HRS DOCUMENTATION RECORD--REVIEW COVER SHEET

Name of Site: Gowanus Canal

Date Prepared: April 2009

Contact Persons:

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Pathways, Components, or Threats Not Scored

The Surface Water Migration Pathway – The Drinking Water Threat and the Environmental Threat were not scored because the Human Food Chain Threat produces an overall score above the minimum required for the site to qualify for the National Priorities List. In addition, there are no surface water intakes along the target distance limit.

Ground Water: The Ground Water Migration Pathway is not scored because there are no drinking water wells located within 4 miles of the site, and the pathway does not contribute significantly to the site score.

Soil Exposure: There are numerous potential sources where soil contamination might exist, but soil contamination was not considered in scoring the site because there is not sufficient information. The Soil Exposure Pathway is not scored because it does not contribute significantly to the site score based on the available data.

Air: No samples were collected to characterize the Air Migration Pathway; therefore, there is no documentation of an observed release. The Air Migration Pathway is not scored because it does not contribute significantly to the site score.

The Ground Water, Soil Exposure, and Air Pathways might be evaluated further during future investigations because evaluation of those pathways might lead to identification of contributing sources of sediment contamination.

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HRS DOCUMENTATION RECORD

Name of Site:	Gowanus Canal	Date Prepared: April 2009
EPA ID No.:	NYN000206222	
EPA Region:	2	
Street Address of Site*:	Butler Street (between Bond St and Nevins St), Brooklyn, NY 11215, 11217, 11231 (Most significant zip code (i.e., largest canal segment) is 11231).	
County and State:	Kings County, New York	
General Location in the State:	New York City (southeast portion of state)	
Topographic Map:	Brooklyn, NY	
Latitude*:	40° 40′ 53.9 North	Longitude*: 73° 59′ 14.4″ West
Site Reference Point:	head of canal (northwest corner along Butler St. between Bond St. and Nevins St.)	

[Figure 1 of this HRS documentation record; Ref. 3, p. 1; 4, p. 1; 5, pp. 1, 2]

* The street address, coordinates, and contaminant locations presented in this Hazard Ranking System (HRS) documentation record identify the general area where the site is located. They represent one or more locations EPA considers to be part of the site based on the screening information EPA used to evaluate the site for NPL listing. EPA lists national priorities among the known "releases or threatened releases" of hazardous substances; thus, the focus is on the release, not precisely delineated boundaries. A site is defined as where a hazardous substance has been "deposited, stored, placed, or otherwise come to be located." Generally, HRS scoring and the subsequent listing of a release merely represent the initial determination that a certain area may need to be addressed under CERCLA. Accordingly, EPA contemplates that the preliminary description of facility boundaries at the time of scoring will be refined as more information is developed as to where the contamination has come to be located.

Scores

Ground Water Pathway	Not Scored
Surface Water Pathway	100.00
Soil Exposure Pathway	Not Scored
Air Pathway	Not Scored
HRS SITE SCORE	50.00

WORKSHEET FOR COMPUTING HRS SITE SCORE
GOWANUS CANAL

		S	S^2
1.	Ground Water Migration Pathway Score (S_{gw}) (from Table 3-1, line 13)	Not Scored	
2a.	Surface Water Overland/Flood Migration Component (from Table 4-1, line 30)	100.00	10,000.00
2b.	Ground Water to Surface Water Migration Component (from Table 4-25, line 28)	Not Scored	
2c.	Surface Water Migration Pathway Score (S_{sw}) Enter the larger of lines 2a and 2b as the pathway score.	100.00	10,000.00
3.	Soil Exposure Pathway Score (S_s) (from Table 5-1, line 22)	Not Scored	
4.	Air Migration Pathway Score (S_a) (from Table 6-1, line 12)	Not Scored	
5.	Total of $S_{gw}^2 + S_{sw}^2 + S_s^2 + S_a^2$	10,000.00	
6.	**HRS Site Score** Divide the value on line 5 by 4 and take the square root	50.00	

SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORESHEET
GOWANUS CANAL

SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT Factor Categories & Factors DRINKING WATER THREAT	MAXIMUM VALUE	VALUE ASSIGNED
Likelihood of Release		
1. Observed Release	550	550
2. Potential to Release by Overland Flow		
2a. Containment	10	not scored
2b. Runoff	25	not scored
2c. Distance to Surface Water	25	not scored
2d. Potential to Release by Overland Flow (lines 2a [2b + 2c])	500	not scored
3. Potential to Release by Flood		
3a. Containment (Flood)	10	not scored
3b. Flood Frequency	50	not scored
3c. Potential to Release by Flood (lines 3a x 3b)	500	not scored
4. Potential to Release (lines 2d + 3c)	500	not scored
5. Likelihood of Release (higher of lines 1 and 4)	550	550
Waste Characteristics		
6. Toxicity/Persistence	*	not scored
7. Hazardous Waste Quantity	*	not scored
8. Waste Characteristics	100	not scored
Targets		
9. Nearest Intake	50	not scored
10. Population		
10a. Level I Concentrations	**	not scored
10b. Level II Concentrations	**	not scored
10c. Potential Contamination	**	not scored
10d. Population (lines 10a + 10b + 10c)	**	not scored
11. Resources	5	not scored
12. Targets (lines 9 + 10d + 11)	**	not scored
13. DRINKING WATER THREAT SCORE ([lines 5 x 8 x 12]/82,500)	100	not scored

* Maximum value applies to waste characteristics category.
** Maximum value not applicable

SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORESHEET
GOWANUS CANAL

SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT Factor Categories & Factors HUMAN FOOD CHAIN THREAT	MAXIMUM VALUE	VALUE ASSIGNED
Likelihood of Release		
14. Likelihood of Release (same as line 5)	550	550
Waste Characteristics		
15. Toxicity/Persistence/Bioaccumulation	*	5.00E+08
16. Hazardous Waste Quantity	*	10,000
17. Waste Characteristics	1,000	1,000
Targets		
18. Food Chain Individual	50	45
19. Population		
19a. Level I Concentrations	**	0
19b. Level II Concentrations	**	0.03
19c. Potential Human Food Chain Contamination	**	0.0000003
19d. Population (lines 19a + 19b + 19c)	**	0.0300003
20. Targets (lines 18 + 19d)	**	45.0300003
21. HUMAN FOOD CHAIN THREAT SCORE ([lines 14 x 17 x 20]/82,500)	100	100.00

* Maximum value applies to waste characteristics category.
** Maximum value not applicable

SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORESHEET
GOWANUS CANAL

SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT Factor Categories & Factors ENVIRONMENTAL THREAT	MAXIMUM VALUE	VALUE ASSIGNED
Likelihood of Release		
22. Likelihood of Release (same as line 5)	550	550
Waste Characteristics		
23. Ecosystem Toxicity/Persistence/Bioaccumulation	*	not scored
24. Hazardous Waste Quantity	*	not scored
25. Waste Characteristics	1,000	not scored
Targets		
26. Sensitive Environments		
26a. Level I Concentrations	**	not scored
26b. Level II Concentrations	**	not scored
26c. Potential Contamination	**	not scored
26d. Sensitive Environments (lines 26a + 26b + 26c)	**	not scored
27. Targets (line 26d)	**	not scored
28. ENVIRONMENTAL THREAT SCORE ([lines 22 x 25 x 27]/82,500)	60	not scored
29. WATERSHED SCORE (lines 13 + 21 + 28)	100	100.00
30. SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORE (S_{of})	100	100.00
SURFACE WATER MIGRATION PATHWAY SCORE (S_{sw})	100	100.00

* Maximum value applies to waste characteristics category.
** Maximum value not applicable

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5.	Gilliland, G., Region 2 Site Assessment Team 2 (SAT 2), Weston Solutions, Inc. (WESTON). Latitude and Longitude Calculation Worksheet, LI Using Engineer's Scale (1/ 60), Site Name: Gowanus Canal. March 28, 2008. [2 pages]
6.	Hunter Research, Inc., Raber Associates, and Northern Ecological Associates, Inc. Final Report, National Register of Historic Places Eligibility Evaluation and Cultural Resources Assessment for the Gowanus Canal, Borough of Brooklyn, Kings County, New York, in Connection With the Proposed Ecosystem Restoration Study. Prepared for U.S. Army Corps of Engineers (USACE), New York District. May 2004 (Revised December 2004). [134 pages]
7.	New York City Soil and Water Conservation District. The Gowanus Canal. Date unknown. [4 pages]
8.	Terry, Virginia, Metropolitan Waterfront Alliance. Imaging the City: Gowanus Canal. April 16, 2003. Historical document downloaded from http://waterwire.net/Resources/archives.cfm?ContID=1355 . [4 pages]
9.	New York/New Jersey Harbor Estuary Program. Welcome to HarborEstuary.org, About the Program, About the Estuary, and Action Plan. Downloaded from http://www.harborestuary.org/ and the following subdirectories: http://www.harborestuary.org/about.htm, http://www.harborestuary.org/aboutestuary.htm, http://www.harborestuary.org/reports/HEP_Action_Plan-061708.pdf, January 8, 2009. [32 pages]
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11.	Feyerick, Deborah, CNN. Canal in Heart of Brooklyn Undergoing Lifesaving Renovation. August 30, 1999. Downloaded from http://www.cnn.com/US/9908/30/new.york.canal/index.html. [3 pages]
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15.	O'Neill, Erin, Error Ink. Third Street Bridge: Gowanus. November 18, 2007. Downloaded from http://errorink.wordpress.com/2007/11/18/third-street-bridge-gowanus/. [4 pages]
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17.	USACE, New York District. Final Report, Sediment Quality Evaluation Report, Gowanus Canal and Bay, Ecological Restoration Project. October 2004. [209 pages]
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20.	EPA. Method 8081A: Organochlorine Pesticides by Gas Chromatography, Revision 1. December 1996. [44 pages]
21.	EPA. Method 8082: Polychlorinated Biphenyls (PCBs) by Gas Chromatography, Revision 0. December 1996. [41 pages]
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23.	Lawler, Matusky and Skelly Engineers, LLP. Gowanus Bay and Canal Ecosystem Restoration Studies, Fish and Epibenthic Invertebrate Sampling Program, Final Report. Prepared for David Miller & Associates, Inc. November 2004. [74 pages]
24.	USACE, New York District. Gowanus Bay and Canal, Borough of Brooklyn, Kings County, New York, Feasibility Study, P-7 Milestone Report. March 2005. [44 pages]
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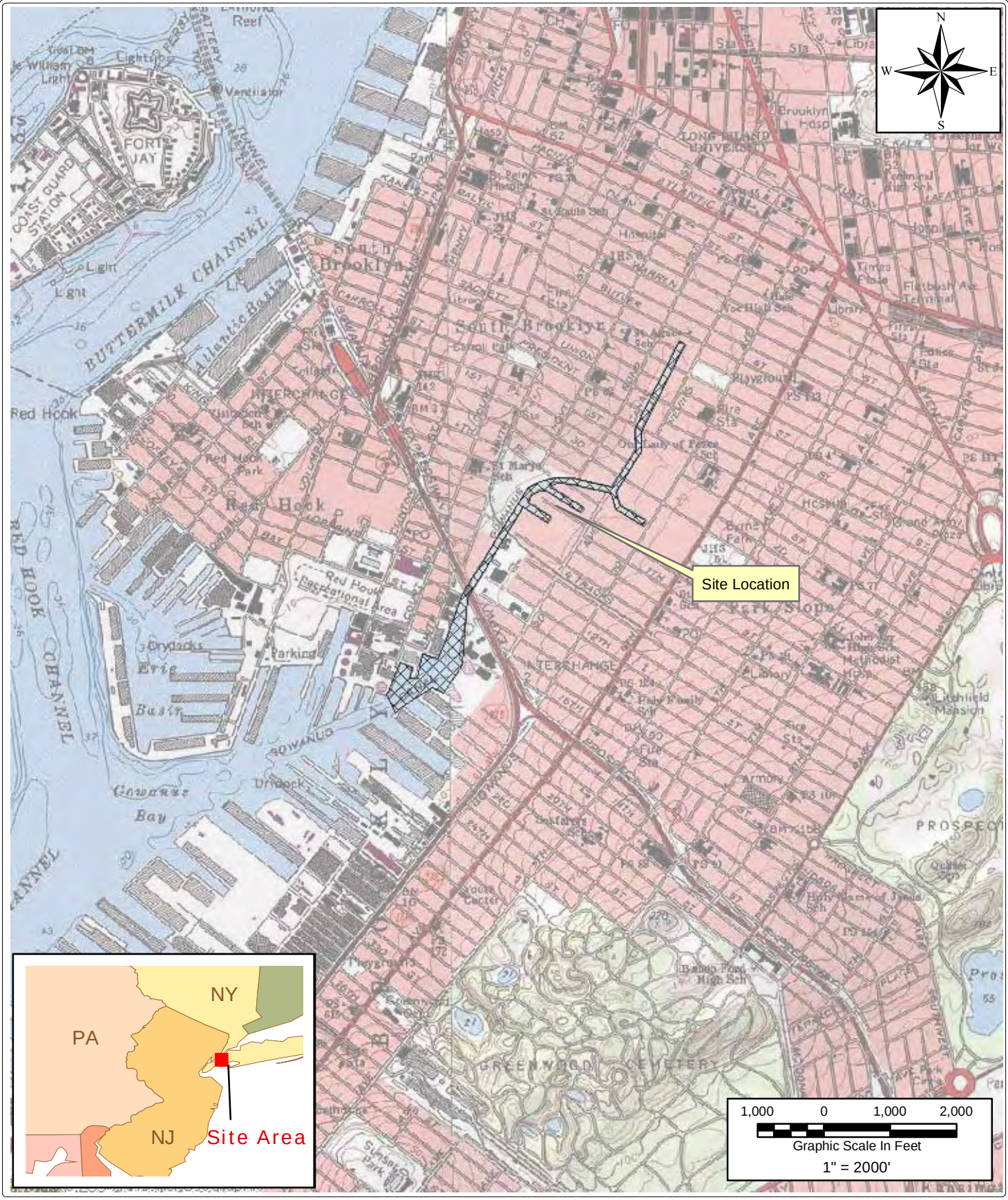
SITE SUMMARY

