A. INTRODUCTION

CEQR GUIDELINES

Based on the *New York City Environmental Quality Review (CEQR) Technical Manual* and its coverage of public health issues, an environmental impact statement (EIS) should address public health as it pertains to “the activities that society undertakes to create and maintain conditions in which people can be healthy.” Thus, the *CEQR Technical Manual* broadly defines public health and an EIS should therefore address the range of potential issues that could be raised by a proposed action or project. The proposed Fresh Kills Park project would benefit public health by creating a new public park with significant opportunities for active recreation (e.g., walking, biking, kayaking, field sports) for both children and adults. In addition to providing new public recreational amenities, the proposed project would also provide environmental benefits through ecological enhancements within the park. These are the public health benefits of the proposed park project. However, the proposed Fresh Kills Park would also allow public access onto a closed municipal solid waste landfill. This raises public health questions as to the measures necessary to ensure there is no adverse impact to public health from allowing public access to a property that is comprised of a municipal solid waste landfill and its supporting environmental control infrastructure. Therefore, the focus of this public health analysis is an examination of the potential for adverse impacts on public health as Fresh Kills Landfill becomes publicly accessible, with a focus on increased human exposure to ambient air, groundwater, surface water, sediment and soil conditions at the project site. This analysis addresses the operational period for the proposed project. Chapter 20, “Construction,” addresses potential impacts during the construction period.

OVERVIEW OF ENVIRONMENTAL AND PUBLIC HEALTH CONCERNS FOR THE PROPOSED PROJECT

An analysis of environmental/public health concerns with respect to projects associated with landfills should address four key areas of concern: air quality, groundwater, surface water and soils. These are the principal environment components that can provide a pathway for landfill-generated pollutants to reach the human respiratory or ingestion systems or result in dermal contact that may create a public heath concern particularly over longer term exposure.

Ambient air quality over or downwind of a landfill is potentially affected by gases that are emitted as biodegradable wastes decompose. These landfill gases, by volume, are primarily methane, carbon dioxide and water vapor. However, they also include small amounts of nitrogen, oxygen, ammonia, inorganic and organic sulfur containing compounds, hydrogen, and non-methane organic compounds (NMOC’s) that typically comprise less than 1 percent of the landfill gas volume. The two components of landfill gas that pose the greatest potential threat to public health are methane and the NMOCs. Landfill gas contains about 50 percent methane (a potentially explosive gas). It is possible for landfill gas to migrate below ground, accumulate in enclosed structures (e.g., basements), and concentrate to explosive levels. NMOCs include volatile organic compounds (VOCs) and hazardous air pollutants (HAPs), such as benzene, toluene, ethyl benzene, and vinyl chloride (United States Environmental Protection Agency, [EPA] 2006). Air quality standards and guidelines exist that provide an understanding of which concentrations of these pollutants is assumed to present a potential public health concern. VOCs can also contribute to ground-level ozone formation, and HAPs are recognized as potential contributors to health problems (e.g., cancer, respiratory irritation).

There are also odorous compounds in landfill gas (e.g., organosulfur compounds and inorganic sulfides and certain NMOCs are considered odorous) that, at elevated concentrations, can cause adverse health effects, particularly for persons with pre-existing respiratory conditions (e.g., asthmatics) as well as triggering headache or nausea. Generally, however, odorous compounds are detected by humans in extremely low concentrations before health symptoms result.

Groundwater, surface water, sediment, and soil quality are also potential exposure pathways for contaminants that can affect public health. Natural conditions can be affected by pollutants derived from solid waste materials that are collected and conveyed by landfill leachate. Leachate is generated at landfills when rain water seeps vertically through the solid waste and collects pollutants. Public health can subsequently be affected by these pollutants through physical contact or ingestion when local groundwater or surface water is used as a drinking water source. Groundwater containing contaminants derived from on- or off-site commercial and/or industrial sources can represent a potential public health threat by impacting surface waters within the proposed park area and/or redistributing the toxics burden and impacting sediments/soils. Potential exposures to contaminants in surface waters or sediments can also include dermal contact from swimming, for example, or ingestion via the consumption of finfish or shellfish.

An assessment of potential public health concerns must consider whether or not the human exposure pathway to pollutants is "complete" (i.e., the pollutants have a method of transmission to the human body). Typically, exposure is accomplished by one of three principal pathways: 1) inhalation, 2) ingestion, 3) or dermal absorption. The likelihood or prevalence of these exposure pathways is strongly dependent upon the physical and chemical properties of the contaminants in question as well as the environmental attributes (i.e. soil/fill types, hydrogeologic conditions and other factors). For example, inhalation of air and dust in an affected area represents a complete exposure pathway for contaminants. The exposure pathways to groundwater or surface water may not, in all cases, be complete since neither is used as a drinking water source at Fresh Kills nor would either be used for drinking water or irrigation by the proposed park. However, public access to surface waters and exposure to sediments at the site does raise the question of the potential for public health impacts via these the dermal absorption pathways.

B. PUBLIC HEALTH IMPACT ASSESSMENT METHODOLOGIES

CEQR GUIDELINES AND GEIS SCOPING

As stated above, according to the *CEQR Technical Manual*, an EIS public health assessment needs to examine a range of potential issues that are project specific. For the proposed Fresh Kills Park, this would be related to the potential for public health impacts on future open space users and DPR personnel that would be introduced to the site. This assessment should take into consideration potential sources of environmental and public health impacts as well as the potential pollutant exposure pathways (see Figure 21-1). The *CEQR Technical Manual* identifies a number of possible environmental concerns with respect to a public health analysis and suggests that the analysis consider the following:

- Increased exposure to air emissions from mobile sources (e.g. vehicular traffic) or emissions from stationary sources (e.g., stacks sources);
- Increased exposure to heavy metals (e.g., lead) and other contaminants in soil/dust;
- The presence of contamination from historic spills or releases of substances that may have affected surface or groundwater, particularly when it is to be used as a source of drinking water or for recreation;
- Solid waste management practices that could attract vermin and result in an increase in pest populations (e.g., rats, mice, cockroaches, and mosquitoes);
- Vapor infiltration from contaminants within a building or underlying soil (e.g., contamination originating from gasoline stations dry cleaners or other commercial and/or industrial sources where volatile chemicals were used or are being used);
- Actions with potential impact(s) or exceedances of accepted federal, state, or local environmental standards or guidance criteria;
- Other actions, which might not exceed established thresholds, but could result in significant public health concerns; and
- Potentially significant adverse impacts to sensitive receptors from noise.

