Diamond Head Oil Refinery Div.

Kearny, New Jersey

EPA Facility ID: NJD092226000

Basin: Hackensack-Passaic

HUC: 02030103

Executive Summary

The Diamond Head Oil Refinery Div. site is located in Kearny, New Jersey. The site encompasses approximately 6 ha (15 acres), part of which is an abandoned oil refinery. The primary contaminants of concern at the site are metals, SVOCs, and PCBs. Surface water runoff and drainage from the site are the primary pathways for the migration of contaminants from the site to NOAA trust resources. Nearby wetlands, Frank's Creek, and the Passaic River are habitats of concern to NOAA. Wetlands lie within, and surround the Diamond Head Oil Refinery Div. site. Anadromous fish use the reach of the Passaic River nearest the site as a migratory route to reach spawning grounds upstream of the site. Other NOAA trust resources use the river for adult forage and juvenile nursery grounds.

Site Background

The Diamond Head Oil Refinery Div. site (Diamond Head) is approximately 6 ha (15 acres) of land in Kearny, Hudson County, New Jersey (Figure 1). The site contains wetlands, drainage ditches, a small pond/wetland, an inactive landfill that is overgrown with vegetation, and the remnants of the former Diamond Head Oil Refinery. The remnants of the oil refinery include the foundations of the former oil refinery building and two above-ground-storage tanks (AST) (Figure 2) (Weston 2000).

The oil refinery was in operation from February 1946 until early 1979. During this time used oil was collected and refined into fuel and lubrication oil. The refinery operated under several company names all owned by Mr. Robert Mahler. In January 1985, Newton Refining Corporation, the last company to operate at the refinery, sold the property to Mimi Urban Development Corporation, which later changed its name to Hudson Meadows Urban Renewal Development Corporation, which is the current property owner (Weston 2000). The site is currently inactive (USEPA 2002a).

Two ASTs, were used to store oily wastes when the refinery was in operation. Oily waste was also intermittently discharged directly to adjacent properties, including a wetland to the south of the site, which created a lake of oil. In March 1968, the New Jersey Department of Transportation acquired property south of the site, where construction of Interstate 280 (I-280) began in 1977. During construction, the New Jersey Department of Transportation removed approximately 34 thousand m^3 (9 million gal) of oil-contaminated water and 3.8 to 4.6 million m^3 (5 to 6 million yd^3) of oily sludge from the lake of oil. Also during the construction of I-280, oil-contaminated groundwater was discovered that extended from beneath the site west to Frank's Creek (Weston 2000).

From the time refinery operations ceased in 1979 until 1982, the Diamond Head site was not fenced off and waste oils and other debris were reportedly dumped at the site during that time. Newton Refining Corporation began cleanup of the site in 1982. Analysis of the material