The Gowanus Canal site (CERCLIS ID No. NYN000206222) in Brooklyn (Kings County), New York consists of contaminated sediments. The geographic coordinates of the site are 40˚ 40' 53.9" north latitude and 73˚ 59' 14.4" west longitude [Figure 1 of this HRS documentation record; Ref. 3, p. 1; 4, p. 1; 5, pp. 1, 2]. Gowanus Canal is a brackish, tidal arm of the New York-New Jersey Harbor Estuary extending for approximately one and a half miles through Brooklyn, New York [Figures 1 and 2 of this HRS documentation record; Ref. 6, pp. 3, 10, 12; 7, pp. 1, 2; 8, p. 3; 9, pp. 1, 6]. The 100-foot-wide canal runs southwest from Butler Street to Gowanus Bay and Upper New York Bay [Ref. 6, pp. 10, 12; 7, p. 1; 8, p. 3]. The adjacent waterfront is primarily commercial and industrial, currently consisting of concrete plants, warehouses, and parking lots; surrounding land use also includes residential neighborhoods [Ref. 7, pp. 1, 2; 8, pp. 1, 2]. Figure 1 of this HRS documentation record shows the site location.

The Gowanus Canal was built in the 19th century to allow access for industrial needs by bulkheading and dredging a tidal creek and wetland that had previously been fished for large oysters [Ref. 6, pp. 3, 21; 7, pp. 1, 2; 8, p. 1]. After its completion in the 1860s, the canal quickly became one of the nation's busiest industrial waterways, home to heavy industry including gas works (i.e., manufactured gas plants [MGP]), coal yards, cement makers, soap makers, tanneries, paint and ink factories, machine shops, chemical plants, and oil refineries. It was also the repository of untreated industrial wastes, raw sewage, and runoff for decades, causing it to become one of New York's most polluted waterways [Ref. 6, p. 3; 7, p. 2; 8, pp. 1, 2; 10, p. 1; 11, p. 1; 12, p. 2]. Although much of the industrial activity along the canal has stopped, high contaminant levels remain in the sediments [Ref. 8, pp. 2, 4; 12, p. 2]. Despite the ongoing pollution problems, some city dwellers have begun to use the Gowanus Canal for recreational purposes such as canoeing, diving, and swimming [Ref. 7, p. 3; 8, p. 3; 13, p. 1; 38, p. 1; 39, pp. 1, 3; 40, p. 2; 41, pp. 1-3; 42, p. 1; 43, p. 2; 44, pp. 1-2]. People also use the canal for fishing and crabbing, and several sources have reported fishing for human consumption [Ref. 13, p. 1; 14, p. 1; 15, pp. 1-2; 39, p. 3; 40, p. 2; 43, pp. 1-3; 45, pp. 1-2; 46, p. 3; 47, p. 1].

Numerous sampling events have shown the sediments in the Gowanus Canal to be contaminated with a variety of pollutants, including polycyclic aromatic hydrocarbons (PAH), polychlorinated biphenyls (PCB), pesticides, metals, and volatile organic contaminants (VOC) [Ref. 16, pp. 24-28; 17, pp. 15-30; 26, pp. 21-46; 27, pp. 5-25; 35, pp. 134-320]. A sampling event by USACE in April and May 2003 provides documentation of contamination and observed release in the canal sediments [References 16, pp, 46-48, 257-667; 17, pp. 57-104; 18, pp. 1-4; 19, pp. 1-8; 20, pp. 1-2; 21, pp. 1-2; 22, pp. 1, 19; 52, pp. 2-23; see Tables 1 and 2 of this HRS documentation record]. Follow-up sampling by USACE in September 2005 confirms the contamination, and an extensive sampling event by KeySpan from December 2005 to January 2006 shows PAHs at total concentrations as high as 45,000 parts per million (4.5%) [Ref. 25, pp. 11-20; 26, pp. 8-16, 21-46; 35, pp. 40, 134-320]. The extent of contamination traverses the entire length of the canal [Ref. 17, p. 21]. Figure 2 of this HRS documentation record shows the sediment sampling locations from the 2003 USACE sampling event that document observed release and actual contamination within the Gowanus Canal fishery, including the background sample locations.



SOURCE:
1. National Geographic TOPO! U.S. Geologic Survey (USGS). 7.5 Minute Series (Topographic) Quadrangles: Jersey City, NJ-NY and Brooklyn, NY.

TITLE:
Site Location Map
Gowanus Canal
Brooklyn, NY

PROJECT: Gowanus Canal

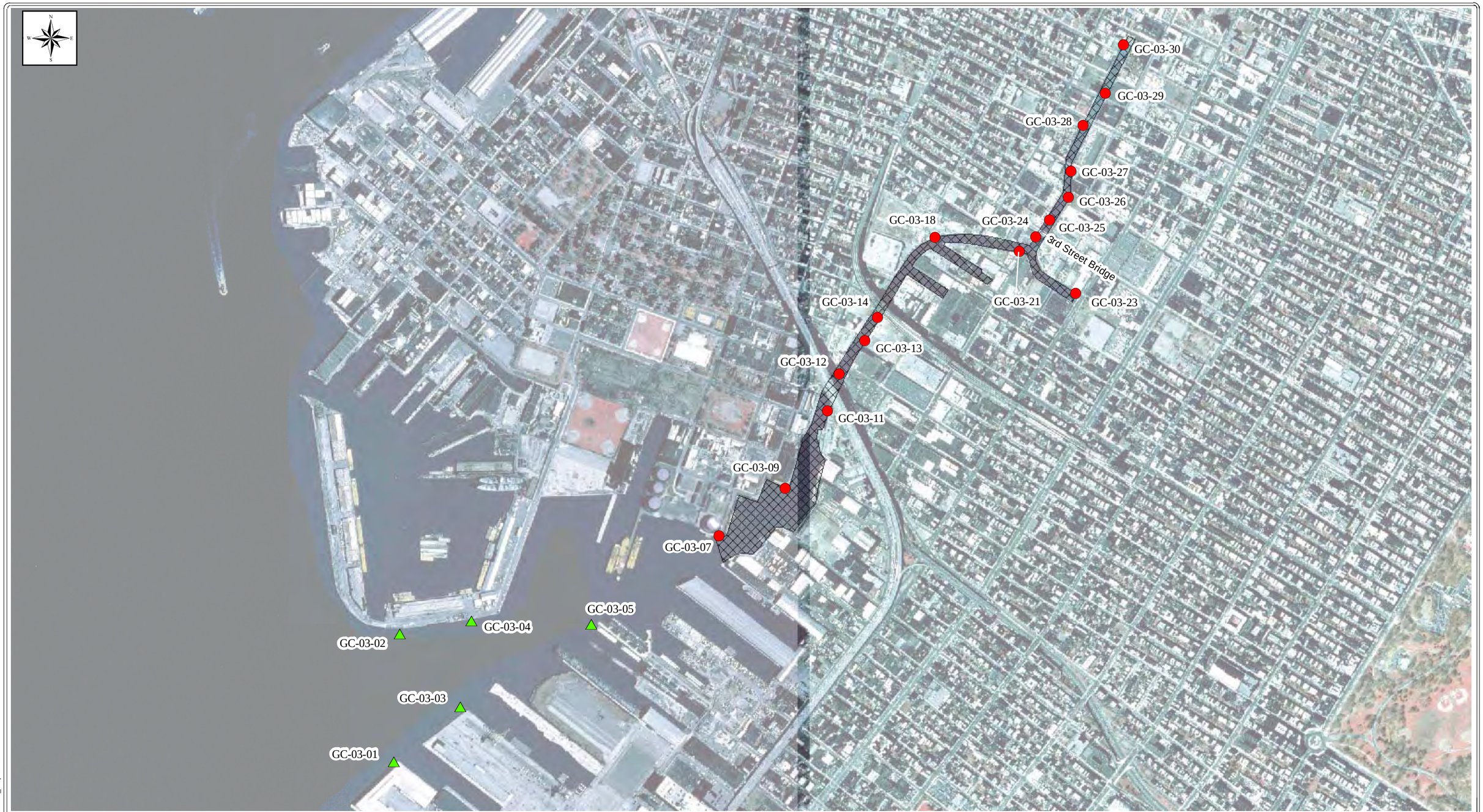
CLIENT NAME: EPA

WESTON SOLUTIONS

DATE: April 15, 2008

FIGURE #: 1

P:\SAT2\Gowanus Canal\GIS\MXD\Site_Map.mxd



SOURCE:

1. U.S. Army Corps of Engineers (USACE), Baltimore District. Final Report, Site Investigation, Gowanus Bay and Gowanus Canal, Kings County, NY. October 2003.

2. USACE, New York District. Final Report, Sediment Quality Evaluation Report, Gowanus Canal and Bay, Ecological Restoration Project. October 2004.

3. New York State Interactive Mapping Gateway. Jersey_CitySE_tile1.sid and BrooklynSW_tile0.sid, accessed at http://www1.nysgis.state.ny.us. March 2008.