This chapter presents a public health impact analysis that addresses each of the above technical areas. It follows the methodologies and technical approaches outlined in the "Final Scope of Work to Prepare a GEIS (August 2006) and a follow-up technical memorandum prepared as a supplement to that scope that provided an expanded discussion of the public health issues to be addressed in this GEIS. That technical memorandum (April 2007) was reviewed by the New York City Department of Health and Mental Hygiene (NYCDOHMH), the New York City Department of Environmental Protection (DEP), and the New York City Department of Sanitation (DSNY). Methodologies used in this analysis are presented below.

AIR QUALITY METHODOLOGY

INTRODUCTION

The analysis of air quality conditions involved both a modeling assessment of local air quality emissions based on current stationary source air permits (e.g., the landfill gas flares, landfill gas recovery plant, leachate treatment plant, DSNY solid waste transfer station) and a review of ambient air monitoring data gathered by DEC that was used to assess the effects of fugitive air emissions sources (e.g., the landfill gas venting systems and infrastructure). The modeling analysis was performed to determine emission levels from specific permitted stationary sources while the monitoring addresses air quality conditions on an area-wide basis. Potential public health impacts associated with vehicular traffic (mobile sources) including air pollutants from increased traffic and vehicle emissions are analyzed in Chapter 17, "Air Quality" and summarized in this chapter under "Project Impacts" (see the discussion below).

STUDY AREA DEFINITION AND DATA SOURCES

As the first step in the air quality analysis, an air quality study area was established. In accordance with the *CEQR Technical Manual* that study area included the project site and uses within 400 feet of the project site. Based on this study area, a data base and map of air emission point sources and other relevant data were gathered for the study area. That search yielded the following sources of data:

- Large industrial facilities within 1,000 feet of the project site based on air permit data on file with the DEC or EPA which included air permit data for DSNY's Staten Island Waste Transfer Station adjacent to the project site (DEC Permit ID 2-6403-00141/00001);
- Major facility air permit data for all DSNY operations also referred to as a Title V permit (e.g., Landfill Gas Flares, DEC Air Permit Application Paulus Sokolowski & Sarter, P.C, 1997 and landfill gas purification facility DEC Permit ID 2-6499-00029/00151);
- DEC 2004, 2005, and 2006 Air Emissions Statement for Fresh Kills Landfill;
- Ambient air monitoring data reports for DEC Fresh Kills Ambient Air Monitoring Stations 7097-17 and 7097-19 (DSNY/DEC);
- Fresh Kills Landfill Gas Migration Monitoring, 4th Quarter—October 2007 (Shaw Environmental, October 29, 2007); and
- Air quality permits for manufacturing facilities and commercial businesses within 400 feet of the project site based on the certificates of operation on file with NYCDEP;
- DSNY Semi-Annual Compliance Report Landfill Gas Collection and Control Systems, Section 3/4 and Section 2/8 (Shaw Environmental, October 30, 2007a and Shaw Environmental October 30, 2007b).

Summary of Title V Permit and 2006 Emissions Statement

The Title V permit for Fresh Kills Landfill and the supporting application included data that were used in the modeling study for DSNY facilities such as the air contaminant emission rates and stack parameters for the landfill gas flares and the sources located at the gas recovery plant (i.e., two compressor engines and a thermal oxidizer). Supplemental data (i.e., air toxic releases from the gas recovery plant and leachate treatment facility) were also obtained from the DEC 2006 Emissions Statement which provides a summary of air emissions from actual operational data collected during the 2006 calendar year. The air emission sources most relevant to potential on site air quality impacts are those sources included in the state facility and Title V permits. The Title V permit also describes additional facilities located within the Fresh Kills Landfill boundaries. These include the leachate treatment plant; three DSNY vehicle maintenance and repair garages; two refueling stations; a rock crushing and screening operation; and a yard waste composting facility.

Condition No. 23 of the permit requires the applicant (DSNY) to identify the source emission units. That list includes the flares, gas recovery plant, and leachate treatment plants. For these source emission units, the permit provides detailed information on unit operations. No detailed information is provided for the site garages, the refueling stations, the rock crushing and screening operation, or yard waste composting facility. It is assumed therefore that these sources are covered under Condition Nos. 13 or 14 of the permit, which allow for "exempt" and "trivial" sources. Exempt or trivial sources do not require the same level of reporting (e.g., emission rates) as emission unit sources. Therefore, these sources were not quantified in the modeling analysis.

The reporting of air emissions for each source emission unit along with process data related to the unit's operation is an annual obligation that the DSNY must fulfill in accordance with DEC regulations. This 2006 Annual Emissions Statement was used to obtain emission rates of air toxic compounds for the thermal oxidizer and two compressor engines (located at the gas recovery plant) and for the Fresh Kills Landfill Leachate Treatment Plant.

Industrial/Commercial Sources

To assess potential air quality impacts due to emissions from nearby industrial sources, a field survey of the area was performed for the purposes of identifying any processing or manufacturing facilities located within 400 feet of the proposed park. That survey, undertaken on January 25, 2007, identified several industrial/commercial operations in the study area that had the potential for air emission permits. Addresses for those facilities were submitted to NYCDEP's Bureau of Environmental Compliance (BEC). BEC air permit data identified the following permitted sources within the park:

- New Silver Hanger Cleaners, and
- Arden Heights Cleaners.

The information subsequently provided by BEC is the most currently available air permit data. Both permits listed tetrachloroethylene as the only contaminant emitted to the atmosphere.

Impacts Due to Large Emission Point Sources

The *CEQR Technical Manual* requires an air quality assessment of large sources located within 1,000 feet of a project site. A review of DEC and EPA permit data was conducted to identify any nearby large emission sources. The results of that search indicated that the only large point source emission within 1,000 feet of the proposed Fresh Kills Park is the Staten Island Waste Transfer Facility, which was included in the air quality analysis along with the combined effects of the landfill point sources and the industrial commercial sources. The DEC permit for this source (see the permit list above) includes a summary of the emissions for this facility, which are primarily nitrogen dioxide (NO_2) emissions related to the heavy machinery and equipment used in the building as well as the building's heating systems. This data was used to model impacts from the facilities as part of the AERMOD dispersion analysis described below.

Background Conditions

Ambient data from local air monitoring stations were used to establish background conditions. These data were compared to a compound list to identify discrete compounds in the ambient air samples that may not originate from the landfill (areas to the west are heavily industrialized). Air samples collected concurrently at locations upwind and downwind of the landfill were reviewed for the purposes of discerning any source contributions from fugitive landfill gases.