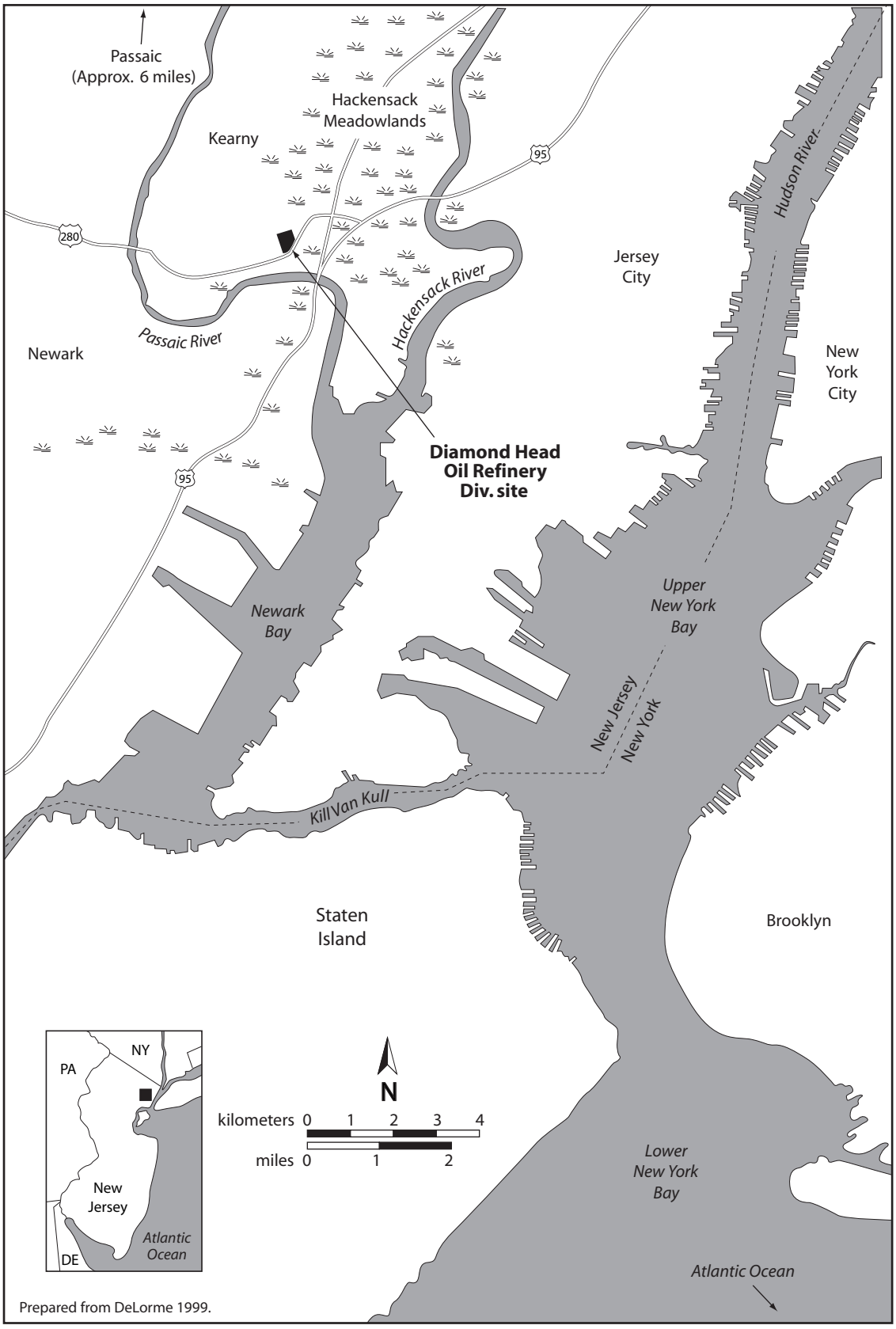

Figure 1. Location of the Diamond Head Oil Refinery Div. site, Kearny, New Jersey.

