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## Crown Vantage Landfill

*Alexandria Township, New Jersey*

*EPA Facility ID: NJN000204492*

*Basin: Middle Delaware-Musconetcong*

*HUC: 02040105*

### Executive Summary

The Crown Vantage Landfill site is an inactive industrial landfill adjacent to the Delaware River in Alexandria Township, New Jersey. From the late 1930s to the early 1970s, the landfill largely received waste from nearby paper mills. PAHs, pesticides, PCBs, herbicides, SVOCs, and metals have been detected during numerous investigations of the site. Adjacent to the site, the Delaware River provides habitat to several NOAA trust resources including the anadromous alewife, American shad, blueback herring, striped bass, and white perch and the catadromous American eel. Surface water runoff, erosion, and flooding are the primary pathways for the migration of contaminants from the site to NOAA trust resources in the Delaware River, the habitat of concern to NOAA.

### Site Background

The Crown Vantage Landfill site is an inactive industrial landfill on 4 ha (10 acres) in Alexandria Township, Hunterdon County, New Jersey. The property is bordered to the west by the Delaware River and lies within the river's floodplain (Figures 1 and 2).

From the late 1930s to the early 1970s, the landfill largely received waste from nearby paper mills, including soil, ash, paper-fiber sludge, metal construction debris, and drums containing varnish, shellac, methyl ethyl ketone, inks, and dyes (Weston 2004). While it was active, the landfill was often intentionally set on fire to reduce the volume of waste and was accidentally set on fire when hot ashes were deposited at the landfill (Weston 2004). The landfill has been inactive since the early 1970s.

Polycyclic aromatic hydrocarbons (PAHs), pesticides, polychlorinated biphenyls (PCBs), herbicides, semivolatile organic compounds (SVOCs), and metals were detected at the site during numerous investigations conducted from 1991 to 2003 (Weston 2004). In 2003, floodplain soil samples were collected adjacent to the western face of the landfill and surface water and sediment samples were collected from the Delaware River adjacent to the landfill. During the 2003 investigation, visible signs that the landfill has been flooded by the Delaware River were observed (Weston 2004).

In 1992, some of the drums and paper products on the surface of the landfill were removed from the site. In 2002, approximately 100 more drums containing detectable concentrations of volatile organic compounds (VOCs), phenols, pesticides, PCBs, and cyanide were removed (Weston 2004). The Crown Vantage Landfill site was placed on the U.S. Environmental Protection Agency's (USEPA) National Priorities List on April 27, 2005 (USEPA 2005a).

Surface water runoff, erosion, and flooding are the primary pathways for the migration of contaminants from the site to NOAA trust resources in the Delaware River. In 2004, the

