized, warmwater stream with a warmwater resident fish population dominated by river chub, shiners, and sunfish. The stream is typically 15 to 23 m wide and 0.6 to 2.5 m deep as it traverses Fort Meade. Slow-flowing runs dominate this portion of the stream with smaller areas of riffle / pool habitat. Sediments range from cobble to silty sands. Extensive hardwood wetlands are located along the river on the Fort Meade property. Overcup oak stands dominate in areas submerged for most of the year, while red maple, sweetgum, and red ash are prevalent in areas that are seasonally flooded (EA Engineering 1992).

Several anadromous species use the Little Patuxent River during their spawning runs in the spring, including white perch, hickory shad, alewife, and blueback herring. Before 1991, the

Table 2. Major NOAA trust species that use the Little Patuxent River and Patuxent River near Fort Meade.

| Species | | Habitat Use | | | Fisheries | |
|---|---|---|---|---|---|---|
| Common Name | Scientific Name | Spawning Ground | Nursery Ground | Adult Forage | Comm. Fishery | Recr. Fishery |
| ANADROMOUS/CATADROMOUS SPECIES | | | | | | |
| Alewife | *Alosa pseudoharengus* | ♦ | ♦ | | | |
| American eel | *Anguilla rostrata* | | ♦ | ♦ | | |
| Blueback herring | *Alosa aestivalis* | ♦ | ♦ | | | |
| Hickory shad | *Alosa mediocris* | ♦ | ♦ | | | |
| Striped bass | *Morone saxatilis* | ♦* | ♦* | ♦* | | ♦ |
| White perch | *Morone americana* | ♦ | ♦ | | | ♦ |

* Striped bass are found in the lower Patuxent River and estuary approximately 30 km downstream of FGGM. They are not found near the site.

Fort Meade Dam, located on the facility, was the upstream extent of migratory runs in the river. In 1991, fish passage facilities were constructed, allowing passage to areas upstream of Fort Meade. The catadromous American eel is a common, year-round resident of the Little Patuxent River. In a 1992 fish survey, eels were collected at all Fort Meade stream stations (EA Engineering 1992).

The Patuxent River is a large, warmwater stream typically about 30 m wide and 0.6 to 3 m deep. The river at the site is low-gradient, dominated by slow-flowing runs; bottom substrates range from sands to silts with a few areas of cobble. The riparian zone of the Patuxent River near Fort Meade is dominated by hardwood wetlands of the type seen on the Little Patuxent (EA Engineering 1992). The anadromous species that spawn in the Little Patuxent River are also found in the Patuxent River next to the site during spawning runs. Striped bass, another anadromous species, is abundant in the lower Patuxent River, but is restricted to tidal portions, 30 km or more downstream of the site. American eel are found throughout the Patuxent and Chesapeake basins (Stone et al. 1994).

There are extensive recreational and commercial fisheries in the lower Patuxent River and estuary, but not adjacent to the site. Recreational fisheries in several ponds and small impoundments on Fort Meade are stocked with catfish, bluegill, and largemouth bass. No Federal threatened or endangered aquatic species are present in the Little Patuxent and Patuxent rivers near Fort Meade. There are no consumption advisories for the basin (EA Engineering 1992).

## Site-Related Contamination

This report summarizes results from the most recent sampling conducted at each of the hazardous waste sites at Fort Meade. At IAL1, IAL2, IAL3, and the Clean Fill Dump, the most recent sampling was conducted in 1996 as part of a remedial investigation for those areas (ICF Kaiser 1997). A 1995 site inspection contained the most recent results for the Helicopter Hangar Area, the DRMO Salvage Yard, the Fire Training Area, and the Ordnance Demolition Area (Arthur D. Little 1995). The most recent sampling at the Active Sanitary Landfill was conducted in 1993 for the remedial investigation (Arthur D. Little 1994). For IAL4, the most recent sampling results were presented in a 1992 site inspection study (EA Engineering 1992).

Table 3 presents the maximum concentrations of contaminants detected in groundwater and soils throughout Fort Meade during the investigations, along with the areas where the maximum concentrations were detected.

The highest concentrations of trace elements in groundwater were in samples collected from the Helicopter Hangar Area, the Active Sanitary Landfill, and the Clean Fill Dump. Groundwater seep samples collected from the Active Sanitary Landfill contained elevated concentrations of a number of trace elements. Soils containing the highest concentrations of trace elements were collected from IAL3 and the Clean Fill Dump. In general, soil and groundwater samples exceeded screening guidelines for trace elements at Fort Meade areas so infrequently and sporadically that gradients of contamination were not apparent.

