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Langley Air Force Base

Hampton, Virginia
CERCLIS #VA2800005033

Site Exposure Potential

Langley Air Force Base (AFB) is located near Hampton, Virginia, approximately 160 km south of Washington, D.C. The base is located on the Hampton Flat, a low-lying area in the outer coastal plain of southeastern Virginia between the northwest and southwest branches of the Back River. The Back River flows into Chesapeake Bay about 5 km from the site (Figure 1).

Purchased in 1916, Langley AFB is the oldest continuously active Air Force base in the U.S. The 1,300-hectare base has been used as an experimental aviation station, as a fighter squadron homebase, and is now headquarters to the Air Combat Command. Thirty-three separate sites throughout the base have been identified as potentially contaminated due to current or historical activities (Table 1; Figure 2). Abandoned landfills account for eleven of the listed sites. The types of materials sent to these landfills included waste oils and solvents in drums, old paints and thinners, batteries, empty pesticide containers, avionics and electron tubes, tires, fabrics, adhesives, construction debris, municipal waste, and sludge from the sanitary wastewater treatment plant. Storage areas for pesticides and PCBs comprise four sites. Nine sites have been identified as UST or fuel-contaminated areas. Leakage, dumping of fuel and waste oil, and incidental spillage of petroleum products are

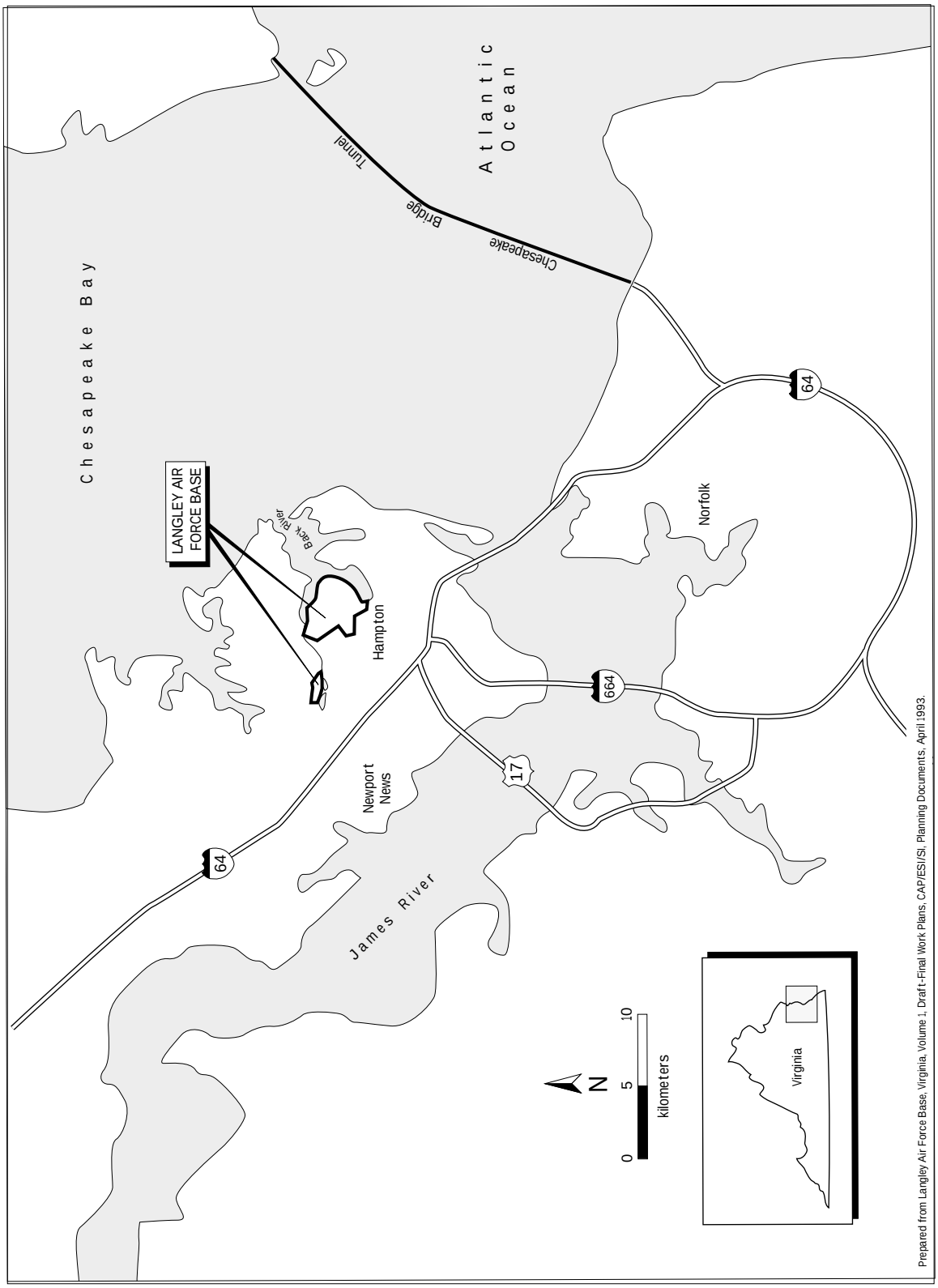

Figure 1. Langley Air Force Base, Hampton, Virginia.

Table 1. Sites identified as potential sources of contaminants (Radian Corporation 1993; Radian Corporation and Law Environmental, Inc. 1993).

Site	Description	Status	Potential contaminant type
Landfills			
LF-001	Landfill	abandoned in 1950	unknown
LF-005	Landfill	abandoned in 1940s	unknown
LF-007	Landfill	abandoned in 1960s	metals, phenols, DDT
LF-010	Landfill/former bombing range	abandoned in 1965	metals, phenols, DDT