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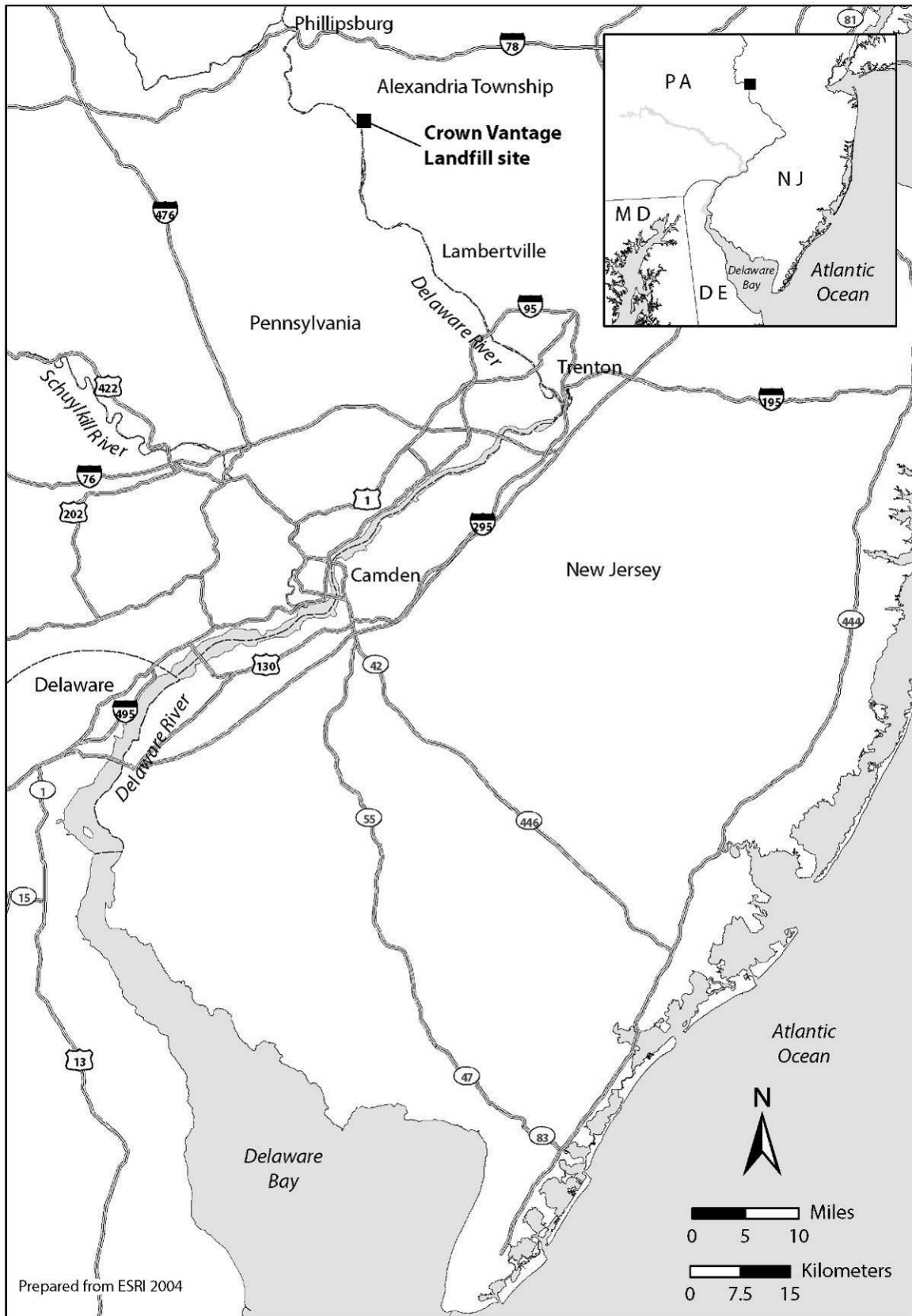


Figure 1. Location of the Crown Vantage Landfill site in Alexandria Township, New Jersey.