AIR DISPERSION MODELING

As the second step in this analysis, the potential concentrations of the air contaminants were determined for the study area using EPA's AERMOD dispersion model. The analysis used currently available data on terrain elevations for the project site to perform the analysis (i.e., current site topography). The air pollutants analyzed included both criteria pollutants and over 100 individual non-criteria pollutants (i.e. air toxic compounds). The criteria pollutants are NO_2, carbon monoxide (CO), particulate matter (PM_{10}/$PM_{2.5}$), and sulfur dioxide (SO_2). Emission rates were obtained from the DEC Title V Air Permit (see the discussion above), individual stationary source permits, and the 2006 DEC Emission Statement for Fresh Kills Landfill. Predicted concentrations were then compared to the National Ambient Air Quality Standards (NAAQS) for criteria pollutants and the Short-term Guidance Values (SGC) and Annual

Guidance Values (AGC) for air toxics compounds. Estimates of worst-case short-term (1 hour) and annual averages were predicted and then compared to the SGC and AGC guideline concentrations. The guideline concentrations are established by DEC and represent levels that are considered safe for public health.

DEC AMBIENT AIR MONITORING DATA AND ON-SITE FUGITIVE SOURCES

The air quality analysis also examined the potential for exposure to air toxic compounds from area wide sources in the study area based on available monitoring data. These data were used to characterize ambient conditions and to discern if toxic compounds may be present due to the gases that may be released by the landfill.

DEC has conducted ambient air monitoring of air toxic compounds at Fresh Kills landfill. The monitoring program includes an upwind site referenced as Fresh Kills West (Site #7097-17) and a downwind site referenced as Fresh Kills East (Site # 7097-19). There were 44 volatile organic compounds (VOCs) sampled at each location which were designated as upwind and downwind based on a predominant wind direction in the areas from west to east over the course of a year. For this analysis, monitoring data was reviewed for the period 1999 through 2003 at Fresh Kills West and for the years 2002 and 2003 at Fresh Kills East. These data are provided in Appendix E. In addition to the monitoring data, a DEC report titled "*An Assessment of Methane and Toxic Compounds over the Fresh Kills Landfill and Surrounding Areas of New York City: A Pilot Study*" (August 6, 2004) was reviewed. The document provides an analysis of methane, total hydrocarbon and 16 air toxic compounds measured at several DEC air monitoring sites including Fresh Kills East and Fresh Kills West.

GROUNDWATER CONDITIONS METHODOLOGY

The *CEQR Technical Manual* acknowledges that groundwater throughout most urbanized areas has been impacted by current or past uses and activities. Such is the case at Fresh Kills which has a long history as a municipal solid waste landfill and is also located in an area of the City that has been historically occupied by manufacturing uses. There are groundwater aquifers on Staten Island; however, groundwater has not been used as a source of potable water since 1970. Potable water for Staten Island is now provided by NYCDEP's public water supply.

In order to characterize groundwater conditions at the site, recent available groundwater data were reviewed. Groundwater monitoring is performed regularly by DSNY in accordance with the Fresh Kills environmental compliance and monitoring programs. These data were reviewed for the purposes of assessing current groundwater conditions at the project site. Among the reports that were reviewed relative to the groundwater conditions at the site were the following:

- Fresh Kills Landfill 2006 Annual Groundwater Monitoring Report, Environmental Monitoring Program (Shaw Environmental, September 6, 2007);
- Fresh Kills Landfill 2005 Annual Groundwater Monitoring Report (Shaw Environmental 2005); and
- The Final Facilities Condition Survey reports for Fresh Kills Landfill Plant 1 (January 2007) and for Fresh Kills Landfill Plant 2 (February 2007), both prepared by Weston Solutions of New York, Inc. (Weston).

SURFACE WATER AND SEDIMENT QUALITY METHODOLOGY

Since the proposed project would provide recreational access to the water, an examination of surface water quality and sediment quality was performed for this public health analysis. For the purposes of this assessment, available water and sediment quality data were reviewed and examined.

In order to determine background (or boundary) conditions, New York City Harbor Survey data were used. The City of New York has monitored the water quality of New York Harbor for over 90 years through the Harbor Survey, which is performed by NYCDEP. The Harbor Survey station closest to the project site is referenced in the Harbor Survey as Station K4 (Fresh Kills). Additionally, DSNY has conducted water and sediment quality monitoring within Little Fresh Kills, Great Fresh Kills, Fresh Kills, Richmond Creek, and Main Creek from 1991 to the present. This sampling is currently being conducted in accordance with DSNY's environmental monitoring program for Fresh Kills Landfill. This chapter describes those existing conditions based on a review of existing data which include the following:

- Fresh Kills Landfill 2006 Annual Surface Water and Sediment Monitoring Report (Shaw Environmental, April 18, 2007);
- Fresh Kills Landfill 2004 Annual Surface Water and Sediment Monitoring Report, Environmental Monitoring Program (Shaw Environmental, April 6, 2005); and
- Fresh Kills Landfill Final Surface Water Sediment Report (IT Corporation, 1993).

These data were used to evaluate the potential for dermal exposure to toxic compounds as the site becomes publicly accessible along its waterways.

SOIL CONDITIONS AND HAZARDOUS MATERIALS

Hazardous materials are defined by the *CEQR Technical Manual* as substances that pose a threat to public health and the environment including, but not limited to: Petroleum-derived hydrocarbons, heavy metals, VOCs, semi-volatile organic compounds (SVOCs), methane, PCBs, pesticides, and other hazardous wastes. Generally, the risk associated with exposure to soil conditions is linked to the presence of one or more hazardous materials in environmental media (i.e. soil, sediments, water, or air) at a concentration exceeding one or more derived regulatory standards. Hazardous wastes are defined differently under the federal and state regulations promulgated by the Resource Conservation and Recovery Act ([RCRA] see the discussion below) and the definitions provided by New York State regulations (6 NYCRR Part 371.4), which include, among them, specific "listed" wastes or wastes that meet at least one of four characteristics: ignitability, corrosivity, reactivity, and/or toxicity (see the discussion below).

The *CEQR Technical Manual* acknowledges that many sites in urban areas contain soils that have been impaired or contaminated by hazardous materials. Many urban activities and practices, industrial and otherwise, that were once common or routine are now considered as having impacted the local soil and groundwater conditions, leaving behind residual contaminants. In addition to legacy contamination concerns, the presence of hazardous materials and petroleum products can be the result of current uses. Hazardous materials can be transported to a site as fill, be found within structures (e.g., asbestos or lead paint used in buildings), and migrate to a site through groundwater.