LEGEND:

- Background Sample Location
- Release Sample Location
- Source 1 (extent of documented contaminated sediments)

SCALE:

1,000 500 0 1,000

Graphic Scale In Feet

PROJECT: Gowanus Canal

CLIENT NAME: EPA

TITLE:

Site and Source Map
Gowanus Canal
Brooklyn, New York

WESTON SOLUTIONS SM

DATE: April 15, 2008

FIGURE #: 2

P:/SAT2/Gowanus_Canal/MXD/05610_Source_Map.mxd

SOURCE DESCRIPTION

2.2 SOURCE CHARACTERIZATION

2.2.1 Source Identification

Number of the source: Source No. 1

Name and description of the source: Gowanus Canal contaminated sediments

Source Type: Other (contaminated sediments with no identified source)

Source 1 consists of contaminated sediments in the Gowanus Canal. There are several hazardous substances affecting the canal sediments, including PAHs, PCBs, pesticides, metals, and VOCs [Ref. 16, pp. 24-28; 17, pp. 15-30; 26, pp. 21-46; 27, pp. 5-25; 35, pp. 134-320]. The origin of these hazardous substances in the contaminated sediments has not been identified due to the presence of too many past and present possible sources. As a result, the source(s) of all the contamination in any particular location in the canal cannot be determined. The upland areas adjacent to this source have been heavily industrialized since construction of the Gowanus Canal was completed in the 1860s. Historical or current industrial activity along and within the canal has included MGPs, coal yards, cement makers, soap makers, tanneries, paint and ink factories, machine shops, chemical plants, and oil refineries. In addition, the Gowanus Canal is the receiving water body for storm water from the surrounding neighborhoods and combined sewer overflow (CSO) discharges [Ref. 6, pp. 54-57, 62-63; 7, pp. 1-2; 8, pp. 1, 2; 10, p. 1; 12, p. 2; 25, p. 6; 27, p. 3; 34, pp. 1-3].

Numerous past investigations with varying scopes have been conducted within and around the Gowanus Canal. Some of the studies focused on specific properties, while others focused on the contaminated sediments within the canal [Ref. 16, pp. 8-9; 23, p. 2; 24, p. 2; 26, pp. 4-5; 28, pp. 7-35; 30, pp. 3-5; 31, p. 11; 32, p. 1; 33, pp. 4-5; 34, pp. 2-4; 35, pp. 10-14, 27-38]. Some of these studies have indicated that PAHs, PCBs, pesticides, metals, and VOCs are present in the canal sediments [Ref. 16, pp. 23-28; 25, pp. 11-20; 26, pp. 8-16, 21-46; 35, pp. 134-320]. Sediment sampling by USACE documents the presence of contaminated sediments at concentrations that meet the criteria for observed release (see Hazardous Substances section below). These contaminants may have entered the canal via several transport pathways or mechanisms, including spillage, direct disposal or discharge, contaminated ground water discharge, surface water runoff, storm water discharge, contaminated soil erosion, or fires at industrial facilities [Ref. 6, pp. 3, 62-63; 25, pp. 4-7; 27, pp. 23, 25; 28, pp. 18-19, 30; 30, pp. 5-7; 31, pp. 84-91; 34, pp. 2-4, 45; 35, pp. 10-11, 19-20, 34]. Analytical results for the April-May 2003 USACE sampling event show that the contaminated sediments are located throughout the Gowanus Canal, from location GC-03-30 at the head of the canal to location GC-03-07 approximately 1.5 miles downstream [Ref. 16, pp. 37-38, 46-62, 86; 17, pp. 11, 48]. USACE has also collected biological data for finfish, crabs, and benthic invertebrates, and has determined that the sediments are polluted to a degree that limits species abundance and diversity throughout the Gowanus Canal [Ref. 23, pp. 2-16; 24, p. 2].

Location of the source, with reference to a map of the site:

The contaminated sediments extend for approximately 1.5 miles, from sample location GC-03-30 at the head of the canal to sample location GC-03-07, as shown in Figure 2 of this HRS documentation record.

Containment

Release to surface water via overland migration and/or flood:

The presence of contaminated sediments provides evidence that a variety of hazardous substances (PAHs, PCBs, pesticides, metals, and VOCs) have migrated into the surface water body (i.e., the Gowanus Canal) from numerous sources. Drilling logs indicate that neither of the following is present: (1) maintained engineered cover, or (2) functioning and maintained run-on control system and runoff management system [Ref. 16, pp. 98-

157]. Therefore, a surface water containment factor value of 10 is assigned for this source [Ref. 1, p. 51609, Table 4-2].

2.4.1 Hazardous Substances

Sampling and analysis by USACE in April and May 2003 showed the presence of several contaminants at concentrations significantly above background concentrations. Table 1 shows information for the samples that document background concentrations and observed release, while Table 2 presents the analytical results for the analytes that meet observed release criteria.

Notes on Sample Similarity:

Since the contamination begins at the head of the canal, it was not possible to obtain upstream samples to document background level concentrations. Therefore, downstream samples collected from Gowanus Bay beyond the documented area of sediment contamination were used to establish background concentrations. The background samples from Gowanus Bay and contaminated samples from Gowanus Canal were handled the same procedurally and were similar physically, as follows:

- The background and release sediment samples were all collected by USACE, using Standard Penetration Test (SPT) sampling methodology, during the sampling event in April and May 2003 [Ref. 16, pp. 14, 24, 261-286; 52, pp. 1-23].
- A single laboratory (Fort Monmouth Environmental Testing Laboratory) analyzed the samples for VOCs according to EPA Method 8260, SVOCs according to EPA Method 8270, pesticides according to EPA Method 8081, PCBs according to EPA Method 8082, and metals according to EPA Method 6010B, as well as other parameters [Ref.16, pp. 290, 291]. References 18 through 22 present the applicable analytical methods.
- The Gowanus Canal and Gowanus Bay are both part of the same estuary (i.e., the New York-New Jersey Harbor Estuary) and are classified under the HRS as "Coastal tidal waters," in which flow and depth characteristics are not considered to be applicable for the evaluation [Ref. 1, pp. 51605, 51613; 4; 9, pp. 1, 6].
- Although the height of the water column varied (15.5 to 30 feet for background; 1 to 21 feet for release), the geologic cross-sections within the Bay and Canal are similar: clay above sand, with variable thickness of the clay layer including gaps [Ref. 16, pp. 88-91, 98-107, 110-111, 114-115, 118-125, 132-133, 138-139, 142-157].
- The percent moisture in the background samples ranged from approximately 16% to 63%, while the percent moisture in the release samples ranged from approximately 11% to 68% [Ref. 16, pp. 405-414, 427-444, 454-495, 502-518, 525-545, 563-565, 573, 581, 583-586, 599-601, 617-622; 52, pp. 1, 32-36].
- The grain-size descriptions for the background samples ranged from "clay, trace of sand" to "silty, fine to medium sand, trace of gravel"; the grain-size descriptions for the release samples ranged from "clay, trace of sand" to "silty, fine to coarse sand with gravel" [Ref. 16, pp. 197-200, 202-204, 208, 211, 213-220].

Due to these similarities (i.e., same time frame, same sampling and analytical methods, same laboratory, similar ranges of percent moisture values, and similar sediment descriptions) among all the background samples from Gowanus Bay and release samples from Gowanus Canal, the background and release analytical results are considered to be comparable. EPA compared observed release concentrations to the maximum background concentration for each analyte.

Table 2 definitions and data qualifiers [Ref. 16, pp. 291-293, 561-624; 18, pp. 27-28, 74; 19, pp. 30-35; 36, p. 1]:

µg/kg - Micrograms per kilogram
mg/kg - Milligrams per kilogram
SQL - Sample quantitation limit
RL - Reporting limit

MDL - Method detection limit
ND - Compound searched for but not detected at or above MDL
J - Compound identified below detection limit
D - Result is from a dilution of the sample

Table 2 Notes:

Italics indicate a background concentration.
Underlined Italics denotes the maximum background concentration for each analyte.
Bold indicates concentrations that meet the criteria for observed release.
Blank spaces indicate that the results do not meet observed release criteria.

Table 1
Background and Release Sample Information
USACE 2003 Sediment Sampling
Gowanus Canal

Field Location	Sample Date	Field Sample ID	Depth (ft) below mean low water	Depth (ft) below canal bottom	Grain-Size Description (visual)	Grain-Size Description (sieve)	Analytical Fraction	Lab ID	Percent Moisture	References
BACKGROUND										
GC-03-01	5/14/2003	GC-03-1-JAR2	34-35.5	4-5.5	clay, trace sand and shells	n/a	VOCs	3023309	60.52	16, pp. 160, 197, 223,
							SVOC/Pest/PCBs	3023311	53.71	278, 427, 528, 581,
							Metals	3023310	NR	617, 660; 52, pp. 1, 17
GC-03-02	5/14/2003	GC-03-2-JAR7	27-28.5	11.5-13	sandy clay, trace gravel	n/a	VOCs	3023313	38.07	16, pp. 161, 197, 224,
		GC-03-2-JAR9	31-32.5	15.5-17	silty fine to medium sand, trace gravel	n/a	SVOCs	3023312	15.8	280, 430, 531, 582, 618, 661; 52, pp. 1, 18,
		GC-03-2-JAR8	28.5-30	13-14.5	clayey fine to medium sand	n/a	Metals/Pest/PCBs	3023314	27.05	25-29
GC-03-03	5/15/2003	GC-03-3/JAR8	29-30.5	13-14.5	clay w/sand	n/a	VOCs	3024407	38.55	16, pp. 162, 198, 225,
		GC-03-3/JAR5	24.5-26	8.5-10	clay w/sand, tr gravel	n/a	SVOC/Pest/PCBs	3024408	48.91	282, 439, 540, 585,
		GC-03-3/JAR7	27.5-29	11.5-13	gravelly clay w/sand	n/a	Metals	3024409	NR	664; 52, p. 20
GC-03-04	5/15/2003	GC-03-4/JAR2	39-43	11-15	clayey fine to coarse sand w/gravel	n/a	VOCs	3024402	58.72	16, pp. 163, 198, 226,
							SVOC/Pest/PCBs	3024403	54.28	282, 433, 436, 534,
							Metals	3024401	NR	537, 583, 584, 619,
	5/15/2003	GC-03-4/JAR4	33.5-35	8.5-10	clay, trace sand	clay, trace sand	VOCs	3024405	55.07	620, 662, 663; 52, pp.
			35-36.5	7-8.5	clay w/sand, trace gravel	n/a	SVOC/Pest/PCBs	3024406	56.16	19, 22
		GC-03-4/JAR5	36.5-38	8.5-10	clay w/sand, trace gravel	n/a	Metals	3024404	NR	
GC-03-05	5/15/2003	GC-03-5/JAR3	26.5-28	5.5-7	clay, trace sand	n/a	VOCs	3024411	59.43	16, pp. 164, 199, 227,
		GC-03-5/JAR2	25-26.5	4-5.5	clay, trace sand	n/a	SVOC/Pest/PCBs	3024410	62.89	282, 442, 543, 586,
		GC-03-5/JAR4	28-29.5	7-8.5	clay, trace sand	n/a	Metals	3024412	NR	622, 665; 52, pp. 1, 21,
RELEASE										
GC-03-07	5/13/2003	GC-03-7-J4	28-29.5	7-8.5	clayey fine to medium sand w/gravel	n/a	SVOC/Pest/PCBs	3022502	47.87	16, pp. 166, 199, 229, 276, 502, 573, 609; 52, pp. 1, 32-36
GC-03-09	5/14/2003	GC-03-9-JAR1	18-21	0-3	clay, trace sand	n/a	SVOC/Pest/PCBs	3023308	44.54	16, pp. 168, 200, 231, 278, 525, 580, 616
GC-03-11	5/14/2003	GC-03-11-JAR7	21-22.5	12-13.5	clayey sand w/gravel	n/a	SVOC/Pest/PCBs	3023302	55.79	16, pp. 170, 201, 233, 278, 516, 577, 613; 52, p. 16
GC-03-12	5/13/2003	GC-03-12-J10	21.1-22.6	21.1-22.6	silty fine to medium sand	n/a	VOCs	3022510	17.16	16, pp. 171, 202, 234,
							SVOC/Pest/PCBs	3022511	17.07	276, 410, 513, 576,
							Metals	3022512	NR	612, 655; 52, p. 15
GC-03-13	5/13/2003	GC-03-13-J8	22.8-24.3	13.8-15.3	silty fine sand	n/a	VOCs	3022507	16.76	16, pp. 172, 203, 235,
							SVOC/Pest/PCBs	3022508	18.54	276, 405, 510, 575, 611; 52, p. 15
GC-03-14	5/13/2003	GC-03-14-J7	21.3-22.8	11.8-13.3	clayey fine to medium sand	n/a	SVOC/Pest/PCBs	3022504	19.32	16, pp. 173, 204, 236, 276, 505, 574, 610; 52, p. 15
GC-03-18	4/30/2003	GC-18 (Jar 10)	26.5-28	15.5-17	sandy silt	n/a	SVOC/Pest/PCBs	3020806	18.63	16, pp. 177, 208, 240, 270, 488, 569, 605
GC-03-21	4/29/2003	GC-21 (Jar 9)	23-24.5	15.5-17	silty fine sand	n/a	SVOC/Pest/PCBs	3020803	21.27	16, pp. 180, 211, 243, 270, 481, 568, 604
GC-03-23	5/1/2003	GC-03-23-J8	14.5-16	13-14.5	clayey fine sand	n/a	SVOC/Pest/PCBs	3020809	17.37	16, pp. 182, 213, 245,
		GC-03-23-J4	8.5-10	7-8.5	clay w/sand, organics	sandy silt	Metals	3020808	NR	268, 493, 570, 606, 649
GC-03-24	4/28/2003	GCB6-GC03-24-J7	17.5-19	10.5-12	silty fine sand	n/a	SVOCs	3019803	26.12	16, pp. 183, 214, 246, 266, 473; 52, p. 11
GC-03-25	4/28/2003	GCB7-GC03-25-J12	26.5-28	19-20.5	sandy clay, trace gravel	n/a	SVOC/Pest/PCBs	3019805	23.5	16, pp. 184, 215, 247, 266, 476, 567, 603; 52, p. 13
GC-03-26	4/25/2003	GCB1-GC03-26 (Jar 8)	20.5-21.8	14.5-15.8	silty fine to medium sand, organics	n/a	SVOC/Pest/PCBs	3018705	10.9	16, pp. 149, 185, 216, 248, 262, 459, 562, 598; 52, pp. 4-5
GC-03-27	4/24/2003	GCB1-GC03-27 (Jar 3)	6.6-8.1	4-5.5	silty fine to medium sand, organics, plastic	n/a	SVOC/Pest/PCBs	3018704	22.92	16, pp. 186, 217, 249,
							Metals	3018702	NR	262, 454, 561, 597, 640; 52, p. 3
GC-03-28	4/27/2003	GCB5-GC03-28 (Jar 2)	6.5-8	4-5.5	clay, trace fine sand, organics	n/a	SVOC/Pest/PCBs	3019309	58.12	16, pp. 187, 218, 250, 264, 470, 565, 601; 52, p. 8
GC-03-29	4/27/2003	GCB4-GC03-29 (Jar 5)	13-14.5	8.5-10	silty fine to coarse sand w/gravel	n/a	SVOC/Pest/PCBs	3019304	32.09	16, pp. 188, 219, 251, 264, 467, 564, 600; 52, pp. 6-7
GC-03-30	4/26/2003	GCB3-GC03-30 (Jar 4)	8-9.5	7-8.5	sandy silt, trace gravel, organics	silty sand	SVOC/Pest/PCBs	3019301	67.68	16, pp. 189, 220, 252,
							Metals	3019303	NR	264, 464, 563, 599, 642; 52, p. 5