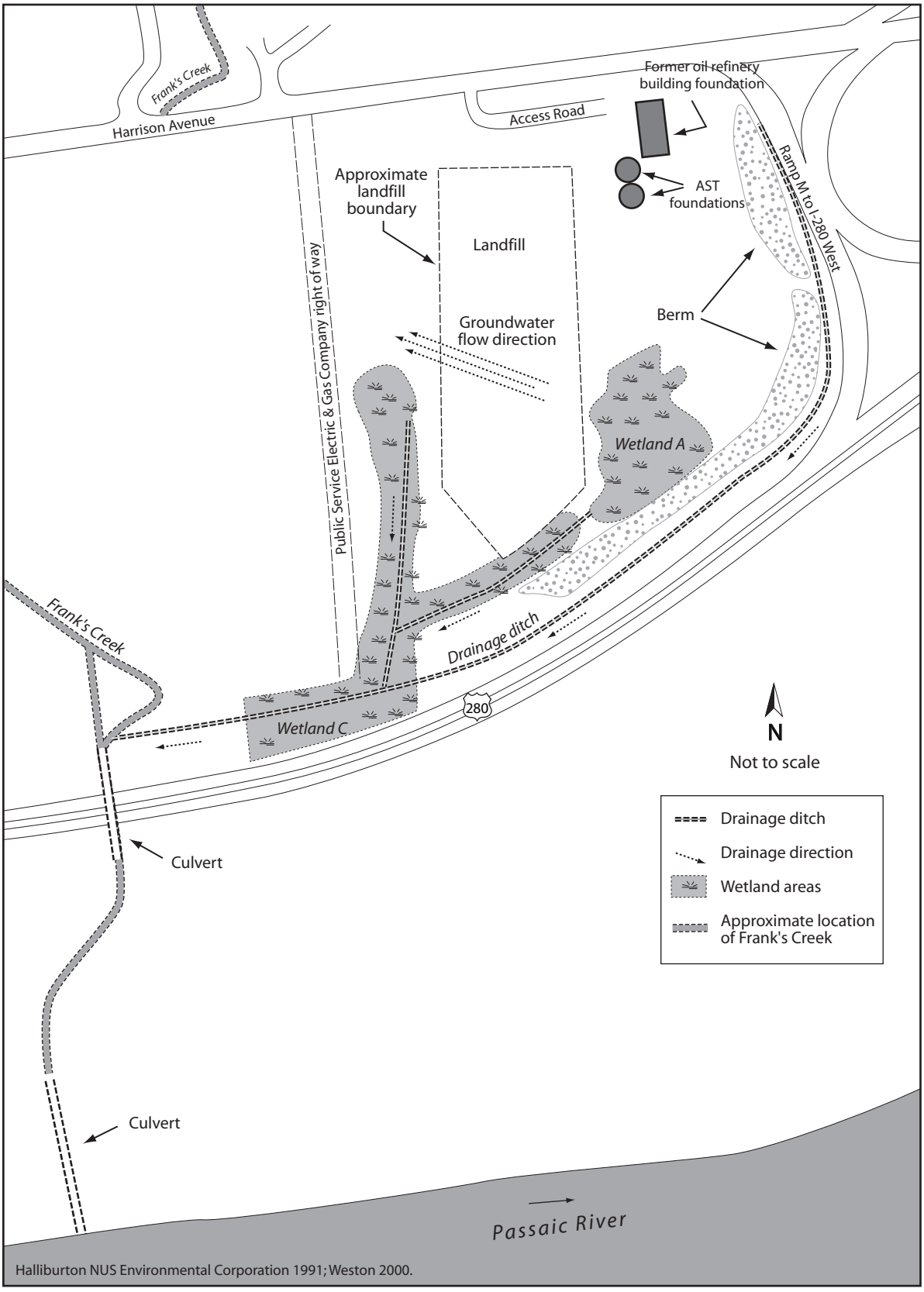

Figure 2. Detail of the Diamond Head Oil Refinery Div. property.

remaining in the ASTs indicated the presence of polychlorinated biphenyls (PCBs) at concentrations greater than 3,100 ppm. After the tank contents were analyzed for PCBs, approximately 28,000 L (7,500 gal) of contaminated material was reportedly pumped from the tanks and disposed of off site. In addition, approximately 24 metric tons (27 tons) of contaminated soil was removed from the site (Weston 2000).

During a 1991 site inspection, extensive areas of orange- and black-stained soil were observed at locations throughout the site. Groundwater, surface water, sediment, surface soil, and subsurface soil samples were collected during this site inspection. Analysis of the soil and sediment samples indicated the presence of elevated concentrations of volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), metals, pesticides, and PCBs (in soil). Analysis of groundwater samples indicated elevated concentrations of VOCs, SVOCs, and metals (Halliburton NUS Environmental Corporation 1991). The site was placed on the National Priorities List on September 5, 2000 (USEPA 2002a).

The pathway for the migration of contaminants from the Diamond Head site to the nearby wetlands, Frank's Creek, and NOAA trust resources in the Passaic River is via surface water runoff (Weston 2000). Groundwater is another potential pathway for the migration of contaminants to NOAA trust resources. Groundwater is encountered beneath the site at approximately 0.3 m (1 ft) below ground surface and generally flows to the west toward Frank's Creek. At the time of this report, it was unknown whether there is a connection between the groundwater below the site and a surface water pathway for the migration of contaminants (Scorca 2004).

NOAA Trust Resources

The habitats of concern to NOAA are the nearby wetlands, Frank's Creek, and the Passaic River. NOAA trust resources that use these habitats are summarized in Table 1 and include anadromous, catadromous, estuarine, and marine species.

Two palustrine emergent wetlands, Wetland A and Wetland C, are present at the Diamond Head site (Figure 2). Wetland A contains a ponded area that is believed to have been part of the former oil lake. Wetland A is connected to Wetland C, which extends along the southern and western ends of the site property. Wetland C connects to Frank's Creek, which drains south into the Passaic River (Weston 2000). Although it could not be confirmed at the time of this report, it appears that Wetlands A and C are connected to Frank's Creek by a drainage ditch. The approximate location of Frank's Creek is shown in Figure 2; the exact location was not available at the time this report was prepared.