LF-011	Landfill	used 1965-1972	metals, phenols, DDT
LF-012	Landfill	used 1972-1980	metals, phenols, DDT
LF-017	Landfill	abandoned 1945	unknown
LF-018	Landfill	abandoned 1930s	unknown
LF-022	Landfill	abandoned 1930s	unknown
LF-13	Landfill	1953-1963	unknown
LF- 15	Landfill	abandoned in 1940s	unknown
PCB/DDT			
SS-019	Transformer storage	currently in use	PCBs
OT-025	Storage of pesticides & herbicides	current storage of debris	pesticide / herbicide
OR-051	Electrical substation	abandoned	PCBs, DDT
OT-06	Sewage treatment/ entomology building	demolished 1960s	unknown (possibly lindane, chlordane, and DDT)
UST/Fuel			
SS-016	Former gas station	removed	fuel oil, unknown
SS-024	Waste oil storage	abandoned UST	waste oil
FT-041	Fire training area	former site replaced with new facility	waste fuel dumped and ignited
OT-048	Former gas station	abandoned UST	gasoline/diesel, fuel oil and waste oil
OR-049	Fuel oil storage	abandoned UST	fuel oil
OT-050	Fuel oil storage	abandoned UST	fuel oil
SS-052	Gasoline storage	replaced UST	gasoline
OT-055	Storage yard/ liquid waste disposal pits	current storage yard	petroleum products, xylenes, toluene
SS-03	Underground fuel line	removed	fuel
Other sites			
OT-056	Six stormwater outfalls	In use	silver
WP-14	Chemical leach pit	abandoned	unknown
ST-035	Septic tank	abandoned	unknown
WP-002	Wastewater treatment plant	abandoned 1968	unknown
WP-008	Wastewater treatment plant	demolished 1960s	unknown
SS-023	Coal storage	removed	unknown
ST-038	Four burning pits	abandoned/removed	unknown
OT-040	Explosive ordnance disposal	abandoned	unknown
DP-09	Cylinder disposal	prior to 1935	unknown

sources of contamination on these sites. The remaining nine sites include two wastewater treatment plants, a coal storage area, a collection of burning pits, two separate disposal areas for gas cylinders and explosive ordnance, a waste chemical leach pit, septic tank area, and silver contamination in storm water throughout the base (Radian Corporation 1993; Radian Corporation and Law Environmental, Inc. 1993).