Pesticides were most frequently detected in soils and groundwater at the landfill areas. Explosive compounds were detected in groundwater but not in soils at the Ordnance Demolition Area and at IAL3. PCBs are the primary contaminants of concern at the DRMO Salvage Yard. Aroclor 1260 was detected in five of six soil samples collected at the salvage yard in 1993 at concentrations ranging from 0.27 to 4 mg/kg (Arthur D. Little 1995). During a previous investigation in 1991, total PCBs were detected at a maximum concentration of 93 mg/kg in the southernmost area of the DRMO Salvage Yard, an area that was not sampled in 1993 (Arthur D. Little 1995). PCBs were not detected in groundwater at the salvage yard, but detection limits were not available.

Surface water and sediment samples have been collected from drainages and tributaries associated with the following areas: IAL1, IAL2, IAL3, IAL4, the Active Sanitary Landfill, the Clean Fill Dump, the Helicopter Hangar Area, and the Fire Training Area (EA Engineering 1992; Arthur D. Little 1994; ICF Kaiser 1997). In addition, during the 1996 RI (ICF Kaiser 1997), sediment and surface water samples were collected from the Little Patuxent River along a stretch from the Helicopter Hangar Area to the Clean Fill Dump. Maximum concentrations of contaminants in surface water and sediment detected during those studies are shown in Table 4, along with the areas

Table 3. Maximum concentrations of contaminants in groundwater and soils detected during recent investigations, locations of maximum concentrations, and water and soil screening guidelines.

| | Groundwater | Location | AWQC[a] | Soils | Location | Mean U.S.[b] |
|---|---|---|---|---|---|---|
| Trace Elements (µg/L or mg/kg) | | | | | | |
| Arsenic | 270 | HHA | 190 | 14 | IAL3 | 5.2 |
| Cadmium | 35 | HHA | 1.1[c] | 3.0 | CFD | 0.06 |
| Copper | 380 | HHA | 12[c] | 70 | CFD | 17 |
| Lead | 220 | HHA | 3.2[c] | 1,000 | CFD | 16 |
| Mercury | 1.2 | ASL | 0.012 | 1.2 | IAL3 | 0.06 |
| Nickel | 1,100 | ASL | 160 | 40 | CFD | 13 |
| Silver | ND | -- | 0.12 | 3.3 | IAL3 | 0.05 |
| Zinc | 8,200 | CFD | 110[c] | 750 | CFD | 48 |
| PCBs | | | | | | |
| Total PCBs | ND | -- | 0.014 | 93 | DSY | NA |
| Pesticides (µg/L or µg/kg) | | | | | | |
| Gamma chlordane | 0.0085 | IAL1 | 0.0043[d] | 0.21 | CFD | NA |
| Alpha chlordane | 0.012 | IAL1 | 0.0043[d] | ND | -- | NA |
| DDT | 0.12 | IAL1 | 0.001 | 1.2 | CFD | NA |
| DDE | ND | -- | NA | 0.26 | CFD | NA |
| DDD | 0.029 | IAL1 | NA | 0.68 | IAL3 | NA |
| Endosulfan II | 0.01 | CFD | 0.056[e] | 0.015 | CFD | NA |
| Endrin | 0.039 | IAL1 | 0.0023 | 0.082 | CFD | NA |
| Other Organic Compounds (µg/L or µg/kg) | | | | | | |
| RDX | 84 | ODA | NA | ND | -- | NA |
| HMX | 9.1 | ODA | NA | ND | -- | NA |
| 1,3,5-Trinitrobenzene | 0.68 | IAL3 | NA | ND | -- | NA |
| 2,4,6-Trinitrotoluene | 7.8 | IAL3 | NA | ND | -- | NA |
| 2,4-Nitrotoluene | 0.62 | ODA | NA | ND | -- | NA |
| 4-Nitrotoluene | 2.2 | IAL3 | NA | ND | -- | NA |
| 2-Amino-4,6-dinitrotoluene | 0.52 | IAL3 | NA | ND | -- | NA |
| 4-Amino-2,6-dinitrotoluene | 32 | IAL3 | NA | ND | -- | NA |

a: Ambient water quality criteria for the protection of aquatic organisms. Freshwater chronic criteria presented (EPA 1993).
b: Shacklette and Boerngen (1984), except for cadmium and silver which represent average concentrations in the earth's crust from Lindsay (1979).
c: Hardness-dependent criteria; 100 mg/L $CaCO_3$ assumed.
d: Chlordane value used.
e: Endosulfan value used.
ND: Not detected; detection limit not available.
NA: Screening guidelines not available.
ASL: Active Sanitary Landfill
CFD: Clean Fill Dump
HHA: Helicopter Hangar Area
IAL1: Inactive Landfill 1
IAL3: Inactive Landfill 2
ODA: Orndance Demolition Area