n/a = not analyzed
VOCs = volatile organic compounds
SVOCs = semivolatile organic compounds
Pest = pesticides
PCBs = polychlorinated biphenyls
NR = not recorded

Table 2
Background and Observed Release Concentrations
USACE 2003 Sediment Sampling
Gowanus Canal

	Background Samples											
Field Sample Location	**GC-03-01**		**GC-03-02**		**GC-03-03**		**GC-03-04**				**GC-03-05**	
Collection Date	**5/14/2003**		**5/14/2003**		**5/15/2003**		**5/15/2003**				**5/15/2003**	
VOCs (µg/kg)												
Field Sample ID	GC-03-1-JAR2		GC-03-2-JAR7		GC-03-3/JAR8		GC-03-4/JAR2		GC-03-4/JAR4		GC-03-5/JAR3	
Laboratory Sample ID	3023309		3023313		3024407		3024402		3024405		3024411	
	Result	SQL	Result	SQL	Result	SQL	Result	SQL	Result	SQL	Result	SQL
Styrene	*ND*	*260*	*ND*	*160*	*ND*	*33*	*ND*	*49*	*ND*	*44*	*ND*	*49*
	Ref. 16, p. 428; 36, p. 1		Ref. 16, p. 431; 36, p. 1		Ref. 16, p. 440; 36, p. 1		Ref. 16, p. 434; 36, p. 1		Ref. 16, p. 437; 36, p. 1		Ref. 16, p. 443; 36, p. 1; 52, p. 1	
SVOCs (µg/kg)												
Field Sample ID	GC-03-1-JAR1		GC-03-2-JAR9		GC-03-3/JAR5		GC-03-4/JAR2		GC-03-4/JAR4		GC-03-5/JAR2	
Laboratory Sample ID	3023311		3023312		3024408		3024403		3024406		3024410	
	Result	SQL	Result	SQL	Result	SQL	Result	SQL	Result	SQL	Result	SQL
Naphthalene	*ND*	*2,100*	*ND*	*1,200*	*ND*	*1,900*	*ND*	*2,100*	*ND*	*2,300*	*ND*	*2,600*
2-Methylnaphthalene	*ND*	*2,100*	*ND*	*1,200*	*ND*	*1,900*	*ND*	*2,100*	*ND*	*2,300*	*ND*	*2,600*
Acenaphthylene	*ND*	*2,100*	*ND*	*1,200*	*ND*	*1,900*	*ND*	*2,100*	*ND*	*2,300*	*ND*	*2,600*
Acenaphthene	*ND*	*2,100*	*ND*	*1,200*	*ND*	*1,900*	*ND*	*2,100*	*ND*	*2,300*	*ND*	*2,600*
Dibenzofuran	*ND*	*2,100*	*ND*	*1,200*	*ND*	*1,900*	*ND*	*2,100*	*ND*	*2,300*	*ND*	*2,600*
Fluorene	*ND*	*2,100*	*ND*	*1,200*	*ND*	*1,900*	*ND*	*2,100*	*ND*	*2,300*	*ND*	*2,600*
Phenanthrene	*ND*	*2,100*	*ND*	*1,200*	*480 J*	*1,900*	*ND*	*2,100*	*ND*	*2,300*	*ND*	*2,600*
Anthracene	*ND*	*2,100*	*ND*	*1,200*	*220 J*	*1,900*	*ND*	*2,100*	*ND*	*2,300*	*ND*	*2,600*
Fluoranthene	*ND*	*2,100*	*ND*	*1,200*	*520 J*	*1,900*	*390 J*	*2,100*	*290 J*	*2,300*	*ND*	*2,600*
Pyrene	*260 J*	*2,100*	*ND*	*1,200*	*660 J*	*1,900*	*560 J*	*2,100*	*370 J*	*2,300*	*440 J*	*2,600*
Benzo(a)anthracene	*ND*	*2,100*	*ND*	*1,200*	*320 J*	*1,900*	*240 J*	*2,100*	*ND*	*2,300*	*ND*	*2,600*
Chrysene	*ND*	*2,100*	*ND*	*1,200*	*370 J*	*1,900*	*260 J*	*2,100*	*ND*	*2,300*	*ND*	*2,600*
Bis(2-ethylhexyl)phthalate	*730 J*	*2,100*	*ND*	*1,200*	*1,700 J*	*1,900*	*1,400 J*	*2,100*	*2,500*	*2,300*	*960 J*	*2,600*
Benzo(b)fluoranthene	*ND*	*2,100*	*ND*	*1,200*	*210 J*	*1,900*	*ND*	*2,100*	*ND*	*2,300*	*ND*	*2,600*
Benzo(k)fluoranthene	*ND*	*2,100*	*ND*	*1,200*	*ND*	*1,900*	*ND*	*2,100*	*ND*	*2,300*	*ND*	*2,600*
Benzo(a)pyrene	*ND*	*2,100*	*ND*	*1,200*	*230 J*	*1,900*	*ND*	*2,100*	*ND*	*2,300*	*ND*	*2,600*
Indeno(1,2,3-cd)pyrene	*ND*	*2,100*	*ND*	*1,200*	*ND*	*1,900*	*ND*	*2,100*	*ND*	*2,300*	*ND*	*2,600*
Benzo(g,h,i)perylene	*ND*	*2,100*	*ND*	*1,200*	*ND*	*1,900*	*ND*	*2,100*	*ND*	*2,300*	*ND*	*2,600*
	Ref. 16, pp. 528-529; 36, p. 1		Ref. 16, pp. 531-532; 36, p. 1		Ref. 16, pp. 540-541; 36, p. 1		Ref. 16, pp. 534-535; 36, p. 1		Ref. 16, pp. 537-538; 36, p. 1		Ref. 16, pp. 543-544; 36, p. 1	
Pesticides/PCBs (µg/kg)												
Field Sample ID	GC-03-1-JAR1		GC-03-2-JAR8		GC-03-3/JAR5		GC-03-4/JAR2		GC-03-4/JAR4		GC-03-5/JAR2	
Laboratory Sample ID	3023311		3023314		3024408		3024403		3024406		3024410	
	Result	RL	Result	RL	Result	RL	Result	RL	Result	RL	Result	RL
beta-BHC	*ND*	*0.01*	*4*	*0.01*	*ND*	*0.01*	*ND*	*0.01*	*ND*	*0.01*	*ND*	*0.01*
4,4'-DDE	*ND*	*0.01*	*8*	*0.01*	*ND*	*0.01*	*ND*	*0.01*	*ND*	*0.01*	*ND*	*0.01*
Dieldrin	*ND*	*0.01*	*11*	*0.01*	*ND*	*0.01*	*ND*	*0.01*	*ND*	*0.01*	*ND*	*0.01*
4,4'-DDD	*ND*	*0.01*	*16*	*0.01*	*ND*	*0.01*	*ND*	*0.01*	*ND*	*0.01*	*ND*	*0.01*
4,4'-DDT	*ND*	*0.01*	*ND*	*0.01*	*ND*	*0.01*	*ND*	*0.01*	*ND*	*0.01*	*ND*	*0.01*
Arclor-1260	*ND*	*50*	*ND*	*50*	*420*	*50*	*270*	*50*	*280*	*50*	*260*	*50*
	Ref. 16, pp. 581, 617		Ref. 16, pp. 582, 618		Ref. 16, pp. 585, 621		Ref. 16, pp. 583, 619		Ref. 16, pp. 584, 620		Ref. 16, pp. 586, 622	
Metals (mg/kg)												
Field Sample ID	GC-03-1-JAR1		GC-03-2-JAR8		GC-03-3/JAR7		GC-03-4/JAR2		GC-03-4/JAR5		GC-03-5/JAR4	
Laboratory Sample ID	3023310		3023314		3024409		3024401		3024404		3024412	
	Result	MDL	Result	MDL	Result	MDL	Result	MDL	Result	MDL	Result	MDL
Copper	*187*	*2.317*	*8.98*	*1.351*	*142*	*1.737*	*252*	*2.677*	*233*	*2.588*	*358*	*2.254*
Lead	*179*	*1.727*	*14.4*	*1.007*	*191*	*1.295*	*225*	*1.996*	*229*	*1.929*	*342*	*1.680*
Selenium	*ND*	*1.011*	*ND*	*0.590*	*ND*	*0.758*	*ND*	*1.168*	*ND*	*1.129*	*ND*	*0.984*
Zinc	*288*	*3.960*	*36.2*	*2.309*	*198*	*2.969*	*346*	*4.575*	*356*	*4.423*	*518*	*3.853*
	Ref. 16, p. 660		Ref. 16, p. 661		Ref. 16, p. 664		Ref. 16, p. 662		Ref. 16, p. 663		Ref. 16, p. 665; 52, p. 1	