The Passaic River provides spawning habitat for alewife, American shad, blueback herring, striped bass, and white perch. The spawning grounds begin 8.2 km (5.1 mi) upstream of the Diamond Head site near the mouth of the Second River and extend upstream to Dundee Dam, in Passaic, which does not have fish passage facilities. Near the site, the Passaic River is a migratory route for anadromous species, which travel to spawning areas located upstream of the Diamond Head site. The spawning areas are located north of the area shown in Figure 1. Juvenile alewife, American shad, and blueback herring frequently overwinter in the estuarine reaches of the Passaic River, possibly near the Diamond Head site, before migrating out to sea (NOAA 1992).

Several estuarine and marine fish species use the lower, estuarine reaches of the Passaic River and the waters of upper Newark Bay. Surface waters in the lower Passaic River frequently experience low levels of dissolved oxygen during summer months (USEPA 1995). Low oxygen levels may con-

Table 1. NOAA trust resources that use the Passaic River and upper Newark Bay (Anselmini 1974; Papson 1981; Byrne 2003).

Species		Habitat Use				Fisheries	
Common Name	Scientific Name	Migratory Route	Spawning Area	Nursery Area	Adult Habitat	Comm.	Rec.
ANADROMOUS FISH							
Alewife	*Alosa pseudoharengus*	◆		◆			
American shad	*Alosa sapidissima*	◆		◆			
Blueback herring	*Alosa aestivalis*	◆		◆			
Striped bass	*Morone saxatilis*	◆		◆			
White perch	*Morone americana*	◆		◆			
CATADROMOUS FISH							
American eel	*Anguilla rostrata*	◆			◆		
MARINE/ESTUARINE FISH							
Atlantic croaker	*Micropogonias undulatus*			◆	◆		
Atlantic menhaden	*Brevoortia tyrannus*			◆	◆		
Atlantic silverside	*Menidia menidia*		◆	◆	◆		
Atlantic tomcod	*Microgadus tomcod*		◆	◆	◆		
Bay anchovy	*Anchoa mitchilli*		◆	◆	◆		
Bluefish	*Pomatomus saltatrix*			◆			
Mummichog	*Fundulus heteroclitus*		◆	◆	◆		
Northern pipefish	*Syngnathus fuscus*		◆	◆	◆		
Spot	*Leiostomus xanthurus*			◆			
Summer flounder	*Paralichthys dentatus*			◆	◆		
Threespine stickleback	*Gasterosteus aculeatus*		◆	◆	◆		
Weakfish	*Cynoscion regalis*			◆	◆		
Windowpane	*Scophthalmus aquosus*			◆	◆		
Winter flounder	*Pleuronectes americanus*		◆		◆		
INVERTEBRATES							
Blue crab	*Callinectes sapidus*			◆	◆		◆

tribute to a seasonal decrease in fish use of the river's lower reaches. American eel and blue crab use the lower reaches of the Passaic River for adult forage habitat. Blue crabs also use the lower reaches of the river as nursery habitat (NOAA 1992).

The Diamond Head site is located within the Hackensack Meadowlands, which consist of numerous wetlands along coastal tidal waters. These meadowlands provide habitat for transient federal- and state-listed endangered or threatened species, especially birds (Halliburton NUS Environmental Corporation 1991).

No commercial fishing takes place in the Passaic River or in upper Newark Bay. Some recreational fishing occurs along the banks of the lower Passaic River and in upper Newark Bay. The most popular recreational fishery is blue crab (NOAA 1992). A consumption advisory for fish and crab is currently in effect for Newark Bay and the Passaic River. The New Jersey Department of Environ-

mental Protection (NJDEP) issued this advisory, which is based on PCB, dioxin, and/or chlordane contamination. The advisory recommends against consuming any fish and shellfish harvested from the lower Passaic River and against harvesting or consuming blue crabs from the lower Passaic River. The NJDEP also advises that American eel, bluefish, white catfish, and white perch harvested from Newark Bay not be eaten more than once per week; that striped bass not be consumed at all; and that blue crab from Newark Bay not be harvested or consumed (NJDEP 2004).