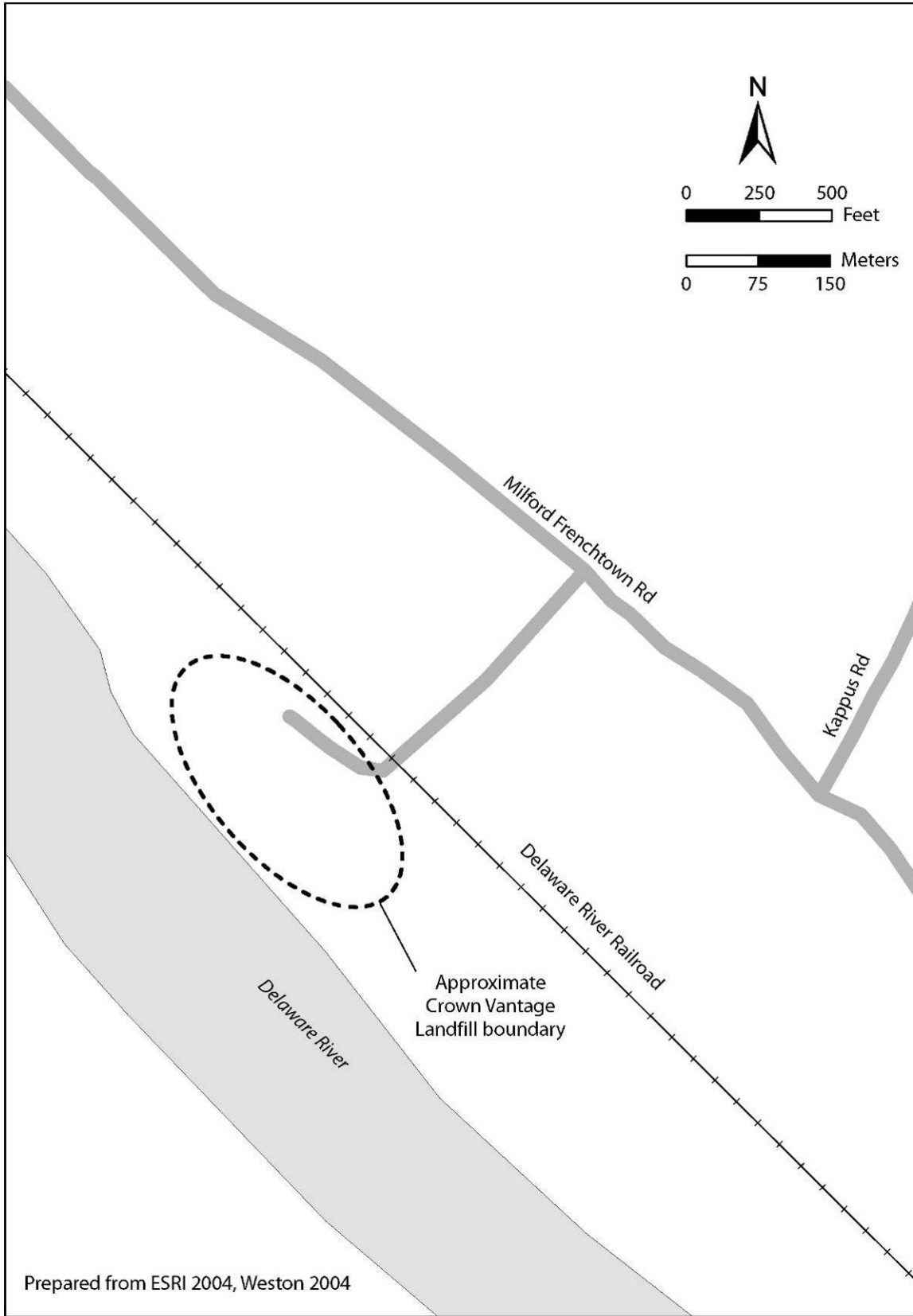


Figure 2. Detail of the Crown Vantage Landfill property.

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USEPA reinforced damaged portions of the landfill that had eroded as a result of flooding of the Delaware River (USEPA 2005a). Only the most severely damaged portions of the landfill were reinforced; other sections still need to be stabilized to prevent further erosion (USEPA 2005a).

### NOAA Trust Resources

The Crown Vantage Landfill site lies within the floodplain of the Delaware River, which is the habitat of concern to NOAA. Near the site, the Delaware River is a free-flowing, low-gradient river system that is 200 to 400 m (656 to 1,312 ft) wide and approximately 0.6 to 3.5 m (2 to 11 ft) deep (Koffman 1988).

The Delaware River provides habitat to several NOAA trust resources, including anadromous and catadromous species. The anadromous alewife, American shad, blueback herring, striped bass, and white perch and the catadromous American eel are all found in the vicinity of the site (Boriek 2004; Table 1). There are no dams downstream of the site that could impede fish passage.

Table 1. NOAA trust resources present in the Delaware River near the Crown Vantage Landfill site (Steiner 2000; Versar 2003; Boriek 2004; Lorantas 2005a, 2005b; NJDEP 2005).

Species		Habitat Use			Fisheries	
Common Name	Scientific Name	Spawning Area	Nursery Area	Adult Habitat	Comm.	Rec.
<b>ANADROMOUS FISH</b>						
Alewife	<i>Alosa pseudoharengus</i>	◆	◆	◆		◆
American shad	<i>Alosa sapidissima</i>	◆	◆	◆	◆	◆
Blueback herring	<i>Alosa aestivalis</i>	◆	◆	◆		◆
Striped bass	<i>Morone saxatilis</i>			◆		◆
White perch	<i>Morone americana</i>			◆	◆	◆
<b>CATADROMOUS FISH</b>						
American eel	<i>Anguilla rostrata</i>			◆		

American shad, the largest member of the herring family, are present in most reaches of the Delaware River. Adult American shad live in marine waters until they are ready to spawn, then they migrate into freshwater streams. In the Delaware River, American shad most commonly spawn upstream of Lambertville, New Jersey, which includes the area adjacent to the site (NJDEP 2005).