Surface-water runoff and groundwater discharge are the potential pathways of contaminant transport from the site to NOAA resources and associated habitats. There is poor drainage on the

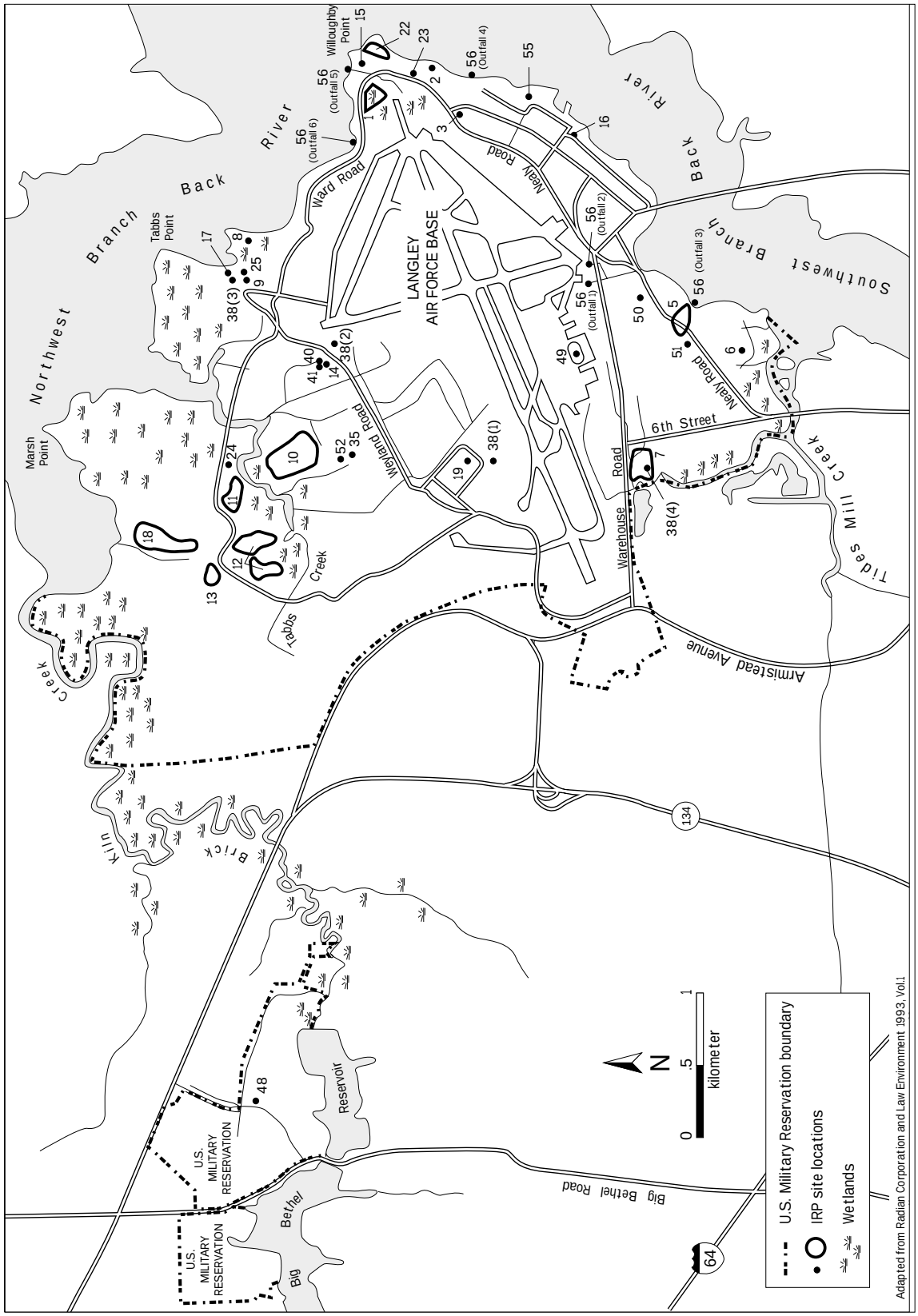

Figure 2. Installation Restoration Program (IRP) sites identified as potentially contaminated at Langley AFB.