The *CEQR Technical Manual* lists the type of facilities, activities, and conditions that require an assessment relative to hazardous materials. Among them are development on or adjacent to a solid waste landfill or a site where the storage or reduction of solid waste has occurred; sites that have had manufacturing operations; activities such as gasoline storage or service (i.e., underground storage tanks); and development on fill material of an unknown origin. These uses and activities have occurred on the project site and in the surrounding area (within 400 feet).

As described in greater detail in Chapter 11 "Hazardous Materials," the methodology for determining potential hazardous materials impacts on soils is as follows:

- Evaluate the land use history using Sanborn fire insurance maps, historical topographic maps and historical aerial photographs from the period 1910 to 1996 and also evaluate current aerial photography.
- Develop a comprehensive database of uses, records, and regulated activities for the site and surrounding area based on EPA and DEC sources that identify the use, generation, storage, treatment and/or disposal of hazardous material and chemicals, or releases of such materials which may impact the project site including federal and state databases prepared under the federal Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS).
- CERCLIS is a compilation of known or suspected, uncontrolled or abandoned hazardous waste sites maintained by EPA; a RCRA Notifiers database that includes facilities where there has been the treatment, storage and/or disposal of hazardous wastes, or transports of hazardous waste regulated under RCRA; the DEC SPILLS database which includes a list of related releases, including those attributed to tank test failures and tank failures; the Chemical Bulk Storage (CBS) database contains a list of facilities that store regulated non-petroleum substances in aboveground storage tanks at a capacity greater than 185 gallons and/or in underground tanks of any size; the Petroleum Bulk Storage (PBS) database lists commercial facilities with registered petroleum tanks in excess of 1,100 gallons and less than 400,000 gallons; the State Inactive Hazardous Waste Disposal Site Registry (SHWS) database identifies hazardous waste disposal sites; the State Hazardous Substance Waste Disposal Site Study (SHSWDS) which tracks waste disposal sites that may pose threats to public health or the environment; and the State Brownfield Cleanup Program (BCP) database includes sites that have been impaired by hazardous waste but where redevelopment is being contemplated in conjunction with liability releases and tax credits.
- Review previously prepared reports for the Fresh Kills Landfill site that contain data relative to potential hazardous soil conditions at the project site including the Final Facilities Condition Survey reports for Fresh Kills Landfill Plant 1 (January 2007) and for Fresh Kills Landfill Plant 2 (February 2007), both prepared by Weston Solutions of New York, Inc. (Weston); the "Preliminary Fresh Kills Landfill Conceptual Design Report, Subtanks 3.2 Mapping and Assessment of Natural Areas (SCS Engineers, April 1990); and "Site Investigation for Owl Hollow Soccer Fields Site," (LiRo Engineers, July 7, 2007).
- Perform a field reconnaissance and visual inspections of potential park areas (e.g., North Park Phase A).

OTHER PUBLIC HEALTH CONCERNS

In recent years the City has needed to address evolving public health issues such as West Nile Virus which is transmitted primarily by mosquitoes. This chapter will also analyze the potential for public health impacts from both West Nile Virus and rabies and will describe the programs of the New York City Department of Health and Mental Hygiene (DOHMH), DSNY, and DPR relative to these concerns. This will include a description of DSNY maintenance programs that are currently employed at Fresh Kills Landfill and DPR programs at other park sites around the City with respect to vector control.

NOISE

Noise is identified in the *CEQR Technical Manual* as a potential public health technical area. As described in Chapter 19, "Noise," baseline noise levels were monitored in the area and future levels with the operation of the proposed park were determined. Based on established thresholds and guidelines for determining noise impacts, the proposed park would not present a public health concern with respect to noise levels and no further analysis was undertaken with respect to noise impact under this public health analysis.

C. GUIDANCE IN DETERMINING PUBLIC HEALTH IMPACTS

INTRODUCTION

The *CEQR Technical Manual* suggests evaluating compliance with in-place applicable environmental standards and guidelines as a way to determine any significant potential public health impacts from a proposed project or action. There are many federal, state, and City regulations that protect public health and safety, some of which have been cited above. These regulations provide guidance in determining the potential for public health impacts as a result of the proposed project and are summarized below.

SUMMARY OF REGULATORY AGENCIES AND PRACTICES PROTECTING PUBLIC HEALTH

The environmental and public health regulations that may apply to Fresh Kills Landfill and the proposed Fresh Kills Park are cited below followed by a discussion of the standards and thresholds that would apply to the proposed project for the purposes of determining significant potential public health impacts.

FEDERAL

- EPA: The Federal Clean Air Act administered by EPA determines NAAQS (see the discussion above) and regulates air emissions; Section 304(a) of the Clean Water Act regulates water quality conditions and discharges. The federal RCRA defines and regulates the generation, treatment, storage, disposal, and transport of hazardous wastes. Under RCRA, hazardous wastes are defined as substances that are chemically reactive, ignitable, corrosive, or toxic as measured by the Toxicity Characteristic Leaching Procedure (TCLP) or as specifically listed. The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), more commonly known as Superfund, established prohibitions and requirements concerning closed and abandoned hazardous waste sites. The act provided for liability of parties responsible for releases of hazardous waste at these sites, and established a trust fund to provide for cleanup when no responsible party can be identified.

- Occupational Safety and Health Administration (OSHA) Regulations: This agency was created by Congress in 1970 and promulgates regulations and standards to protect worker safety and health.
- U.S. Department of Transportation (USDOT): USDOT regulations pertain to public health through its mission of ensuring that various modes of transportation operate safely on an individual basis and together as an interlinked transportation system. USDOT provides numerous transportation safety organizations and programs to protect public health (http://www.dot.gov/safety.html).