Alewife and blueback herring are closely related species with similar life histories. Adult alewife and blueback herring live in nearshore marine waters until they migrate into rivers, including the Delaware River, to spawn. In the Delaware River, alewife and blueback herring spawn in habitat several miles upstream of the tidal line, which includes the reach adjacent to the Crown Vantage Landfill site (Steiner 2000).

White perch are also found in the reach of the Delaware River adjacent to the Crown Vantage Landfill site (Versar 2003). White perch spawn in both the tidal and non-tidal

portions of the Delaware River downstream of Lambertville, New Jersey, which is approximately 24 km (15 mi) downstream of the site (Lorantas 2005a).

Adult striped bass are found in the reach of the Delaware River adjacent to the site (Versar 2003). Striped bass, which are anadromous fish native to the Delaware River, mostly spawn downstream of the site in the tidally influenced freshwater section of the river, which extends from near Camden, New Jersey, to Trenton, New Jersey (Lorantas 2005b). Juvenile striped bass remain in the tidally influenced section of the Delaware River for approximately two years before they migrate to coastal waters, where they continue to mature (Lorantas 2005b).

The catadromous American eel, which spawns in the ocean and then migrates to fresh water, uses the section of the Delaware River adjacent to the site as a migratory corridor (Boriek 2004).

American shad and white perch are important commercial fisheries in Delaware Bay, which is downstream of the site (Sutton et al. 1996). Recreational fishing of alewife, American shad, blueback herring, striped bass, and white perch occurs adjacent to the site (Versar 2003). Several warm-water fish species, including bluegill, brown bullhead, channel catfish, and rock bass, are also fished recreationally from the river near the site (Versar 2003).

A statewide consumption advisory is in effect for certain fish and shellfish because of dioxin, mercury, and PCB contamination (NJDEP 2006). The New Jersey Department of Environmental Protection's fish consumption advisory for the Delaware River between Phillipsburg and Trenton recommends reduced consumption of American eel, channel catfish, and striped bass for the general public and no consumption for high-risk individuals (NJDEP 2006). The advisory recommends reduced consumption of white sucker and smallmouth bass for both the general public and high-risk individuals. Consumption of largemouth bass from waters near the Crown Vantage Landfill site is not restricted for the general public; reduced consumption is recommended for high-risk individuals (NJDEP 2006).

### **Site-Related Contamination**

During 2003, 14 sediment and 30 soil samples were collected at the Crown Vantage Landfill site and analyzed for metals, pesticides, PCBs, and SVOCs, which include PAHs (Weston 2004). The sediment samples and eight of the soil samples were also analyzed for VOCs (Weston 2004). Surface water samples were also collected during this investigation, but the analytical results were not available in the documents reviewed for this report. Metals and PAHs are the primary contaminants of concern to NOAA at the Crown Vantage Landfill site.

Table 2 summarizes the maximum concentrations of contaminants of concern to NOAA detected in sediment and soil samples during the site investigations and compares them to relevant screening guidelines. Site-specific or regionally specific screening guidelines are always used when available. In the absence of such guidance, the screening guidelines for sediment in a freshwater environment are the threshold effects concentrations (TECs; MacDonald et al. 2000), and the screening guidelines for soil are the Oak Ridge National Laboratory final preliminary remediation goals (ORNL-PRGs; Efroymsen et al. 1997) and the USEPA's ecological soil screening guidelines (USEPA 2005b). Exceptions to these

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Table 2. Maximum concentrations of contaminants of concern to NOAA at the Crown Vantage Landfill site (Weston 2004). Contaminant values in bold exceed or are equal to screening guidelines.