featureless Hampton Flat, which lies between 1.5 and 2.5 m above mean sea level. Storm drains direct most of the runoff from the runway area at Langley AFB is directed via storm drains towards the southwest branch of the Back River. Tabbs Creek drains most of the northern part of the base, meandering to the northeast and discharging into the northwest branch of the Back River. The northernmost portion of Langley Research Center (NASA) is drained by Brick Kiln Creek. Due to the base's proximity to Chesapeake Bay, much of the drainage is tidally influenced. Surficial deposits (1 to 2 m) at the site are primarily sandy, silty clays overlying 600 m of sediments deposited from the early Cretaceous to Holocene periods. Several areas on the base, particularly those next to the southwest branch of the Back River, contain artificial material used to fill wetlands. The water table aquifer extends from 1.5 to 3 m below the surface to an estimated depth of 12 m. Two deeper artesian aquifers, the upper and principal, occur at depths of 120 m and 210 m, respectively. The artesian aquifers are separated from the shallow water table by silt and clay formations. Saline intrusion prevents any of the groundwater at the base from being a viable drinking water source. Surface and near-surface soils have low to moderate permeabilities. Groundwater flow is generally from west to east towards the Back River (Radian Corporation and Law Environmental, Inc. 1993).

NOAA Trust Habitats and Species

Habitats of concern to NOAA are surface water, bottom substrates, and brackish emergent wetlands associated with Tabbs Creek, Tides Mill Creek, Brick Kiln Creek, and the northwest and southwest branches of the Back River next to the site. Secondary habitats of concern are Back River surface water and substrates. The northwest and southwest branches of the Back River provide extensive nursery and adult forage habitat for numerous species (Table 2; Austin personal communication 1994; vanMontfrans personal communication 1994). Limited data were available regarding resource use of the creeks within the site. However, tidal exchange and the creeks' nearness to the northwest and southwest branches of the Back River suggest that they are regularly used by trust species.

Salinities in the northwest and southwest branches of the Back River near the site, classified as mesohaline, range from 8 to 20 ppt and fluctuate throughout the year depending on rainfall, saltwater intrusion, and urban runoff (Austin personal communication 1994; Hershner personal communication 1994). The creeks associated with the base are reportedly tidally influenced to approximately 2 km inland (Hershner personal communication 1994). The substrate of the northwest and southwest branches of the Back River is mainly mud (Austin personal communication 1994; Orth personal communication 1994). Eelgrass (*Zostera marina*) beds and isolated areas of widgeon grass (*Ruppia maritima*) are present in the Back River,

Table 2. Major species that use surface water associated with the Back River near Langley AFB.