Table 2
Background and Observed Release Concentrations
USACE 2003 Sediment Sampling
Gowanus Canal

	Release Samples											
Field Sample Location	**GC-03-07**		**GC-03-09**		**GC-03-11**		**GC-03-12**		**GC-03-13**		**GC-03-14**	
Collection Date	**5/13/2003**		**5/14/2003**		**5/14/2003**		**5/13/2003**		**5/13/2003**		**5/13/2003**	
VOCs (µg/kg)												
Field Sample ID							GC-03-12-J10		GC-03-13-J8			
Laboratory Sample ID							3022510		3022507			
							Result	SQL	Result	SQL		
Styrene							**6300 D**	6,000	**1,100**	120		
							Ref. 16, p. 414; 36, p. 1		Ref. 16, p. 406; 36, p. 1			
SVOCs (µg/kg)												
Field Sample ID	GC-03-7-J4		GC-03-9-JAR1		GC-03-11-JAR7		GC-03-12-J10		GC-03-13-J8		GC-03-14-J7	
Laboratory Sample ID	3022502		3023308		3023302		3022511		3022508		3022504	
	Result	SQL	Result	SQL	Result	SQL	Result	SQL	Result	SQL	Result	SQL
Naphthalene	**4,300**	1,900	**8,300**	1,800	**39,000 D**	4,500	**19,000 D**	2,300	**30,000 D**	3,100	**820,000 D**	120,000
2-Methylnaphthalene	**17,000**	1,900	**4,600**	1,800	**24,000 D**	4,500	**11,000 D**	2,300	**25,000 D**	3,100	**390,000 D**	120,000
Acenaphthylene							**2,600 D**	2,300	**9,900 D**	3,100	**34,000**	30,000
Acenaphthene			**3,000**	1,800	**15,000 D**	4,500	**5,000 D**	2,300	**7,100 D**	3,100	**240,000**	30,000
Dibenzofuran												
Fluorene					**6,900 D**	4,500	**2,900 D**	2,300	**9,000 D**	3,100	**130,000**	30,000
Phenanthrene	**4,200**	1,900	**8,300**	1,800	**23,000 D**	4,500	**8,300 D**	2,300	**25,000 D**	3,100	**540,000 D**	120,000
Anthracene			**2,700**	1,800	**8,000 D**	4,500	**2,600 D**	2,300	**7,000 D**	3,100	**120,000**	30,000
Fluoranthene			**4,200**	1,800	**6,500 D**	4,500	**3,300 D**	2,300	**6,700 D**	3,100	**150,000**	30,000
Pyrene	**3,600**	1,900	**5,600**	1,800	**11,000 D**	4,500	**5,000 D**	2,300	**12,000 D**	3,100	**240,000**	30,000
Benzo(a)anthracene									**3,200 D**	3,100	**82,000**	30,000
Chrysene											**72,000**	30,000
Bis(2-ethylhexyl)phthalate	**15,000**	1,900										
Benzo(b)fluoranthene											**33,000**	30,000
Benzo(k)fluoranthene												
Benzo(a)pyrene											**61,000**	30,000
Indeno(1,2,3-cd)pyrene												
Benzo(g,h,i)perylene												
	Ref. 16, pp. 502-503; 36, p. 1		Ref. 16, pp. 525-526; 36, p. 1		Ref. 16, pp. 516-517; 36, p. 1		Ref. 16, pp. 513-514; 36, p. 1		Ref. 16, pp. 510-511; 36, p. 1		Ref. 16, pp. 505-509; 36, p. 1	
Pesticides/PCBs (µg/kg)												
Field Sample ID	GC-03-7-J4											
Laboratory Sample ID	3022502											
	Result	RL										
beta-BHC	**12.00**	0.01										
4,4'-DDE												
Dieldrin												
4,4'-DDD												
4,4'-DDT												
Arclor-1260												
	Ref. 16, p. 573											
Metals (mg/kg)												
Field Sample ID							GC-03-12-J10					
Laboratory Sample ID							3022512					
							Result	MDL				
Copper												
Lead												
Selenium							**5.33**	0.536				
Zinc												
							Ref. 16, p. 655					

Table 2
Background and Observed Release Concentrations
USACE 2003 Sediment Sampling
Gowanus Canal

	Release Samples											
Field Sample Location	**GC-03-18**		**GC-03-21**		**GC-03-23**		**GC-03-24**		**GC-03-25**		**GC-03-26**	
Collection Date	**4/30/2003**		**4/29/2003**		**5/1/2003**		**4/28/2003**		**4/28/2003**		**4/25/2003**	
VOCs (µg/kg)												
Field Sample ID												
Laboratory Sample ID												
Styrene												
SVOCs (µg/kg)												
Field Sample ID	GC-18		GC-21		GC-GC03-23-J8		GC-B6-GC03-24-J7		GCB7-GC03-25-J12		GC-B1-GC03-26	
Laboratory Sample ID	3020806		3020803		3020809		3019803		3019805		3018705	
	Result	SQL	Result	SQL	Result	SQL	Result	SQL	Result	SQL	Result	SQL
Naphthalene	**3,300,000 D**	610,000	**6,200,000 D**	1,300,000			**100,000 D**	34,000	**290,000**	33,000	**210,000**	28,000
2-Methylnaphthalene	**2,700,000**	240,000	**3,600,000 D**	1,300,000			**110,000 D**	34,000	**310,000**	33,000	**670,000 D**	110,000
Acenaphthylene	**660,000**	240,000	**1,800,000 D**	1,300,000							**47,000**	28,000
Acenaphthene	**660,000**	240,000	**230,000**	31,000	**7,000 D**	6,000	**71,000 D**	34,000	**220,000**	33,000	**570,000 D**	110,000
Dibenzofuran			**91,000**	31,000							**30,000**	28,000
Fluorene	**680,000**	240,000	**1,100,000**	130,000			**39,000 D**	34,000	**140,000**	33,000	**300,000**	28,000
Phenanthrene	**2,200,000**	240,000	**3,000,000 D**	1,300,000	**22,000 D**	6,000	**130,000 D**	34,000	**610,000 D**	130,000	**1,000,000 D**	110,000
Anthracene	**620,000**	240,000	**890,000**	130,000	**8,900 D**	6,000	**39,000 D**	34,000	**180,000**	33,000	**290,000**	28,000
Fluoranthene	**570,000**	240,000	**910,000**	130,000	**26,000 D**	6,000	**37,000 D**	34,000	**190,000**	33,000	**280,000**	28,000
Pyrene	**870,000**	240,000	**1,300,000**	130,000	**42,000 D**	6,000	**55,000 D**	34,000	**260,000**	33,000	**400,000 D**	110,000
Benzo(a)anthracene	**300,000**	240,000	**440,000**	130,000	**15,000 D**	6,000			**110,000**	33,000	**130,000**	28,000
Chrysene	**300,000**	240,000	**400,000**	130,000	**16,000 D**	6,000			**100,000**	33,000	**130,000**	28,000
Bis(2-ethylhexyl)phthalate												
Benzo(b)fluoranthene			**230,000**	31,000	**7,900 D**	6,000			**52,000**	33,000	**65,000**	28,000
Benzo(k)fluoranthene			**77,000**	31,000							**33,000**	28,000
Benzo(a)pyrene			**320,000**	31,000	**11,000 D**	6,000			**73,000**	33,000	**93,000**	28,000
Indeno(1,2,3-cd)pyrene			**96,000**	31,000							**29,000**	28,000
Benzo(g,h,i)perylene			**87,000**	31,000								
	Ref. 16, pp. 488-492; 36, p. 1		Ref. 16, pp. 481-487; 36, p. 1		Ref. 16, pp. 493-494; 36, p. 1		Ref. 16, pp. 473-474; 36, p. 1		Ref. 16, pp. 476-480; 36, p. 1		Ref. 16, pp. 459-463; 36, p. 1	
Pesticides/PCBs (µg/kg)												
Field Sample ID												
Laboratory Sample ID												
beta-BHC												
4,4'-DDE												
Dieldrin												
4,4'-DDD												
4,4'-DDT												
Arclor-1260												
Metals (mg/kg)												
Field Sample ID					GC-03-23-J4							
Laboratory Sample ID					3020808							
					Result	MDL						
Copper												
Lead					**1,130**	0.450						
Selenium												
Zinc					**1,860**	2.248						
					Ref. 16, p. 649							

Table 2
Background and Observed Release Concentrations
USACE 2003 Sediment Sampling
Gowanus Canal

	Release Samples							
Field Sample Location	**GC-03-27**		**GC-03-28**		**GC-03-29**		**GC-03-30**	
Collection Date	**4/24/2003**		**4/27/2003**		**4/27/2003**		**4/26/2003**	
VOCs (µg/kg)								
Field Sample ID								
Laboratory Sample ID								
Styrene								
SVOCs (µg/kg)								
Field Sample ID	GCB1-GC03-27		GCB5-GC03-28		GCB4-GC03-29		GCB3-GC03-30	
Laboratory Sample ID	3018704		3019309		3019304		3019301	
	Result	SQL	Result	SQL	Result	SQL	Result	SQL
Naphthalene					**93,000 D**	36,000		
2-Methylnaphthalene					**83,000 D**	36,000	**84,000 D**	31,000
Acenaphthylene								
Acenaphthene			**29,000 D**	24,000	**110,000 D**	36,000	**69,000 D**	31,000
Dibenzofuran								
Fluorene					**37,000 D**	36,000	**47,000 D**	31,000
Phenanthrene	**37,000**	32,000	**65,000 D**	24,000	**140,000 D**	36,000	**210,000 D**	31,000
Anthracene			**38,000 D**	24,000	**60,000 D**	36,000	**56,000 D**	31,000
Fluoranthene	**33,000**	32,000	**74,000 D**	24,000	**88,000 D**	36,000	**86,000 D**	31,000
Pyrene	**40,000**	32,000	**99,000 D**	24,000	**120,000 D**	36,000	**130,000 D**	31,000
Benzo(a)anthracene			**35,000 D**	24,000	**38,000 D**	36,000	**39,000 D**	31,000
Chrysene			**38,000 D**	24,000	**38,000 D**	36,000	**43,000 D**	31,000
Bis(2-ethylhexyl)phthalate	**1,000,000 D**	130,000	**94,000 D**	24,000			**100,000 D**	31,000
Benzo(b)fluoranthene			**27,000 D**	24,000				
Benzo(k)fluoranthene								
Benzo(a)pyrene			**30,000 D**	24,000				
Indeno(1,2,3-cd)pyrene								
Benzo(g,h,i)perylene								
	Ref. 16, pp. 454-458; 36, p. 1		Ref. 16, pp. 470-471; 36, p. 1		Ref. 16, pp. 467-468; 36, p. 1		Ref. 16, pp. 464-465; 36, p. 1	
Pesticides/PCBs (µg/kg)								
Field Sample ID			GCB5-GC03-28		GCB4-GC03-29		GCB3-GC03-30	
Laboratory Sample ID			3019309		3019304		3019301	
			Result	RL	Result	RL	Result	RL
beta-BHC								
4,4'-DDE			**59.00**	0.01				
Dieldrin			**43.00**	0.01			**41.00**	0.01
4,4'-DDD			**150.00**	0.01	**61.00**	0.01	**86.00**	0.01
4,4'-DDT			**43.00**	0.01			**45.00**	0.01
Arclor-1260			**1,900**	50	**1,400**	50	**1,600**	50
			Ref. 16, pp. 565, 601		Ref. 16, pp. 564, 600		Ref. 16, pp. 563, 599	
Metals (mg/kg)								
Field Sample ID	GCB1-GC03-27						GCB3-GC03-30	
Laboratory Sample ID	3018702						3019303	
	Result	MDL					Result	MDL
Copper	**1,290**	0.659						
Lead							**1,140**	0.421
Selenium								
Zinc								
	Ref. 16, p. 640						Ref. 16, pp. 642	

2.4.2 Hazardous Waste Quantity

2.4.2.1.1 Hazardous Constituent Quantity

The information available is not sufficient to evaluate Tier A source hazardous waste quantity; therefore, hazardous constituent quantity is not scored (NS).