Contaminant	Soil (mg/kg)		Sediment (mg/kg)	
	Soil	ORNL-PRG <sup>a</sup>	Sediment	TEC <sup>b</sup>
<b>METALS/INORGANICS</b>				
Arsenic	<b>16</b>	9.9	7.6	9.79
Cadmium	<b>12.0</b>	0.36 <sup>c</sup>	<b>5.6</b>	0.99
Chromium <sup>d</sup>	<b>5,500</b>	0.4	<b>48</b>	43.4
Copper	<b>4,500</b>	60	<b>52</b>	31.6
Lead	<b>34,000</b>	40.5	<b>80</b>	35.8
Mercury	<b>3.3</b>	0.00051	<b>0.21</b>	0.18
Nickel	<b>64</b>	30	<b>46</b>	22.7
Selenium	<b>9.8</b>	0.21	6.0	NA
Zinc	<b>3,800</b>	8.5	<b>620</b>	121
<b>PAHs</b>				
Acenaphthene	<b>230</b>	20	<0.65	0.290 <sup>e</sup>
Acenaphthylene	0.083	NA	0.051	0.160 <sup>e</sup>
Anthracene	460	NA	<b>0.20</b>	0.0572
Benz(a)anthracene	<b>820</b>	0.1 <sup>f</sup>	<b>0.65</b>	0.108
Benzo(a)pyrene	<b>700</b>	0.1 <sup>f</sup>	<b>0.62</b>	0.15
Benzo(b)fluoranthene	<b>740</b>	0.1 <sup>f</sup>	0.58	NA
Benzo(k)fluoranthene	<b>560</b>	0.1 <sup>f</sup>	0.50	13.4 <sup>e</sup>
Chrysene	1.2	NA	<b>0.76</b>	0.166
Dibenz(a,h)anthracene	<b>220</b>	0.1 <sup>f</sup>	<b>0.12</b>	0.033
Fluoranthene	1,600	NA	<b>1.5</b>	0.423
Fluorene	0.13	NA	<b>0.091</b>	0.0774
Indeno(1,2,3-cd)pyrene	<b>370</b>	0.1 <sup>f</sup>	<b>0.37</b>	0.330 <sup>e</sup>
2-Methylnaphthalene	0.06	NA	0.050	NA
Naphthalene	<b>0.16</b>	0.1 <sup>f</sup>	0.057	0.176
Phenanthrene	<b>1,300</b>	0.1 <sup>f</sup>	<b>0.85</b>	0.204
Pyrene	<b>1,900</b>	0.1 <sup>f</sup>	<b>1.3</b>	0.195
<b>PESTICIDES/PCBs</b>				
4,4'-DDE	<0.0040	NA	<b>0.0048</b>	0.00316
4,4'-DDT	<b>2.8</b>	0.7 <sup>f</sup>	<b>0.059</b>	0.00416
Dieldrin	<0.0040	0.000032 <sup>c</sup>	<0.0037	0.0019
Aroclor 1254	<b>2.0</b>	0.371 <sup>g</sup>	<0.037	0.0598 <sup>g</sup>
Aroclor 1260	<0.040	0.371 <sup>g</sup>	<b>0.26</b>	0.0598 <sup>g</sup>

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

b: Threshold Effects Concentration (TEC). Concentration below which harmful effects are unlikely to be observed (MacDonald et al. 2000).

c: Ecological soil screening guidelines (USEPA 2005b).

d: Screening guidelines represent concentrations for Cr.<sup>+6</sup>

e: Freshwater upper effects threshold (UET) for bioassays. The UET represents the concentration above which adverse biological impacts would be expected.

f: Canadian Council of Ministers of the Environment (CCME) soil quality guidelines for the protection of environmental and human health (CCME 2004).

g: Screening guideline is for Total PCBs.

NA: Screening guidelines not available.

< : Indicates that the analyte was not detected above the concentration shown.

screening guidelines, if any, are noted on Table 2. Only maximum concentrations that exceeded relevant screening guidelines or for which no screening guidelines are currently available, are discussed below. When known, the general sampling locations are also provided for maximum concentrations that exceeded screening guidelines or do not have screening guidelines. The general areas where samples were collected are depicted on Figure 2.

### Sediment

Seven metals were detected in sediment samples taken from the Delaware River near the Crown Vantage Landfill site at maximum concentrations that exceeded screening guidelines; one metal for which no screening guideline is currently available was also detected (Table 2).

Maximum concentrations of cadmium, chromium, copper, lead, mercury, nickel, and zinc were detected in sediment samples collected from the Delaware River adjacent to the southwest end of the landfill. Maximum concentrations of cadmium and zinc exceeded the TECs by a factor of approximately five. Maximum concentrations of lead and nickel exceeded the TECs by a factor of approximately two. The maximum concentration of copper exceeded the TEC by a factor of approximately 1.5. Maximum concentrations of chromium and mercury slightly exceeded the TECs.