STATE

- DEC: DEC is responsible for protecting and enforcing environmental laws and regulations for New York State. Among those pertinent to the proposed project are those related to solid waste management, water quality (groundwater and surface water), wetlands, and air quality protection. With respect to air quality, DEC has implemented numerous programs to maintain or improve existing air quality at both a local and regional level. New or modified sources of emissions are issued permits and registrations by DEC. DEC environmental regulations under Title 6 of the New York State Codes, Rules and Regulations (NYCRR) at Part 360, which governs Solid Waste Management Facilities are directly applicable to both Fresh Kills Landfill and the proposed project. These regulations cover the final closure and post-closure design, operation, maintenance, and monitoring of solid waste landfills in New York State. DEC also regulates the cleanup of sites under the brownfields program.
- New York State Department of Health (NYSDOH): NYSDOH maintains public and human health standards (www.health.state.ny.us/home.html). NYSDOH also regulates drinking water. While EPA distinguishes between health-based (primary) and aesthetic (secondary) water standards, NYSDOH considers them equally important.
- New York State Department of Transportation (NYSDOT): NYSDOT has an Environmental Procedure Manual (http://www.dot.state.ny.us/eab/epm.html) that supports its mission to ensure that that those who live, work and travel in New York State are entitled to a safe, efficient, balanced and environmentally sound transportation system.

LOCAL

- NYCDEP: NYCDEP is responsible for the installation and maintenance of the water and supply sewer systems for the City of New York. Through numerous programs, NYCDEP protects the quality of the City’s waterbodies. NYCDEP also performs a New York harbor survey which is relevant to the proposed project, as it includes water quality monitoring data for selected locations near Fresh Kills Landfill.
- NYCDOHMH: NYCDOHMH’s mission is to protect and promote the health of New York City residents. NYCDOHMH has taken the lead in developing programs to reduce asthma-related illnesses in New York City by undertaking initiatives, and providing public health information for medical practitioners and the public on asthma treatments and effects on health. Agency responsibilities also include implementing the New York City Health Code, Title IV, Environmental Sanitation. The most relevant Article under this Title is 173 (governing hazardous substances). NYCDOHMH also takes the lead in the City’s comprehensive mosquito surveillance and control planning and other public health protections such as the monitoring and control of rabies.

STANDARDS FOR DETERMINING POTENTIAL PUBLIC HEALTH IMPACTS

AIR QUALITY STANDARDS

Criteria Pollutants

With respect to determining significant air quality impacts, any proposal where an increased concentration of a criteria air pollutant to a level that exceeds the concentrations defined by the NAAQS (see the description above) is predicted to have a potentially significant adverse public health impact. In addition, to maintain concentrations lower than the NAAQS in attainment areas, or to ensure that concentrations are not significantly increased in non-attainment areas, threshold levels have been defined for determining significant impacts when increases in pollutant concentrations related to a proposed action or project are predicted. Any action predicted to increase the concentrations of these pollutants above the identified threshold levels would be deemed to have a potential significant adverse air quality impact, even in cases where violations of the NAAQS are not predicted. The *CEQR Technical Manual* defines these threshold levels for increases in pollutant levels that are predicted as part of a project's environmental review.

As required by the Clean Air Act, primary and secondary NAAQS have been established for six criteria air pollutants: CO, NO_2, ozone, respirable PM (both $PM_{2.5}$ and PM_{10}), SO_2, and lead (see Table 21-1). The primary standards are constituent concentrations that have been established to protect public health, while also allowing a margin of safety. The secondary standards are intended to protect soil, water, visibility, materials, vegetation, and other elements of the environment. The primary and secondary standards are the same for NO_2, ozone, lead, and PM. There is no secondary standard for CO.

EPA has revised the NAAQS for particulate matter, effective December 18, 2006. The revision included lowering the level of the 24-hour $PM_{2.5}$ standard from the current level of 65 micrograms per cubic meter ($\mu g/m^3$) to 35 $\mu g/m^3$ and maintaining the annual standard at 15 $\mu g/m^3$. In addition, the PM_{10} 24-hour average standard was retained and the annual average PM_{10} standard was revoked.

$PM_{2.5}$ is currently subject to NYCDEP and DEC interim guidance impact criteria because ambient air monitoring data for this criteria pollutant is currently being reviewed and evaluated in New York City and throughout the state. However, the interim guidance criteria are incremental values that are only applicable to new sources of $PM_{2.5}$ emissions. Since the DSNY flares, gas recovery plant and other facilities are existing sources the interim guidance criteria would not apply to these facilities that would continue to operate independent of the proposed project.

Table 21–1
National Ambient Air Quality Standards (NAAQS)

Pollutant	Primary Standard		Secondary Standard	
	ppm	μg/m³	ppm	μg/m³
Carbon Monoxide (CO)				
8–Hour Average (1)	9	10,000	None	
1–Hour Average (1)	35	40,000		
Lead				
3-Month Average	NA	1.5	NA	1.5
Nitrogen Dioxide (NO_2)				
Annual Average	0.053	100	0.053	100
Ozone (O_3)				
8–Hour Average (2)	0.075	160	0.075	160
Respirable Particulate Matter (PM_{10})				
Average of 3 Annual Means — (revoked, effective December 18, 2006)	NA	50	NA	50
24–Hour Average (1)	NA	150	NA	150
Fine Respirable Particulate Matter ($PM_{2.5}$)				
Average of 3 Annual Means	NA	15	NA	15
24–Hour Average (3)	NA	35	NA	35
Sulfur Dioxide (SO_2)				
Annual Arithmetic Mean	0.03	80	NA	NA
Maximum 24–Hour Average (1)	0.14	365	NA	NA
Maximum 3–Hour Average (1)	NA	NA	0.50	1,300

Notes: ppm – parts per million
μg/m³ – micrograms per cubic meter
NA – not applicable
PM concentrations (including lead) are in μg/m³ since ppm is a measure for gas concentrations. Concentrations of all gaseous pollutants are defined in ppm and approximately equivalent concentrations in μg/m³ are presented.
(1) Not to be exceeded more than once a year.
(2) 3–year average of the annual fourth highest daily maximum 8–hr average concentration. Standard lowered in March 2008.
(3) Not to be exceeded by the annual 98th percentile when averaged over 3 years.
Source: 40 CFR Part 50: National Primary and Secondary Ambient Air Quality Standards.

Recommended Guideline Concentrations for Non-Criteria Pollutants

New York State also seeks to control the ambient levels of air toxics through the use of recommended guideline concentrations in the New York Code, Rules and Regulations (6 NYCRR Part 212). These “non-criteria pollutants” include carcinogens, as well as non-carcinogenic compounds and irritants. DEC provides 1-hour and annual average guideline concentrations called SGCs and AGCs, respectively, for these compounds and describes the methodology for assessing the impact due to air toxic emissions in Air Guide-1: Guidelines for the Control of Toxic Air Contaminants (DAR-1, DEC, 1991) (see the discussion above). These guideline concentrations are presented in Table 21-2. Any action predicted to increase the concentration of a criteria air pollutant to a level that would exceed the concentrations defined by the SGC's or AGC's would generally be deemed to have a potential significantly adverse public health impact.