Hazardous Constituent Quantity (C) Value: NS

2.4.2.1.2 Hazardous Wastestream Quantity

The information available is not sufficient to evaluate Tier B source hazardous waste quantity; therefore, hazardous wastestream quantity is not scored.

Hazardous Wastestream Quantity (W) Value: NS

2.4.2.1.3 Volume

Analytical results for the April-May 2003 USACE sampling event show that the contaminated sediments are located throughout the Gowanus Canal, a length of approximately 1.5 miles (see Sections 2.2.1 and 2.4.1). An extensive sampling event by KeySpan from December 2005 to January 2006 confirms the USACE data and shows PAHs at total concentrations as high as 45,000 parts per million (4.5%) [Ref. 35, pp. 40, 134-320]. Based on a review of the KeySpan data and conservative (i.e., low bias) assumptions, a conservative estimate of the volume of contaminated sediments in Gowanus Canal is 330,000 cubic yards [Ref. 51, p. 1]. The source type is 'Other', so the volume value is divided by 2.5 to obtain the assigned value, as shown below [Ref. 1, p. 51591, Section 2.4.2.1.3, Table 2-5].

Dimension of source (yd^3): 330,000

Volume (V) Assigned Value: 330,000/2.5 = 132,000

2.4.2.1.4 Area

Tier D is not evaluated for source type "other" [Ref. 1, p. 51591, Table 2-5, Section 2.4.2.1.4].

Area of source (ft^2): N/A

Area (A) Assigned Value: 0

2.4.2.1.5 Source Hazardous Waste Quantity Value

The source hazardous waste quantity value for Source 1 is 132,000 for Tier C - Volume [Ref. 1, p. 51591].

Source Hazardous Waste Quantity Value: 132,000

SITE SUMMARY OF SOURCE DESCRIPTIONS

Source Number	Source Hazardous Waste Quantity Value	Containment: Ground Water	Containment: Surface Water	Containment: Air Gas	Containment: Air Particulate
1	132,000	NS	10 *	NS	NS

NS = Not Scored

* The overland flow containment factor is 10 for the source.

4.1 OVERLAND/FLOOD MIGRATION COMPONENT

4.1.1.1 Definition of Hazardous Substance Migration Path for Overland/Flood Component

The Gowanus Canal originates near Butler Street in Brooklyn, and then flows southwest for approximately one and a half miles into Gowanus Bay and Upper New York Bay [Figures 1 and 2 of this HRS documentation record; Ref. 4; 6, pp. 10, 12; 7, p. 1; 8, p. 3]. The Gowanus Canal, Gowanus Bay, and Upper New York Bay are all part of the core area of the New York-New Jersey Harbor Estuary, which was designated as an "Estuary of National Significance" by EPA in 1988 [Ref. 9, pp. 1, 6]. The canal is a tidal arm of the Harbor Estuary and is classified as a Class SD saline surface water. The only fresh water that enters the canal is stormwater runoff and CSO discharges during storm events [Figure 1 of this HRS documentation record; Ref. 7, pp. 1, 2]. Saline water from Buttermilk Channel enters the head of the canal through a flushing tunnel, which operated from 1911 to 1960 and since 1999 [Ref. 6, pp. 66-67, 70].

Upon construction, the Gowanus Canal was a semi-stagnant body of water due to its narrow width and long reach from the Bay limiting the ability of tidal movement [Ref. 26, pp. 6-7]. In 1911, the Gowanus Flushing Tunnel was constructed to bring water into the head of the canal from the Buttermilk Channel in New York Harbor and increase the movement of water within the canal. In the 1950s and 1960s, the city's economy moved away from manufacturing, and the Gowanus Canal went from being a busy commercial canal to one that was polluted and surrounded by a dilapidated waterfront. The flushing tunnel also stopped operating in approximately 1960, when the propeller drive shaft was disabled. The Gowanus Flushing Tunnel was repaired and reactivated in April 1999 [Ref. 6, pp. 3, 66-67, 70; 7, p. 2; 8, pp. 2-3; 10, pp. 1-2; 11, pp. 1-2; 16, p. 10; 26, pp. 6-7].

Despite the ongoing pollution problems, some city dwellers have begun to use the Gowanus Canal for recreational purposes such as canoeing, diving, and swimming [Ref. 7, p. 3; 8, p. 3; 13, p. 1; 38, p. 1; 39, pp. 1, 3; 40, p. 2; 41, pp. 1-3; 42, p. 1; 43, p. 2; 44, pp. 1-2]. People also use the canal for fishing and crabbing, and several sources have reported fishing for human consumption [Ref. 13, p. 1; 14, p. 1; 15, pp. 1-2; 39, p. 3; 40, p. 2; 43, pp. 1-3; 45, pp. 1-2; 46, p. 3; 47, p. 1]. It is reported that a handful of people catch fish at the 3rd Street Bridge and at other bridges along the canal, take the fish home, and eat them [Figure 2 of this HRS documentation record; Ref. 13, p. 1; 14, p. 1; 15, p. 1]. Residents also catch fish for consumption from the Gowanus Bay, just downstream of the site, and the rest of the New York-New Jersey Harbor Estuary [Ref. 9, p. 2; 14, p. 1; 46, pp. 1-2; 48, pp. 8-12; 49, p. 1; 50, p. 1].

4.1.2.1 Likelihood of Release

4.1.2.1.1 Observed Release

Direct Observation

An observed release by direct observation is not being scored.

Chemical Analysis

An observed release by chemical analysis is documented in the Gowanus Canal between sample location GC-03-30, at the head of the canal, and sample location GC-03-07, approximately 1.5 miles downstream (see Section 2.2).

Attribution

Sediments in the Gowanus Canal are contaminated with PAHs, PCBs, pesticides, metals, and the VOC styrene for a length of approximately 1.5 miles (see Section 2.2). The origin of these hazardous substances in the contaminated sediments has not been identified due to the presence of too many past and present possible sources. As a result, the source(s) of all the contamination in any particular location in the canal cannot be determined.
The contaminants detected in the canal sediments can come from a wide variety of industrial and other anthropogenic activities [Ref. 37, pp. 1-2, 5-6, 9-10, 13-14, 17-18, 21-22, 25-26]. For instance, the PAHs detected in Gowanus Canal sediments might have derived from a multitude of petroleum and coal-tar sources, including MGPs, oil storage depots, asphalt manufacturers, coal yards, and historical fires [Ref. 29, p. 3; 34, pp. 3, 23-45; 35, pp. 19, 85-86]. EPA identified dozens of possible contamination sources of VOCs, SVOCs, PCBs, or metals in the Gowanus Canal and Bay watershed, but did not specifically identify any potential sources of pesticides [Ref. 34, pp. 13-14, 23-45]. In addition, contaminants discharged into the canal are likely to have been redistributed due to flushing and dredging over the years [Ref. 34, p. 45]. As discussed below, there are numerous possible contributors to the sediment contamination that affects the Gowanus Canal.

The 100-foot-wide Gowanus Canal runs southwest from Butler Street to Gowanus Bay and Upper New York Bay [Ref. 6, pp. 10, 12; 7, p. 1; 8, p. 3; 16, p. 9]. The adjacent waterfront is primarily commercial and industrial, currently consisting of concrete plants, warehouses, and parking lots; surrounding land use also includes residential neighborhoods [Ref. 7, pp. 1, 2; 8, pp. 1, 2]. The waterfront and surrounding properties have been heavily industrialized since construction of the Gowanus Canal was completed in the 1860s. Historical or current industrial activity along and within the canal has included MGPs, coal yards, cement makers, soap makers, tanneries, paint and ink factories, machine shops, chemical plants, and oil refineries. In addition, the Gowanus Canal is the receiving water body for storm water from approximately 6 square miles of urban land and CSO discharges during storm events [Ref. 6, pp. 3; 7, pp. 1, 2; 8, pp. 1, 2; 10, p. 1; 11, p. 1; 12, p. 2; 17, pp. 10, 11; 26, p. 6; 27, p. 3; 34, pp. 3]. The land elevation around the canal ranges from 0 to 30 feet above Mean Sea Level (MSL), and a watershed of approximately 6 square miles feeds storm water into the canal from the surrounding neighborhoods [Ref. 6, p. 10; 7, p. 1; 16, p. 9; 17, p. 10].

Numerous past investigations with varying scopes have been conducted within and around the Gowanus Canal. Some of the studies focused on specific properties, while others focused on the contaminated sediments within the canal [Ref. 16, pp. 8-9; 23, p. 2; 24, p. 2; 26, pp. 4-5; 28, pp. 7-35; 30, p. 4; 31, p. 11; 32, p. 1; 33, pp. 4-5; 34, pp. 2-4; 35, pp. 10-12]. Some of these studies have indicated that PAHs, PCBs, pesticides, metals, and VOCs are present in the canal sediments [Ref. 16, pp. 23-28; 26, pp. 8-16, 21-46; 35, pp. 134-320]. These contaminants may have entered the canal via several transport pathways or mechanisms, including spillage, direct disposal or discharge, contaminated ground water discharge, surface water runoff, storm water discharge contaminated soil erosion, or fires at industrial facilities [Ref. 6, pp. 3, 62-63; 25, pp. 4-7; 27, pp. 23, 25; 28, pp. 18-19, 30; 30, pp. 5-7; 31, pp. 84-91; 34, pp. 2-4, 45; 35, pp. 10-11, 19-20, 34, 85-86]. Analytical results for the April-May 2003 USACE sampling event show that the contaminants are located throughout the

Gowanus Canal, from location GC-03-30 at the head of the canal to location GC-03-07 approximately 1.5 miles downstream [Ref. 16, pp. 37, 38, 46-62, 86; 17, pp. 11 and 48].

EPA completed an extensive study of possible contamination sources in July 2004. In addition to standard environmental record sources search performed as specified by American Society for Testing and Materials (ASTM), EPA also conducted a proprietary database search of former MGPs, a manual review of publicly accessible files maintained by NYSDEC, a review of historic maps, an electronic search of New York Times archives dating back to 1857, a 3-day site reconnaissance of major areas of interest, and interviews with local government officials [Ref. 34, pp. 13-22]. Searches of Federal and state environmental databases indicate that there are hundreds of possible contamination sources in the vicinity of Gowanus Canal. Listed are incinerators, former MGPs, chemical plants, asphalt plants, manufacturing facilities, shipyards, dry cleaners, oil depots, auto repair shops including body shops, salvage yards, tank cleaning companies, recycling and waste disposal facilities, and numerous facilities operated by the Department of Transportation and other State and City agencies [Ref. 34, pp. 13-17, 65-99].