Species		Habitat			Fisheries	
Common Name	Scientific Name	Spawning	Nursery	Adult Forage	Comm.	Recr.
ANADROMOUS /CATADROMOUS SPECIES						
Blueback herring	*Alosa aestivalis*		♦	♦		♦
Alewife	*Alosa pseudoharengus*		♦	♦		♦
American shad	*Alosa sapidissima*		♦	♦	♦	
American eel	*Anguilla rostrata*		♦	♦	♦	
Striped bass	*Morone saxatilis*		♦	♦	♦	♦
ESTUARINE /MARINE FISH						
Bay anchovy	*Anchoa mitchilli*	♦	♦	♦		♦
Atlantic menhaden	*Brevoortia tyrannus*		♦			♦
Spotted seatrout	*Cynoscion nebulosus*		♦	♦	♦	♦
Weakfish	*Cynoscion regalis*		♦	♦	♦	♦
Sheepshead minnow	*Cyprinodon variegatus*	♦	♦	♦		
Atlantic stingray	*Dasyatis sabina*		♦	♦		
Gizzard shad	*Dorosoma cepedianum*		♦	♦		
Killifish	*Fundulus* spp.	♦	♦	♦		♦
Goby	*Gobiosoma* spp.	♦	♦	♦		
Spot	*Leiostomus xanthurus*		♦	♦	♦	♦
Silverside	*Menidia* spp.	♦	♦	♦		♦
Southern kingfish	*Mentricirrhus littoralis*		♦			♦
Northern kingfish	*Mentricirrhus saxatilis*		♦			♦
Atlantic croaker	*Micropongonias undulatus*		♦	♦	♦	♦
Mullet	*Mugil* spp.		♦	♦	♦	♦
Oyster toadfish	*Opsanus tau*	♦	♦	♦		
Summer flounder	*Paralichthys dentatus*		♦	♦	♦	♦
Black drum	*Pogonias cromis*		♦			
Bluefish	*Pomatomus saltatrix*		♦		♦	♦
Winter flounder	*Pleuronectes americanus*		♦	♦		
Cobia	*Rachycentron canadum*		♦	♦	♦	
Cownose ray	*Rhinoptera bonansus*		♦	♦		
Red drum	*Sciaenops ocellatus*		♦		♦	♦
Spanish mackerel	*Scomberomorus maculatus*		♦	♦	♦	
Northern puffer	*Sphoeroides maculatus*	♦	♦	♦	♦	♦
Spiny dogfish	*Squalus acanthias*		♦	♦		
Northern pipefish	*Syngnathus fuscus*	♦	♦	♦		
Tautog	*Tautoga onitis*		♦		♦	
Hogchoker	*Trinectes maculatus*	♦	♦	♦		
Red hake	*Urophycis chuss*		♦		♦	
Spotted hake	*Urophycis regia*		♦			
INVERTEBRATE SPECIES						
Blue crab	*Callinectes sapidus*	♦	♦	♦	♦	♦
Sand shrimp	*Crangon septemspinosa*	♦	♦	♦		
Eastern oyster	*Crassostrea viginica*	♦	♦	♦	♦	♦
Common razor clam	*Ensis directus*	♦	♦	♦		
Baltic macoma	*Macoma balthica*	♦	♦	♦		
Northern quahog	*Mercenaria mercenaria*	♦	♦	♦	♦	♦
Opossum shrimp	*Mysis* spp.	♦	♦	♦		
Grass shrimp	*Palaemonetes pugio*	♦	♦	♦		♦
Brown shrimp	*Penaeus aztecus*		♦			

but bottom habitats associated with the northwest and southwest branches of the Back River are largely barren of submerged aquatic vegetation (Orth personal communication 1994).

Wetlands associated with Tabbs Creek, Tides Mill Creek, Brick Kiln Creek, and portions of the northern and southern fringes of the base are

classified as brackish-water, emergent marsh. Wetland vegetation is predominantly large stands of saltmarsh cordgrass (*Spartina alterniflora*) and salt grass (*Distichlis spicata*). Marsh elder (*Iva frutescens*), groundsel tree (*Baccharis halimifolia*), and black needlerush (*Juncus roemerianus*) are associated with these areas but are less dominant in coverage (Hershner personal communication 1994).

Abundant populations of alewife, American shad, blueback herring, and striped bass use Back River surface water for juvenile rearing and adult forage. These anadromous species return as adults to upper portions of Chesapeake Bay in the spring and migrate to suitable freshwater habitats to spawn during late spring and mid-summer. After spawning, adults return to open marine environments by early fall. Juveniles commonly use areas within the Back River as nursery habitat before returning to the ocean by the following fall (Austin personal communication 1994).