It should be noted that DEC guidance interprets impacts of less than 10 times higher than the AGC for carcinogenic compounds that have a risk-based threshold (which includes tetrachloroethylene) as allowable, as long as BACT is in place. The DEP permitted sources listed above are equipped with state-of-the-art controls designed to minimize the formation and emission of tetrachloroethylene vapors to the atmosphere, which clearly represents BACT. Thus, these allowances would apply.

GROUNDWATER STANDARDS

The groundwater standards for Staten Island are class GA. While these standards are applied to Staten Island aquifers, it is recognized that no groundwater on Staten Island is used as a drinking water source.

Table 21-2
New York State Short Term and Annual Guidance Concentrations for Air Toxics

Compound	DEC SGC ($\mu g/m^3$)	DEC AGC ($\mu g/m^3$)
Acenaphthene	—	—
Acetaldehyde	4500	0.5
Acetone	180000	28000
Acetonitrile	—	60
Acrolein	0.19	0.02
Acrylonitrile	—	0.015
Allyl Chloride	600	1
Anthracene	—	0.02
Antimony	—	1.2
Arsenic	—	0.00023
Barium	—	1.2
Benzene	1300	0.13
Benzo (a) anthracene	—	0.02
Benzo (a) pyrene	—	0.0091
Benzyl Chloride	240	0.02
Beryllium	1	0.00042
Bis-(2-chloro,1-methyl ethyl) ether	—	—
Bis-(2-chloroethyl) ether	5800	0.003
Bromodichloromethane	—	0.02
Bromoform	—	0.91
Bromomethane	3900	5
Butadiene 1,3-	—	0.033
Butane n-	—	57000
Butyl Mercaptan n-	—	4.3
Cadmium	—	0.00024
Carbon Disulfide	6200	700
Carbon Tetrachloride	1900	0.067

Table 21-2 (cont'd)
New York State Short Term and Annual Guidance Concentrations for Air Toxics

Compound	DEC SGC (μg/m³)	DEC AGC (μg/m³)
Carbonyl Sulfide	250	28
Chlorobenzene	—	110
Chloroethane	—	10000
Chloroethyl vinyl ether 2-	—	—
Chloroform	150	0.043
Chloromethane	22000	90
Chromium	—	1.2
Chrysene	—	0.02
Cobalt	—	0.001
Copper	100	0.02
Cumene	—	400
Cyclohexane	—	6000
Decane n-	—	200
Dibromo-3-Chloropropane 1,2-	—	0.2
Dibromochloromethane	—	0.1
Dibromoethane 1,2-	—	0.0017
Dichlorobenzene 1,2-	30000	360
Dichlorobenzene 1,3-	30000	360
Dichlorobenzene 1,4-	—	0.09
Dichlorobenzene o-	30000	360
Dichlorodifluoromethane	—	12000
Dichloroethane 1,1-	—	0.63
Dichloroethane 1,2-	—	0.038
Dichloroethene 1,1-	—	70
Dichloroethene cis-1,2-	—	63
Dichloroethene trans-1,2-	—	63
Dichloropropane 1,2-	—	4
Dimethyl Disulfide	14	4.8
Dimethyl Sulfide	14	60
Dioxane 1,4-	3000	0.13
Epichlorohydrin	1300	0.83
Ethane	—	2900
Ethanol	—	45000
Ethyl Mercaptan	—	3.1
Ethylbenzene	54000	1000
Fluoranthene	—	—
Fluorene	—	—
Formaldehyde	30	0.06
Freon 114	—	17000
Heptane n-	210000	3900
Hexachloro-1,3-butadiene	—	0.045
Hexane	—	700
Hexanone 2-	4000	48
Hydrogen Chloride	2100	20
Hydrogen Sulfide	14	2
Isobutane	—	57000
Isobutanol	—	360
Isopentane	—	42000

Table 21-2 (cont'd)
New York State Short Term and Annual Guidance Concentrations for Air Toxics

Compound	DEC SGC (µg/m³)	DEC AGC (µg/m³)
Isopropyl Alcohol	98000	7000
Lead	—	0.38
Limonene	—	0.1
Mercury	1.8	0.3
Methacrylonitrile	—	6.4
Methyl Ethyl Ketone	13000	5000
Methyl Isobutyl Ketone	31000	3000
Methyl Mercaptan	14	2.3
Methyl tert-Butyl Ether	—	3000
Methylcyclohexane	—	3800
Methylcyclopentane	—	700
Methylene Chloride	14000	2.1
Naphthalene	7900	3
Nonane n-	—	25000
Octane n-	—	3300
Pentane	—	4200
Pentene 1-	—	700
Phenanthrene	—	0.02
Phenol	5800	45
Propane	—	43000
Propyl Mercaptan n-	160	3.8
Propylbenzene n-	54000	1000
Propylene Oxide	3100	0.27
Pyrene	—	0.02
Styrene	17000	1000
Tetrachloroethane 1,1,2,2-	—	0.016
Tetrachloroethene	1000	1
Toluene	37000	5000
Trichlorobenzene 1,2,4-	3700	—
Trichloroethane 1,1,1-	68000	1000
Trichloroethane 1,1,2-	—	1.4
Trichloroethene	14000	0.5
Trichlorofluoromethane	68000	1000
Trichlorotrifluoroethane	960000	180000
Trimethylbenzene 1,2,3-	—	290
Trimethylbenzene 1,3,5-	29000	290
Trimethylpentane 2,2,4-	—	3300
Vanadium	—	0.2
Vinyl Acetate	5300	200
Vinyl Chloride	180000	0.11
Xylene o-	4300	100
Xylenes	4300	100
Zinc	—	45

SURFACE WATER/SEDIMENT CONDITIONS AND RECREATIONAL/COMMERCIAL FISHERIES

WATER USE CLASSIFICATIONS

Title 6 of the NYCRR Part 703 provides surface water standards and Use Classification for New York State surface waters. The New York State classified use of the Arthur Kill and the lower portion of the Fresh Kills defines them as suitable for fish survival (Use Class SD) (see Figure 21-4). This classification is applied to water bodies that cannot meet the requirements for primary (e.g. swimming) and secondary (e.g. boating) human contact and fish propagation. The classification for Richmond Creek, Main Creek and the upper portion of Fresh Kills Creek requires that the water be suitable for fish propagation and survival, and for primary and secondary contact recreation (Use Class SC).