Three of the many possible sources of sediment contamination are the former MGPs located along the Gowanus Canal [Ref. 34, pp. 65-99, 289, 493, 503, 788, 1366]. MGPs used tar and petroleum to produce combustible gas which was used for lighting, heating, and cooking in the surrounding community [Ref. 30, p. 4]. A typical byproduct associated with the manufactured gas process is coal tar, which was likely released at MGPs due to spills and leaks; coal tar is known to be contaminated with PAHs [29, pp. 1, 3]. **While these MGPs are thought to be contributing to the contamination in the canal, they are not thought to be the only sources of PAHs, nor are they normally associated with several of the individual hazardous substances in the canal, including PCBs.** Brief descriptions of the former MGPs and associated investigations are provided below:

Former Fulton MGP

The former Fulton Manufactured Gas Plant (Fulton) is located near the northern terminus of the Gowanus Canal. The former MGP extended from the eastern shoreline of the Gowanus Canal approximately three city blocks on either side of Degraw Street east to Third Avenue [Ref. 30, pp. 21, 27, 29; 35, p. 541]. Historical maps indicate that the Fulton facility consisted of two MGPs that operated at this location from approximately 1886 to 1933 [Ref. 30, pp. 4, 21, 27-29].

From April to June 2007, NYSDEC conducted a Site Characterization Investigation of the former Fulton facility to determine if coal tar and associated PAHs are present in the subsurface soil and ground water at the site [Ref. 30, p. 4]. During the investigation, NYSDEC observed subsurface soil saturated with coal tar throughout the former Fulton facility [Ref. 30, pp. 5, 6, 24, 31, 32, 34-39, 41-49, 52, 54, 56-58, 60-62, 65]. At one soil boring, NYSDEC observed coal tar flowing out of the drilling equipment prior to collecting the sample [Ref. 30, p. 5]. During monitoring well development, NYSDEC encountered non-aqueous phase liquid (NAPL) exhibiting a strong coal tar odor in the central portion of the study area, in the immediate vicinity of former MGP structures and visible coal tar soil contamination [Ref. 30, pp. 6, 7, 21, 23, 24]. NYSDEC collected subsurface soil and ground water samples from the former Fulton facility [Ref. 30, pp. 4, 5, 10-18].

NYSDEC laboratory analysis of the subsurface soil samples indicated elevated PAH concentrations in samples collected from western and central portions of the study area, at locations in close proximity to former MGP facility structures of the former Fulton facility [Ref. 30, pp. 14, 15, 21, 22]. Maximum PAH concentrations range from 1,200,000 µg/kg to 2,900,000 µg/kg in a soil boring (KSF-SB-01) completed in the immediate vicinity of a former MGP facility structure [Ref. 30, pp. 14, 15, 21, 22]. Analysis of subsurface soil samples KSF-SB-11 (22'-24') and KSF-SB-12 (16'-18'), collected from eastern portions of the study area, indicated either non-detect values or estimated concentrations below the SQL, for the same PAH parameters [Ref. 30, pp. 14, 21, 22]. NYSDEC laboratory analysis of the ground water samples indicated significantly higher PAH concentrations in monitoring wells MW-2, MW-6, and MW-7, which are located in the immediate vicinity of former MGP structures, as compared to concentrations detected in upgradient monitoring well MW-5 [Ref. 30, pp. 7, 17, 18, 21, 23]. NYSDEC concluded that lateral movement of coal tar at depths observed during the SCI could intersect the Gowanus Canal [Ref. 30, p. 7].

Former Citizens Gas Works MGP

The Former Citizens Gas Works MGP site (a.k.a. Carroll Gardens/Public Place) property is located at the intersection of Smith and Fifth Streets in the Carroll Gardens neighborhood of Brooklyn [Ref. 31, p. 11]. The Gowanus Canal abuts the property to the east and the southeast [Ref. 35, p. 541]. The former MGP facility began operations in the late 1860s; by 1939 the plant had reached the maximum extent of its construction, encompassing 11.5 acres [Ref. 31, p. 11, 21]. The facility was decommissioned and demolished in the early 1960s [Ref. 31, p. 21]. The property is currently divided into four parcels, including a vacant lot owned by the City of New York [Ref. 31, pp. 11, 12].

Environmental investigations have been conducted in the area of the Former Citizens Gas Works MGP from 1984 to 2005 [Ref. 31, pp. 26-29]. These investigations focused on assessing the environmental impacts resulting from the former operations of the MGP as well as the assessment of an illegal dumping area located on the vacant lot [Ref. 31, pp. 26-28]. The City of New York conducted an investigation within the area of the illegal dump and concluded that there are no environmental conditions associated with drums encountered during the excavation [Ref. 31, p. 12].

Conclusions drawn from previous investigations indicate that the property is impacted by the former operations of the MGP [Ref. 31, pp. 27, 28, 113- 116]. The principal byproduct resulting from the manufactured gas process, coal tar, is present at the property [Ref. 29, p. 1; 31, pp. 27, 28, 113-116]. The most recent RI conducted on the property included the collection of surface and subsurface soil, ground water, and soil vapor samples. Analytical results of soil and ground water samples collected from the property indicated elevated PAH concentrations in two areas of the property where tar was most intensively handled [Ref. 31, pp. 30, 73-82, 113, 114]. These areas are defined by significant zones of coal tar saturation and the presence of coal tar in the subsurface and ground water [Ref. 31, pp. 60, 61, 82].

Former Metropolitan Gas Light Company MGP

The former Metropolitan Gas Light Company (Metropolitan) MGP (a.k.a. former 2nd Avenue MGP; a.k.a. Brooklyn Union Gas Co.) was located at what is now 124-136 Second Avenue, Brooklyn, New York [Ref. 33, pp. 4, 6; 34, pp. 65, 99, 493, 503]. The Gowanus Canal abuts the property to the west-northwest [Ref. 33, p. 6; 35, p. 541]. The southeast portion of the subject property, along with adjacent properties to the south and west, were occupied by a MGP from prior to 1880 until approximately 1938 [Ref. 33, p. 6]. The facility was also the location of an asphalt plant, a paint factory, and a United States Postal Service (USPS) vehicle maintenance facility. The USPS vacated the site in 1992 [Ref. 33, p. 6].

A Final Completion Report for remedial activities conducted at the former Metropolitan facility, prepared for the NYSDEC and USPS in May 2003, concludes that coal tar-impacted soils observed within three former gasholder structures, as well as hotspot areas (defined as soil with total PAH concentrations greater than 1,000 milligrams per kilogram [mg/kg]), subsurface soils, and in ground water, are a result of former MGP operations [Ref. 32, p. 1; 33, pp. 6, 7]. Contaminant characterization was conducted from January to March 2002 under a Voluntary Cleanup Agreement (VCA) between the USPS and NYSDEC [Ref. 32, p. 1]. Soil borings were installed and sampled at four suspected hot spot areas and adjacent to the exterior walls of former gasholders [Ref. 32, pp. 1, 2]. PAHs were detected in three of the four areas at concentrations exceeding the hot spot criteria [Ref. 32, pp. 7, 14-16, 18, 22, 23, 26, 28]. Sample CN-2 showed the maximum Total PAH concentration of 226,100,000 µg/kg, with individual PAH concentrations as high as 87,000,000 µg/kg (naphthalene) [Ref. 32, p. 13-32]. The maximum Total PAH concentration from subsurface samples collected beneath the gasholders was 3,360,000 µg/kg in Sample GH-31 (SB7) [Ref. 32, p. 20].

<u>Hazardous Substances Released:</u>

Acenaphthene	Dibenzofuran
Acenaphthylene	Dieldrin
Anthracene	Fluorene
Benzo(a)anthracene	Beta-BHC

Benzo(a)pyrene	Indeno(1,2,3-cd)pyrene
Benzo(b)fluoranthene	Lead
Benzo(g,h,i)perylene	2-Methylnaphthalene
Benzo(j,k)fluorene [Fluoranthene]	Naphthalene
Benzo(k)fluoranthene	Phenanthrene
Bis(2-ethylhexyl)phthalate	PCBs [Aroclor-1260]
Chrysene	Pyrene
Copper	Selenium
4,4’-DDD	Styrene
4,4’-DDE	Zinc
4,4’-DDT	

==========

Observed Release Factor Value: 550

4.1.3.2 Human Food Chain Threat - Waste Characteristics

4.1.3.2.1 Toxicity/Persistence/Bioaccumulation

Hazardous Substance	Source	Toxicity Factor Value	River Persistence Factor Value	Salt Water Food Chain Bioaccumulation Factor Value*	Toxicity/ Persistence/ Bioaccumulation Factor Value (Table 4-16)	Ref. 2 Page
Acenaphthene	1, OR	10	0.4	500	2,000	BI-1
Acenaphthylene	1, OR	0	0.4	500	0	BI-1
Anthracene	1, OR	10	0.4	50,000	2×10^5	BI-1
Benzo(a)anthracene	1, OR	1,000	1	50,000	5×10^7	BI-2
Benzo(a)pyrene	1, OR	10,000	1	50,000	5×10^8	BI-2
Benzo(b)fluoranthene	1, OR	Values for this compound were not readily available				
Benzo(g,h,i)perylene	1, OR	0	1	50,000	0	BI-2
Benzo(j,k)fluorene [Fluoranthene]	1, OR	100	1	5,000	5×10^5	BI-2, C-1
Benzo(k)fluoranthene	1, OR	100	1	50,000	5×10^6	BI-2
Bis(2-ethylhexyl)phthalate	1, OR	100	1	500	5×10^4	BI-2
Chrysene	1, OR	10	1	5	50	BI-3
Copper	1, OR	0	1	50,000	0	BI-3
4,4'-DDD	1, OR	100	1	50,000	5×10^6	BI-4
4,4'-DDE	1, OR	100	1	50,000	5×10^6	BI-4
4,4'-DDT	1, OR	1,000	1	50,000	5×10^7	BI-4
Dibenzofuran	1, OR	1,000	1	500	5×10^5	BI-4
Dieldrin	1, OR	10,000	1	5,000	5×10^7	BI-5
Fluorene	1, OR	100	1	500	5×10^4	BI-6
Hexachlorocyclohexane, beta- [Beta-BHC]	1, OR	100	1	500	5×10^4	BI-7
Indeno(1,2,3-cd)pyrene	1, OR	1,000	1	50,000	5×10^7	BI-8
Lead	1, OR	10,000	1	5,000	5×10^7	BI-8
2-Methylnaphthalene	1, OR	0	0.4	50,000	0	BI-9
Naphthalene	1, OR	1,000	0.4	5,000	2×10^6	BI-9
Phenanthrene	1, OR	0	0.4	5,000	0	BI-9
PCBs [Aroclor-1260]	1, OR	10,000	1	50,000	5×10^8	BI-10
Pyrene	1, OR	100	1	5,000	5×10^5	BI-10
Selenium	1, OR	100	1	500	5×10^4	BI-10
Styrene	1, OR	10	0.4	50	200	BI-10
Zinc	1, OR	10	1	50,000	5×10^5	BI-12

* The Gowanus Canal is a tidal arm of the New York-New Jersey Harbor Estuary and is classified as a Class SD saline surface water. The only fresh water that enters the canal is stormwater runoff and CSO discharges during storm events [Figure 1 of this HRS documentation record; Ref. 7, pp. 1, 2]. The Food Chain Bioaccumulation Potential Factor Value that corresponds to the type of water body in which the fishery is located (i.e., salt water) is assigned to each hazardous substance [Ref. 1, p. 51617].

Benzo(a)pyrene and PCBs are the hazardous substances associated with the highest toxicity/persistence/bioaccumulation factor value with a quantity of 5×10^8.