Spot, Atlantic croaker, spotted seatrout, bluefish, cobia, weakfish, and summer flounder are common summer migrants typically returning to surface water near the site during the spring and summer. Resident finfish of the Back River that occur in substantial numbers include bay anchovy, hogchoker, oyster toadfish, killifish, and silverside. Bay anchovy, an estuarine species, the most abundant fish in the estuarine water of Chesapeake Bay, dominates the total biomass of pelagic fishes in the bay. The bay anchovy spawning period typically extends from early May through mid-September (Austin personal communication 1994).

Atlantic menhaden rear young in the surface water of the Back River system and are abundant near the site during the late summer months. Adult and juvenile Atlantic stingray and cownose ray frequently migrate into the Back River system during the summer. Northern puffer periodically occur near the site in the spring, while juvenile red and black drum commonly arrive later to rear in the Back River system during the summer months. The catadromous American eel is seen throughout the Back River system. Eel use intertidal habitats for juvenile and adult forage habitat and are likely to inhabit wetland areas associated with Tabbs and Tides Mill creeks (Austin personal communication 1994).

Blue crab are commonly densest in areas associated with submerged aquatic vegetation. Although unconfirmed, wetlands associated with the site may provide juvenile rearing and adult forage habitat to local populations of blue crab. Adult blue crab typically mate from May through July, with gravid females subsequently migrating to higher-salinity areas of the bay and coastal continental shelf for egg dispersal (vanMontfrans personal communication 1994). Some beds of eastern oyster are suspected to exist in the northwest and southwest branches of the Back River, but the extent of their presence near the site has not been established (Mann personal communication 1994).

The Back River system supports important recreational and commercial fisheries. Species commercially harvested in the greatest numbers include American shad, American eel, striped bass, spot, Atlantic croaker, bluefish, Spanish mackerel, northern puffer, blue crab, and northern quahog. Weakfish, sheepshead minnow, mullet, cobia, tautog, red hake, and eastern oyster are also commercially targeted, but to a lesser degree. Spot, Atlantic croaker, summer flounder, and quahog represent the most popular sport fisheries in the area. Striped bass, spotted seatrout, weakfish, mullet, bluefish, cobia, northern puffer, blue crab, eastern oyster, and grass shrimp are also fished recreationally. There are several bait fisheries in the Back River system, including blueback herring, alewife, bay anchovy, Atlantic menhaden, killifish, and silverside (O'Reilly personal communication 1994).

No closures or health advisories for the consumption of fish are reported for surface water near the site (Sherertz personal communication 1994). The Virginia Department of Health, Division of Shellfish Sanitation requires permits to harvest bivalves in Tabbs Creek, Tides Mill Creek, the southwest branch of the Back River, and upper portions of the northwest branch of the Back River. These restrictions are based on fecal coliform contamination associated with urban runoff. Bivalve harvesters in these areas are permitted to relay shellfish to certified areas for depuration when water temperatures exceed 10°C (Wright personal communication 1994).

Site-Related Contamination

There has been limited environmental sampling at Langley AFB. Since data are available for only eight of the 33 sites, and sampling at these sites was limited, the nature and extent of contamination at the site is not well characterized. All data reviewed were from sampling conducted between 1982 and 1992. The results from preliminary sampling indicate that trace elements, pesticides, and PCBs are the primary contaminants of concern to NOAA. Maximum concentrations of contaminants detected in samples collected from Langley AFB are presented in Table 3.

At Site LF-007, surface water and sediment samples were collected from 12 locations in Tides Mill Creek and analyzed for trace elements and pesticides. Low concentrations of pesticides and moderate concentrations of cadmium (5.3 mg/kg), compared to the respective ERL concentrations (Long and MacDonald 1992), were found in sediments. Contaminants were not detected in surface water samples (Radian Corporation and Law Environmental, Inc. 1993).

Three paired surface water and sediment samples were collected from Tabbs Creek to investigate potential contamination from three nearby sites: LF-010, LF-011, and LF-012. Four groundwater samples were collected near LF-010. Concentrations of pesticides in sediments (460 mg/kg DDT, 79 mg/kg DDD, and 44 mg/kg DDE) were elevated with respect to their screening guidelines. Low concentrations

Table 3. Maximum concentrations of contaminants of concern at seven of the waste sites at Langley AFB (Radian Corporation and Law Environmental, Inc. 1993).