WATER QUALITY STANDARDS

There are several primary water quality objectives for SC and SD waters. These include the following:

- **Fecal Coliform.** The presence of coliform bacteria in surface waters indicates potential health impacts from human or animal waste, and elevated levels of coliform can result in the closing of bathing beaches and shellfish beds.
- **Dissolved Oxygen (DO).** DO in the water column is necessary for respiration by all aerobic forms of life, including fish and invertebrates such as crabs, clams, and zooplankton. Thus, DO is one of the most universal indicators of overall water quality in aquatic systems.
- **Nutrients.** Although not a public health issue, high levels of nutrients can lead to excessive plant growth (a sign of eutrophication) and depletion of DO.
- **Transparency.** Although also not a public health issue, secchi transparency is a measure of the clarity of surface waters.

A more detailed description of the standards is provided in Chapter 10, “Natural Resources.”

FISH ADVISORIES

The catch and consumption of fish is one pathway for toxics from the aquatic environment into the human body. For this reason, the DEC routinely monitors potentially harmful levels of contaminants in fish and wildlife in New York State waters. The general health advisory for sportfish obtained from New York’s fresh waters and the marine waters at the mouth of the Hudson River, including the Arthur Kill, is that a person should eat no more than one half pound of fish per week, or six blue crabs (*Callinectes sapidus*) per week. Specific restrictions have been issued on the consumption of certain species of fish from the Arthur Kill, Kill van Kull and Newark Bay due to concentrations of dioxin and PCBs. Fish not recommended for consumption include American eel (*Anguilla rostrata)*, gizzard shad (*Dorosoma cepedianum*), striped bass (*Morone saxatilis)* and white perch (*Morone Americana*). Fish recommended for consumption of no more than one meal per month include Atlantic needlefish (*Strongylura marina*), bluefish (*Pomatomus saltatrix)*, and rainbow smelt (*Osmersus mordax*) (NYSDOH 2007).

SOIL CRITERIA

As described in greater detail in Chapter 1 “Project Description,” the guiding the strategy for soils at Fresh Kills Park are standards found under Title 6 NYCRR Part 375 Environmental Remediation Program, which regulates the redevelopment of “brownfield” sites in New York State. Although not directly applicable to landfills, Part 375 Soil Cleanup Objectives can be used as guidance for sites regarding land use conversion to a park/open space use that would allow public access and create vegetation and wildlife communities.

D. EXISTING CONDITIONS

AIR QUALITY

BACKGROUND CONCENTRATIONS

To estimate the maximum projected total pollutant concentrations at modeled air quality receptors within the park, pollutant concentrations were predicted using EPA’s AERMOD model and then added to corresponding background concentrations for criteria pollutants. These background values are presented in Table 21-3, below, along with the monitoring station data source. The maximum value for the most recent available five years of data was obtained for NO_2 (2001–2005), SO_2 (2000–2004) and CO (2000–2004). The maximum value for the most recent available three years of data was obtained for PM_{10} (2002–2004). Annual values presented in Table 21-3 are the overall highest reported concentrations. Short-term values in the table (i.e., 24-hour averaging periods or less) are the highest reported concentrations.

Table 21-3
Background Concentrations of Criteria Pollutants

Pollutant	Monitoring Station	Averaging Period	Background Concentration (ug/m^3)	Ambient Standard (ug/m^3)
NO_2	Elizabeth Lab, NJ	Annual	75.3	100
CO	Elizabeth Lab, NJ	1-hr	5,840	40,000
		8-hr	4,008	10,000
PM_{10}	Susan Wagner, NY	24-hr	51	150
SO_2	Elizabeth Lab, NJ	3-hr	162.3	1300
		24-hr	65.4	365
		Annual	23.6	80

Sources:
DEC State Ambient Air Quality Reports, 2000 through 2005 (DEC 2007).
NJDEP State Ambient Air Quality Reports, 2000 through 2005 (NJDEP 2007).

The DEC Susan Wagner H.S. monitoring station in Staten Island, New York was selected for the PM_{10} background data because of its proximity to the Fresh Kills Landfill. However, PM_{10} data has only been collected at this location in recent years. Therefore, historical data for the remaining pollutants (i.e., NO_x, SO_2, and CO) were selected from the Elizabeth Lab monitoring station in Elizabeth, New Jersey, which is five miles northwest across the Arthur Kill from Fresh Kills Landfill and the next closest air monitoring station. Data for the Elizabeth Lab monitoring station was obtained from the New Jersey Department of Environmental Protection (NJDEP). Since prevailing winds from the west may carry background pollutants from industrial areas of eastern New Jersey toward Staten Island, use of data from this station is considered to be a reasonable source for representing background conditions for the area, adding in the contributions from existing permits. Data from Elizabeth, NJ was also accepted by DEC for modeling analyses performed in support of the DSNY air permit application for the on-site flares (see the description above).

MODELING RESULTS

Criteria Pollutants

The modeling analysis for criteria pollutants was performed cumulatively for the nearby stationary sources which include the Staten Island Waste Transfer Station (building ventilation and boiler stack), a thermal oxidizer and two compressor engines at the landfill gas recovery plant, and the six landfill gas flares. The analysis as performed is extremely conservative since it was assumed in the model the flares and gas plant were both operating at the maximum capacity which is a situation that could not occur. In addition, the emission rates are held steady over time and are therefore they are based on the peak landfill gas generation rates when, in fact, landfill gas generation will diminish significantly through the 2016 and 2036 analysis years. However, the reasonable worst-case assumption is the current condition. Using the methodologies presented above, the maximum predicted concentrations of each air pollutant for each applicable averaging period are presented in Table 21-4 along with background concentrations obtained from the stations described above. As shown in that table, the results of the modeling analysis demonstrate compliance with the NAAQS for NO_2, CO, PM_{10} and SO_2 at ground level receptors placed within the boundaries of the proposed Fresh Kills Park.

Table 21-4
Fresh Kills Park Cumulative Air Quality Impacts from Nearby Sources
Maximum Predicted Criteria Pollutant Concentrations ($\mu g/m^3$)

Pollutant	Averaging Period	Concentration Due to Source Emissions	Maximum Background Concentration[a]	Total Concentration	Air Quality Standard
NO_2 [b]	Annual	3.0	75.3	78.3	100
CO	1-hr	130	5,840	5,970	40,000
	8-hr	87	4,008	4,095	10,000
PM_{10}	24-hr	12.7	51	63.7	150
SO_2	3-hr	12.5	162.3	174.8	1300
	24-hr	5.7	65.4	71.1	365
	Annual	0.35	23.6	23.95	80

Notes: a). Background concentrations are from DEC and NJDEP monitoring data. b). A ratio of 55% NO_2 to NO_x was employed in the analysis in accordance with NYCDEP procedures.
Source: ARKF, Inc., January, 2008.