Site-Related Contamination

The primary contaminants of concern at the Diamond Head site are metals, SVOCs, and PCBs. Soil, groundwater, surface water, and sediment samples collected from the site in 1985 and 1991 were analyzed for metals, selenium, cyanide, VOCs, SVOCs, pesticides, and PCBs. The maximum concentrations of contaminants of concern to NOAA are summarized in Table 2. The data in Table 2 were derived from a total of 12 soil samples, four groundwater samples, five surface water samples, and three sediment samples.

Surface Water

In surface water samples collected from the site, five metals and cyanide were detected at concentrations that exceeded the ambient water quality criteria (AWQC), which is the screening guideline for water. The maximum concentrations of arsenic, chromium, copper, cyanide, lead, nickel, and zinc were detected in samples collected from the drainage ditch in the southwest corner of the site. The maximum concentration of lead exceeded the AWQC by two orders of magnitude, and maximum concentrations of copper, zinc, and cyanide exceeded the AWQC by one order of magnitude. Arsenic was detected in the surface water samples but concentrations did not exceed the AWQC. Cadmium, mercury, selenium, and silver were not detected in the surface water samples.

Sediment

In sediment samples collected from the Diamond Head site, maximum concentrations of all detected contaminants exceeded the Effects Range-Low (ERL) screening guidelines, which is the main screening guideline for sediment. Arsenic, chromium, copper, lead, and nickel were detected at maximum concentrations in a sediment sample collected from the south end of Wetland A. The greatest concentrations of cadmium and zinc were detected in a sediment sample collected from the north end of Wetland A. The maximum concentration of zinc exceeded the ERL by two orders of magnitude. Maximum concentrations of cadmium, copper, and lead exceeded the ERL by one order of magnitude. Two SVOCs, 2-methylnaphthalene and naphthalene, were detected in a sediment sample collected from the north end of Wetland A at concentrations that exceeded the ERL by three orders of magnitude and two orders of magnitude, respectively. The pesticide, DDT and its metabolite DDE, were detected in a sediment sample collected from the south end of Wetland A. The maximum concentration of DDT exceeded the ERL by two orders of magnitude, and the maximum concentration of DDE exceeded the ERL by one order of magnitude. No PCBs were detected in the sediment samples.

Groundwater

Several metals, cyanide, and SVOCs were detected in groundwater samples collected from the Diamond Head site. The maximum concentrations of arsenic, chromium, nickel, and zinc were found in a groundwater sample collected from the area of the former refinery. The maximum concentrations of cadmium, copper, lead, mercury, and cyanide were found in a sample collected near the

Table 2. Maximum concentrations of contaminants of concern detected in soil, groundwater, surface water, and sediment samples collected from the Diamond Head site (ETC 1985; Halliburton NUS Environmental Corporation 1991; Weston 2000). Contaminant values in bold exceeded screening guidelines.

	Soil (mg/kg)		Water (µg/L)			Sediment (mg/kg)	
Contaminant	Soil	ORNL PRG[a]	Ground-water	Surface Water	AWQC[b]	Sediment	ERL[c]
METALS/INORGANICS							
Arsenic	**59**	9.9	**46**	27	36	**15**	8.2
Cadmium	**22**	0.38[d]	7.6	<3.0	8.8	**31**	1.2
Chromium[e]	**1900**	0.4	**4700**	**94**	50	**92**	81
Copper	**1600**	60	**170**	**290**	3.1	**340**	34
Cyanide, free	N/A	NA	**30**	**12**	1	N/A	NA
Lead	**76000**	40.5	**320**	**970**	8.1	**910**	46.7
Mercury	**7.5**	0.00051	**2.2**	<0.6	0.94[f]	R	0.15
Nickel	**270**	30	**120**	**60**	8.2	**53**	20.9
Selenium	**3.5**	0.21	ND	<5.0	71	ND	1.0[g]
Silver	**93**	2	ND	<10	1.9[h]	ND	1
Zinc	**5600**	8.5	**650**	**1200**	81	**18000**	150
SVOCs							
Acenaphthene	**120**	20	10	<1.9	710[i]	ND	0.016
Acenaphthylene	690	NA	ND	<3.5	300[h,i,j]	ND	0.044
Anthracene	380	NA	ND	<1.9	300[h,i,j]	ND	0.0853
Benz(a)anthracene	**440**	0.1[k]	ND	<7.8	300[h,i,j]	ND	0.261
Chrysene	220	NA	ND	<2.5	300[h,i,j]	ND	0.384
Dibenz(a,h)anthracene	**0.16**	0.1[k]	ND	<2.5	300[h,i,j]	ND	0.0634
Fluoranthene	601	NA	3	<2.2	16[i]	ND	0.6
Fluorene	370	NA	3	<1.9	NA	ND	0.019
2-Methylnaphthalene	370	NA	22	N/A	300[h,i,j]	**310**	0.07
Naphthalene	**1400**	0.1[k]	39	<1.6	2350[h,i]	**130**	0.16
Pentachlorophenol	0.49	3	ND	<7.2	7.9	ND	NA
Phenanthrene	**1500**	0.1[k]	5	<5.4	NA	ND	0.24
Pyrene	**1100**	0.1[k]	3	<1.9	300[h,i,j]	ND	0.665
PESTICIDES/PCBs							
DDE	0.14	NA	ND	<5.6	NA	**0.1**	0.0022
DDT	1.3	NA	ND	<4.7	0.001[l]	**0.26**	0.00158[l]
Endrin	2.0	NA	ND	<10	0.0023	ND	NA
Total PCBs	**770**	0.371	ND	<36	0.03	ND	0.0227