	Water (µg/l)			Soil (mg/kg)	Sediment (mg/kg)	
Compound/Analyte	Groundwater	Surface water	AWQC[1]	Soils	Tabbs Creek Sediment	ERL[2]
Trace Elements						
Cadmium	60	<50	1.1+	NT	5.3[3]	5.0
Chromium	88	<50	11	NT	301	80
Lead	340	<50	3.2+	NT	5.8	35
Mercury	3.4	<2.5	0.012	NT	<2.5	0.15
Silver	230	790	0.12	NT	0.7	1.0
Organic Compounds						
o,p'-DDE	ND	trace[4]	NA	1.2	7.6	NA
p,p'-DDE	ND	trace	14	0.14	44	0.002
o,p'-DDD	ND	trace	NA	trace	29	NA
p,p'-DDD	ND	trace	0.6	0.12	79	0.002
o,p'-DDT	ND	trace	NA	0.3	66	NA
p,p'-DDT	ND	trace	0.001	0.52	460	0.001
PCB						
Aroclor 1254	ND	NT	0.014	1.7	NT	0.05
Aroclor 1260	ND	NT	0.014	1.0	NT	0.05

1: Ambient water quality criteria for the protection of aquatic organisms. The lower concentration of the marine or freshwater chronic criteria are presented, because waste sites are located near both marine and freshwater environments (EPA 1993).
2: 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 (1992).
3: Tides Mill Creek sediment.
4: A peak, reported only as "trace," was measured at less than the detection limit.
+: freshwater chronic AWQC value dependent on water hardness (100 mg/l $CaCO_3$ used)
NA: Screening guidelines not available.
ND: Not detected; detection limit not available.
NT: Not tested; sample not analyzed for compound.

of pesticides were detected in the overlying surface water (no values reported). Trace elements were present in sediments (300 mg/kg chromium) and groundwater (60 µg/l cadmium, 88 µg/l chromium, 3.4 µg/l mercury, and 230 µg/l silver) at concentrations of concern to NOAA. The relative contribution of each individual site to contamination in Tabbs Creek is not known (Radian Corporation and Law Environmental, Inc. 1993).

Soil samples were collected from two sites (OT-025 and OR-051) suspected of pesticide and PCB contamination. Soils in four samples collected from Site 0T-025 contained maximum concentrations of 1.2 mg/kg DDE, 0.12 mg/kg DDD, and 0.52 mg/kg DDT. Three of the 18 samples collected at site OR-051 contained pesticides or PCBs (0.39 mg/kg DDE; 0.64 mg/kg DDT; 1.0 mg/kg Aroclor 1260; and 1.7 mg/kg Aroclor 1254). The source of PCBs is believed to be from transformer oil

spilled at the abandoned electrical substation (Radian Corporation and Law Environmental, Inc. 1993).

High concentrations of silver (detected in 46 of 115 samples, 790 µg/l maximum concentration), with respect to the AWQC for silver, were recorded during the monthly sampling of effluent from the stormwater outfalls draining the base. The presence of silver may be the result of film incineration at the site. Silver was the only analyte tested in the stormwater effluent.

Low concentrations of petroleum-related compounds were also identified in soil and groundwater samples at site OT-055, although specific data were not available (Radian Corporation and Law Environmental, Inc. 1993).

Summary

DDT and its metabolites, cadmium, chromium, lead, mercury, and silver were measured at concentrations that pose a threat to NOAA resources in habitats likely used by NOAA trust resources. Numerous sites at the facility are sources of contamination. Sampling is limited to date; the main pathways from the site to NOAA trust resources and habitats are stormwater runoff and groundwater discharge to Tides Mill Creek, Tabbs Creek, and the northwest and southwest branches of the Back River next to Langley AFB. Trust resources are located in each of these pathways.

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