The maximum concentration of selenium was detected in a sediment sample collected approximately 760 m (2,493 ft) downstream of the landfill boundary. No screening guideline is currently available for comparison to the maximum concentration of selenium detected in the soil samples.

Ten PAHs were detected in sediment samples taken from the Delaware River near the Crown Vantage Landfill site at maximum concentrations that exceeded screening guidelines, and two PAHs for which no screening guidelines are currently available were also detected (Table 2).

Maximum concentrations of anthracene, benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, chrysene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, 2-methylnaphthalene, phenanthrene, and pyrene were detected in sediment samples collected from the Delaware River adjacent to the northwest corner of the landfill. Concentrations of benz(a)anthracene and pyrene exceeded the TECs by a factor of six. Maximum concentrations of benzo(a)pyrene, chrysene, and phenanthrene exceeded the TECs by a factor of approximately four, while maximum concentrations of anthracene and fluoranthene exceeded the TECs by a factor of approximately three. Maximum concentrations of fluorene and indeno(1,2,3-cd)pyrene slightly exceeded the screening guidelines. No screening guidelines are currently available for comparison to the maximum concentrations of benzo(b)fluoranthene and 2-methylnaphthalene.

The maximum concentration of dibenz(a,h)anthracene was detected in a sample collected from the Delaware River adjacent to the southwest corner of the landfill. The maximum concentration of dibenz(a,h)anthracene exceeded the TEC by a factor of three.

Two pesticides were detected in sediment samples taken from the Delaware River near the Crown Vantage Landfill site at maximum concentrations that exceeded screening guidelines (Table 2). The maximum concentration of 4,4'-DDT, which was detected in a sample

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collected from the Delaware River adjacent to the southwest corner of the landfill, exceeded the TEC by one order of magnitude.

The maximum concentration of 4,4'-DDE, which was detected in a sample collected from the Delaware River adjacent to the northwest corner of the landfill, exceeded the TEC by a factor of 1.5.

The maximum concentration of PCB Aroclor 1260, which was measured in a sample collected from the Delaware River adjacent to the west side of the landfill, exceeded the TEC by a factor of four.

### Soil

Nine metals were detected in soil samples collected from the Crown Vantage Landfill site at maximum concentrations that exceeded screening guidelines (Table 2).

Maximum concentrations of cadmium, copper, nickel, selenium, and zinc were detected in a soil sample collected from the west side of the landfill adjacent to the Delaware River. The maximum concentration of zinc exceeded the ORNL-PRG by two orders of magnitude. The maximum concentrations of cadmium, copper, and selenium exceeded screening guidelines by one order of magnitude. The maximum concentration of nickel exceeded the ORNL-PRG by a factor of two.

Maximum concentrations of arsenic, chromium, lead, and mercury were detected in a soil sample collected from the northwest corner of the landfill. The maximum concentrations of chromium, mercury, and lead exceeded the ORNL-PRGs by four, three, and two orders of magnitude, respectively. The maximum concentration of arsenic exceeded the ORNL-PRG by a factor of approximately 1.5.

All the PAHs listed in Table 2 were detected in soil samples collected from the west side of the landfill adjacent to the Delaware River. The maximum concentrations of ten PAHs exceeded screening guidelines, and six PAHs for which no screening guidelines are currently available, were also detected in the soil samples.

The maximum concentrations of phenanthrene and pyrene exceeded the screening guidelines by four orders of magnitude. The maximum concentrations of benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene exceeded the screening guidelines by three orders of magnitude. The maximum concentration of acenaphthene exceeded the screening guideline by one order of magnitude. The maximum concentration of naphthalene exceeded the screening guideline by a factor of approximately 1.5. No screening guidelines are currently available for comparison to the maximum concentrations of acenaphthylene, anthracene, chrysene, fluoranthene, fluorene, and 2-methylnaphthalene detected in the soil samples.

One pesticide was detected in a soil sample collected from the west side of the landfill adjacent to the Delaware River at maximum concentrations that exceeded the screening guidelines. The maximum concentration of 4,4'-DDT exceeded the screening guideline by a factor of four.



The maximum concentration of PCB Aroclor 1254 exceeded the screening guideline by a factor of five in a sample collected from the west side of the landfill adjacent to the Delaware River.

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