a: Oak Ridge National Laboratory (ORNL) final preliminary remediation goals (PRG) for ecological endpoints (Efroymson et al. 1997).

b: Ambient water quality criteria (AWQC) for the protection of aquatic organisms (USEPA 2002b). Marine chronic criteria presented.

c: Effects Range-Low (ERL) represents the 10th percentile for the dataset in which effects were observed or predicted in studies compiled by Long et al (1998).

d: Ecological soil screening guidelines (USEPA 2004).

e: Screening guidelines represent concentrations for $Cr.^{+6}$

f: Derived from inorganic, but applied to total mercury.

g: Marine apparent effects threshold (AET) criterion represents the concentration above which adverse biological impacts would be expected.

h: Chronic criterion not available; acute criterion presented.

i: Lowest Observable Effect Level (LOEL) (USEPA 1986).

j: Value for chemical class.

k: Canadian Council of Ministers of the Environment (CCME) environmental quality guidelines for agricultural land uses.

l: Expressed as Total DDT.

N/A: Contaminant not analyzed for.

NA: Screening guidelines not available.

ND: Not detected.

R: Analysis of this contaminant did not pass EPA QA/QC standards.

center of the landfill. Concentrations of chromium, copper, lead, mercury, nickel, and cyanide exceeded the AWQC by at least one order of magnitude. Cadmium was detected in the groundwater samples but concentrations did not exceed the AWQC. Selenium and silver were not detected in the groundwater samples. Several SVOCs were detected in groundwater samples but concentrations did not exceed the AWQC. No AWQC have been established for fluorene and phenanthrene. Maximum concentrations of five of the seven SVOCs detected were found in samples collected from the landfill area. No pesticides or PCBs were detected in the groundwater samples.

Soil

Analyses of soil samples indicated several contaminants were present at elevated concentrations. The maximum concentrations of all metals detected were found in the area of the former refinery, in the northeastern section of the site. All metals detected in soil samples exceeded the soil screening guidelines (Table 2). Concentrations of chromium, lead, and mercury exceeded screening guidelines by more than three orders of magnitude, and concentrations of zinc exceeded the screening guideline by at least two orders of magnitude. Concentrations of cadmium, copper, selenium, and silver exceeded screening guidelines by at least one order of magnitude.

Several SVOCs were detected in the soil samples at concentrations which ranged from 0.16 mg/kg of dibenz(a,h)anthracene to 1,500 mg/kg of phenanthrene. Concentrations of benz(a)anthracene, naphthalene, phenanthrene, and pyrene exceeded the screening guidelines by at least one order of magnitude. Acenaphthene was detected at a maximum concentration that was six times greater than the screening guideline. There are no screening guidelines available for comparison with the other SVOCs detected in the soil samples. All but two of the SVOCs detected were found in samples collected from the AST foundation area. Endrin, DDE, and DDT were the pesticides detected in the soil samples but there are no screening guidelines available for comparison. The maximum concentrations of pesticides were found in samples collected from near the former oil refinery building foundation. PCBs were detected in a sample collected just west of the former refinery building foundation at a concentration that exceeded the screening guideline by three orders of magnitude.

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