4.1.3.2.2 Hazardous Waste Quantity

Source Number	Source Hazardous Waste Quantity Value (HRS Section 2.4.2.1.5)	Is source hazardous constituent quantity data complete? (yes/no)
1	132,000	no

Sum of Values: 132,000 (rounded to nearest integer as specified in HRS Section 2.4.2.2)

The sum corresponds to a hazardous waste quantity factor value of 10,000 in Table 2-6 of the HRS [Ref. 1, p. 51591]. Therefore, a hazardous waste quantity factor value of 10,000 is assigned for the surface water pathway [Ref. 1, p. 51591, 51592].

4.1.3.2.3 Waste Characteristics Factor Category Value

Two hazardous substances [benzo(a)pyrene and PCBs] associated with the waste source, which has a surface water pathway containment factor greater than 0 for the watershed, corresponds to a Toxicity/Persistence Factor Value of 10,000 and Bioaccumulation Potential Factor Value of 50,000, as shown previously [Ref. 1, pp. 51618, 51620; 2, pp. BI-2, BI-10].

(Toxicity/Persistence Factor Value) x (Hazardous Waste Quantity Factor Value) = 10,000 x 10,000 = 1×10^8

(Toxicity/Persistence Factor Value x Hazardous Waste Quantity Factor Value)
x (Bioaccumulation Potential Factor Value) = $(1 \times 10^8) \times (50,000) = 5 \times 10^{12}$

The product corresponds to a Waste Characteristics Factor Category Value of 1,000 in Table 2-7 of the HRS [Ref. 1, p. 51592].

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Toxicity/Persistence/Bioaccumulation Factor Value: 5×10^8
Hazardous Waste Quantity Factor Value: 10,000
Waste Characteristics Factor Category Value: 1,000

4.1.3.3 Human Food Chain Threat - Targets

People use the Gowanus Canal for fishing and crabbing, and several sources have reported fishing for human consumption [Ref. 13, p. 1; 14, p. 1; 15, pp. 1-2; 39, p. 3; 40, p. 2; 43, pp. 1-3; 45, pp. 1-2; 46, p. 3; 47, p. 1]. It is reported that people catch fish for consumption at the 3rd Street Bridge, which crosses the Gowanus Canal within the zone of sediment contamination, and at other bridges along the canal [Figure 2 of this HRS documentation record; Ref. 13, p. 1; 14, p. 1; 15, p. 1]. In addition, many of the released hazardous substances have a bioaccumulation potential factor value of 500 or greater. Therefore, Actual Human Food Chain Contamination is documented, and the target fishery is evaluated for Actual Human Food Chain Contamination. The target fishery is subject to Level II concentrations [Ref. 1, pp. 51592, 51593, 51620, 51621].

Sediment Samples for Documenting Observed Contamination

Sample ID	Distance from PPE	Hazardous Substance	Bioaccumulation Potential Factor Value *	Reference(s)
GCB4-GC03-29	0 feet	Acenaphthene	500	Figure 2; Ref. 1, p. 51620; 2, p. BI-1; 16, p. 468.
GC-03-14-J7	0 feet	Acenaphthylene	500	Figure 2; Ref. 1, p. 51620; 2, p. BI-1; 16, p. 505
GC-03-14-J7	0 feet	Anthracene	50,000	Figure 2; Ref. 1, p. 51620; 2, p. BI-1; 16, p. 506.
GC-03-14-J7	0 feet	Benzo(a)anthracene	50,000	Figure 2; Ref. 1, p. 51620; 2, p. BI-2; 16, p. 506
GC-21	0 feet	Benzo(a)pyrene	50,000	Figure 2; Ref. 1, p. 51620; 2, p. BI-2; 16, p. 482.
GC-21	0 feet	Benzo(g,h,i)perylene	50,000	Figure 2; Ref. 1, p. 51620; 2, p. BI-2; 16, p. 482.
GC-21	0 feet	Benzo(k)fluoranthene	50,000	Figure 2; Ref. 1, p. 51620; 2, p. BI-2; 16, p. 482.
GCB1-GC03-27	0 feet	Bis(2-ethylhexyl) phthalate	500	Figure 2; Ref. 1, p. 51620; 2, p. BI-2; 16, p. 458.
GCB1-GC03-27	0 feet	Copper	50,000	Figure 2; Ref. 1, p. 51620; 2, p. BI-3; 16, p. 640.
GCB5-GC03-28	0 feet	4,4'-DDD	50,000	Figure 2; Ref. 1, p. 51620; 2, p. BI-4; 16, p. 565.
GCB5-GC03-28	0 feet	4,4'-DDE	50,000	Figure 2; Ref. 1, p. 51620; 2, p. BI-4; 16, p. 565.
GCB5-GC03-28	0 feet	4,4'-DDT	50,000	Figure 2; Ref. 1, p. 51620; 2, p. BI-4; 16, p. 565.
GC-21	0 feet	Dibenzofuran	500	Figure 2; Ref. 1, p. 51620; 2, p. BI-4; 16, p. 482.
GCB5-GC03-28	0 feet	Dieldrin	5,000	Figure 2; Ref. 1, p. 51620; 2, p. BI-5; 16, p. 565.
GC-21	0 feet	Fluoranthene	5,000	Figure 2; Ref. 1, p. 51620; 2, p. BI-2; 16, p. 485.
GCB4-GC03-29	0 feet	Fluorene	500	Figure 2; Ref. 1, p. 51620; 2, p. BI-6; 16, p. 468.
GC-03-7-J4	0 feet	Beta-BHC	500	Figure 2; Ref. 1, p. 51620;

				2, p. BI-7; 16, p. 573.
GC-21	0 feet	Indeno(1,2,3-cd) pyrene	50,000	Figure 2; Ref. 1, p. 51620; 2, p. BI-8; 16, p. 482.
GC-GC03-26-J4	0 feet	Lead	5,000	Figure 2; Ref. 1, p. 51620; 2, p. BI-8; 16, p. 649.
GC-21	0 feet	2-Methylnaphthalene	50,000	Figure 2; Ref. 1, p. 51620; 2, p. BI-9; 16, p. 486.
GC-21	0 feet	Naphthalene	5,000	Figure 2; Ref. 1, p. 51620; 2, p. BI-9; 16, p. 486
GC-21	0 feet	Phenanthrene	5,000	Figure 2; Ref. 1, p. 51620; 2, p. BI-9; 16, p. 487.
GCB5-GC03-28	0 feet	PCBs [Aroclor-1260]	50,000	Figure 2; Ref. 1, p. 51620; 2, p. BI-10; 16, p. 601.
GCB3-GC03-30	0 feet	Pyrene	5,000	Figure 2; Ref. 1, p. 51620; 2, p. BI-10; 16, p. 465.
GC-03-12-J10	0 feet	Selenium	500	Figure 2; Ref. 1, p. 51620; 2, p. BI-10; 16, p. 655.
GC-GC03-23-J4	0 feet	Zinc	50,000	Figure 2; Ref. 1, p. 51620; 2, p. BI-12; 16, p. 649.

* The Gowanus Canal is a tidal arm of the New York-New Jersey Harbor Estuary and is classified as a Class SD saline surface water. The only fresh water that enters the canal is stormwater runoff and CSO discharges during storm events [Figure 1 of this HRS documentation record; Ref. 7, pp. 1, 2]. The Food Chain Bioaccumulation Potential Factor Value that corresponds to the type of water body in which the fishery is located (i.e., salt water) is assigned to each hazardous substance [Ref. 1, p. 51617]. The maximum factor value of 50,000 applies to benzo(a)pyrene and PCBs [Ref. 2, pp. BI-2, BI-10].

4.1.3.3.1 Food Chain Individual

Sample ID: GC-21 / GCB7-GC03-25-J12
Hazardous Substance: Benzo(a)pyrene
Bioaccumulation Potential: 50,000
References: Figure 2 of this HRS documentation record; Ref. 1, p. 51620; 2, p. BI-2; 16, pp. 476-487

Identity of Fishery	Type of Surface Water Body	Dilution Weight	Reference(s)
Gowanus Canal	Coastal tidal water (salt water)	0.0001	1, p. 51613; 7, pp. 1-2; 13, p. 1; 14, p. 1; 15, pp. 1-2; 39, p. 3; 40, p. 2; 43, pp. 1-3; 45, pp. 1-2; 46, p. 3; 47, p. 1

There is an observed release of hazardous substances, including benzo(a)pyrene, with Bioaccumulation Potential Factor Values of 500 or greater, and Level II Actual Contamination of the Gowanus Canal fishery is documented between samples GC-03-07 and GC-03-30 [Table 2 and Figure 2 of this HRS documentation record; Ref. 1, pp. 51592, 51593, 51620; 2, pp. BI-1-BI-10, BI-12; 13, p. 1; 14, p. 1; 15, pp. 1-2; 39, p. 3; 40, p. 2; 43, pp. 1-3; 45, pp. 1-2; 46, p. 3; 47, p. 1; 16, pp. 476-487] . Therefore, a Food Chain Individual Factor Value of 45 is assigned [Ref. 1, p. 51620].

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Food Chain Individual Factor Value: 45

4.1.3.3.2 Population

4.1.3.3.2.1 Level I Concentrations

There are no media-specific benchmarks for sediment. Therefore, there are no fisheries subject to Level I concentrations and the Level I Concentrations Factor Value is 0 [Ref. 1, pp. 51592, 51593, 51620, 51621].

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Level I Concentrations Factor Value: 0

4.1.3.3.2.2 Level II Concentrations

People use the Gowanus Canal for fishing and crabbing, and several sources have reported fishing for human consumption [Ref. 13, p. 1; 14, p. 1; 15, pp. 1-2; 39, p. 3; 40, p. 2; 43, pp. 1-3; 45, pp. 1-2; 46, p. 3; 47, p. 1]. It is reported that people catch fish for consumption at the 3rd Street Bridge, which crosses the Gowanus Canal within the zone of sediment contamination, and at other bridges along the canal [Figure 2 of this HRS documentation record; Ref. 13, p. 1; 14, p. 1; 15, p. 1]. The fish consumption rate for the Gowanus Canal fishery is not documented, so the fishery is assigned to the category "Greater than 0 to 100 pounds per year" [Ref. 1, p. 51621; 13, p. 1; 14, p. 1; 15, pp. 1-2; 39, p. 3; 40, p. 2; 43, pp. 1-3; 45, pp. 1-2; 46, p. 3; 47, p. 1]. The category corresponds to the assigned Human Food Chain Population Value of 0.03 in Table 4-18 of the HRS, which is assigned as the Level II Concentrations Factor Value [Ref. 1, p. 51621].

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Level II Concentrations Factor Value: 0.03

4.1.3.3.2.3 Potential Human Food Chain Contamination

People catch fish for consumption from the Gowanus Bay, just downstream of the site, and the rest of the New York-New Jersey Harbor Estuary. The fish consumption rate for the downstream fishery is not documented, so the fishery is assigned to the category "Greater than 0 to 100 pounds per year" [Ref. 1, p. 51621; 9, p. 2; 14, p. 1; 46, pp. 1-2; 48, pp. 8-12; 49, p. 1; 50, p. 1], which corresponds to the assigned Human Food Chain Population Value of 0.03 in Table 4-18 of the HRS [Ref. 1, p. 51621].

Identity of Fishery	Annual Production (pounds)	Type of Surface Water Body	Average Annual Flow (cfs)	Population Value (P_i)	Dilution Weight (D_i)	$P_i \times D_i$
Gowanus Bay/ New York Harbor	0-100	Coastal tidal water (salt water)	N/A	0.03	0.0001	0.000003

Sum of $P_i \times D_i$: 0.000003
(Sum of $P_i \times D_i$)/10: 0.0000003

[Figures 1, 2 of this HRS documentation record; Ref. 1, pp. 51613, 51621; 9, p. 2; 14, p. 1; 46, pp. 1-2; 48, pp. 8-12; 49, p. 1; 50, p. 1]

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Potential Human Food Chain Contamination Factor Value: 0.0000003