Table 4. Maximum concentrations of contaminants in surface water and sediment detected during recent investigations; locations of maximum concentrations; and water and sediment screening guidelines.

| | Surface Water µg/L | Location | AWQC[a] µg/L | Sediment mg/kg | Location | ERL[b] mg/kg |
|---|---|---|---|---|---|---|
| Trace Elements | | | | | | |
| Arsenic | 2.6 | ASL stream | 190 | 14 | AL4 drainage swale | 8.2 |
| Cadmium | ND | -- | 1.1[c] | 1.8 | IAL3[d] | 1.2 |
| Chromium | 47 | CFD tributary | 11 | 24 | HHA Little Patuxent R. | 81 |
| Copper | 36 | CFD tributary | 12[c] | 70 | IAL4 drainage swale | 34 |
| Lead | 37 | CFD tributary | 3.2[c] | 170 | IAL4 drainage swale | 46.7 |
| Mercury | ND | -- | 0.012 | 0.51 | IAL4 drainage swale | 0.15 |
| Silver | 0.149 | IAL1 east marsh | 0.12 | 4.8 | CFD tributary | 1.0 |
| Zinc | 145 | CFD tributary | 110[c] | 180 | CFD tributary | 150 |
| PCBs | | | | | | |
| Aroclor 1260 | ND | -- | 0.014 | 0.51 | IAL4 drainage swale | 0.0027 |
| Pesticides | | | | | | |
| Chlordane | ND | -- | NA | 0.15 | CFD tributary | NA |
| DDD | ND | -- | NA | 2.0 | IAL4 drainage swale | 0.0016[e] |
| DDE | ND | -- | NA | 0.14 | IAL4 drainage swale | 0.0022 |
| DDT | ND | -- | 0.001 | 0.15 | IAL4 drainage swale | 0.0016[e] |
| Dieldrin | ND | -- | NA | 0.015 | IAL4 drainage swale | NA |
| Endosulfan II | 0.0065 | IAL2 marsh | NA | 0.072 | CFD tributary | NA |
| Endrin | ND | -- | 0.0023 | 0.022 | CFD tributary | NA |
| Endrin ketone | 0.0093 | IAL2 marsh | 0.0023[f] | ND | -- | NA |

a: Ambient water quality criteria for the protection of aquatic organisms. Freshwater chronic criteria presented (EPA 1993).
b: Effects range-low; the concentration representing the lowest 10 percentile value for the data in which effects were observed or predicted in studies compiled by Long and MacDonald (1995).
c: Hardness-dependent criteria; 100 mg/L $CaCO_3$ assumed.
d: Sampling location at IAL3 was not available.
e: Total DDT value used.
f: Endrin value used.
ND: Not detected; detection limit not available.
NA: Screening guidelines not available.
ASL: Active Sanitary Landfill
CFD: Clean Fill Dump
HHA: Helicopter Hangar Area
IAL1-4: Inactive Landfills 1-4

where the maximum concentrations were detected.

For trace elements in surface water, most of the AWQC exceedances were detected in a tributary near the Clean Fill Dump. Concentrations of trace elements in surface water of the Little Patuxent River did not exceed AWQCs. For sediment, the highest concentrations of trace elements were primarily found in a drainage swale at IAL4 and in a tributary near the Clean Fill Dump. In the Little Patuxent River, concentrations of arsenic (12 mg/kg) and silver (3.4 mg/kg) exceeded their respective ERL concentrations.

Pesticide screening guidelines for surface water and sediment were occasionally exceeded in drainages or tributaries but, overall, pesticides were infrequently detected. Pesticides that exceeded their sediment screening guidelines in the Little Patuxent River were DDD (0.012 mg/kg) and DDE (0.0079 mg/kg). Sediment samples collected from IAL4 and CFD contained the highest concentrations of pesticides relative to ERL concentrations. Gradients of contamination were not apparent. PAHs were not detected at concentrations above screening guidelines in surface water or sediment. Concentrations of PCBs in sediment infrequently exceeded the screening guidelines.

## Summary

Several waste sites at Fort Meade have drainage pathways leading directly to the Little Patuxent River. Concentrations of a variety of contaminants in streams and wetlands associated with waste sites have been found to exceed screening guidelines, although exceedances were infrequent and sporadic. The Little Patuxent River and Patuxent River near the site are used by several anadromous fish, including white perch, hickory shad, alewife, and blueback herring. These species may be exposed to contamination from waste sites at Fort Meade.

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