Non-Criteria Pollutants

As previously stated, although landfill gas is mostly comprised primarily of methane and CO_2, it also contains small amounts of other gases, such as hydrogen sulfide, NMOC and certain metals. Many of these non-criteria pollutants or “air toxic” compounds are regulated by DEC and are potentially emitted by the landfill gas flares and landfill gas recovery plant when they are active. According to the 2006 DSNY Annual Emission Statement for Fresh Kills, the flares operate approximately 10 percent of the time; otherwise the landfill gas is collected and conveyed to the gas treatment facility. In addition to these on-site emissions, there are two nearby dry cleaners that have air emission permits for tetrachloroethylene (also known as perchloroethylene [PCE]) as permitted by the NYCDEP for industrial sources. For the analysis of non-criteria pollutants, a cumulative modeling assessment was performed examining the combined effects of all these sources. Provided below in Table 21-5 is a summary of the predicted concentrations for each of the air toxic compounds examined in this analysis along with the listed corresponding DEC guidelines for SGCs and AGCs. As shown in the table, the results of the modeling analysis in almost all cases demonstrate compliance with the DEC air guideline concentrations (see the discussion of tetrachloroethylene, acrolein, and formaldehyde below) for all receptors within the park boundaries. The exceptions are described below.

Table 21-5
Fresh Kills Park Maximum Predicted Air Toxic Concentrations (μg/m3)

Compound	Predicted One-hour Conc. (μg/m^3)	DEC SGC (μg/m^3)	Predicted Annual Conc. (μg/m^3)	DEC AGC (μg/m^3)
Acenaphthene	5.1E-04	—	3.3E-05	—
Acetaldehyde	1.3E+00	4500	8.2E-02	0.5
Acetone	3.1E-02	180000	4.7E-04	28000
Acetonitrile	2.3E-03	—	7.6E-05	60
Acrolein	1.3E+00	0.19	8.2E-02	0.02
Acrylonitrile	2.3E-03	—	7.6E-05	0.015
Allyl Chloride	1.8E-03	600	6.7E-05	1
Anthracene	1.2E-04	—	7.5E-06	0.02
Antimony	3.4E-02	—	2.8E-04	1.2
Arsenic	2.0E-02	—	1.8E-04	0.00023
Barium	2.9E-05	—	1.9E-06	1.2
Benzene	3.3E-01	1300	2.1E-02	0.13
Benzo (a) anthracene	5.4E-05	—	3.5E-06	0.02
Benzo (a) pyrene	3.8E-06	—	2.5E-07	0.0091
Benzyl Chloride	2.1E-02	240	3.1E-04	0.02
Beryllium	1.7E-06	1	2.2E-07	0.00042
Bis-(2-chloro,1-methyl ethyl) ether	4.2E-04	—	9.4E-06	—
Bis-(2-chloroethyl) ether	1.8E-03	5800	6.7E-05	0.003
Bromodichloromethane	1.8E-03	—	6.7E-05	0.02
Bromoform	1.9E-03	—	6.7E-05	0.91
Bromomethane	2.3E-03	3900	7.7E-05	5
Butadiene 1,3-	1.4E-01	—	8.8E-03	0.033
Butane n-	8.1E-01	—	5.2E-02	57000
Butyl Mercaptan n-	3.4E-04	—	5.0E-06	4.3
Cadmium	1.4E-04	—	1.5E-06	0.00024
Carbon Disulfide	2.0E-02	6200	8.7E-04	700
Carbon Tetrachloride	1.2E-02	1900	7.1E-04	0.067
Carbonyl Sulfide	9.7E-04	250	3.5E-05	28
Chlorobenzene	4.3E-02	—	1.5E-03	110
Chloroethane	5.2E-03	—	1.4E-04	10000
Chloroethyl vinyl ether 2-	4.2E-04	—	9.4E-06	—
Chloroform	1.1E-02	150	5.9E-04	0.043
Chloromethane	4.3E-02	22000	1.0E-03	90
Chromium	2.3E-04	—	1.9E-06	1.2
Chrysene	1.1E-04	—	7.0E-06	0.02
Cobalt	5.6E-07	—	3.6E-08	0.001

Table 21-5 (cont'd)
Fresh Kills Park Maximum Predicted Air Toxic Concentrations (μg/m3)

Compound	Predicted One-hour Conc. (μg/m^3)	DEC SGC (μg/m^3)	Predicted Annual Conc. (μg/m^3)	DEC AGC (μg/m^3)
Copper	5.6E-06	100	3.7E-07	0.02
Cumene	1.1E-02	—	4.1E-04	400
Cyclohexane	3.3E-03	—	4.9E-05	6000
Decane n-	1.7E-01	—	2.6E-03	200
Dibromo-3-Chloropropane 1,2-	1.8E-03	—	6.7E-05	0.2
Dibromochloromethane	1.1E-03	—	1.6E-05	0.1
Dibromoethane 1,2-	1.9E-03	—	6.7E-05	0.0017
Dichlorobenzene 1,2-	1.6E-03	30000	3.7E-05	360
Dichlorobenzene 1,3-	2.4E-02	30000	3.6E-04	360
Dichlorobenzene 1,4-	3.1E-01	—	1.1E-02	0.09
Dichlorobenzene o-	2.8E-02	30000	4.1E-04	360
Dichlorodifluoromethane	2.9E-02	—	4.3E-04	12000
Dichloroethane 1,1-	1.3E-02	—	6.3E-04	0.63
Dichloroethane 1,2-	8.6E-03	—	5.1E-04	0.038
Dichloroethene 1,1-	1.9E-02	—	6.7E-04	70
Dichloroethene cis-1,2-	4.8E-03	—	7.2E-05	63
Dichloroethene trans-1,2-	1.6E-03	—	2.7E-05	63
Dichloropropane 1,2-	9.0E-03	—	5.3E-04	4
Dimethyl Disulfide	1.7E-04	14	2.5E-06	4.8
Dimethyl Sulfide	6.8E-03	14	1.0E-04	60
Dioxane 1,4-	2.3E-03	3000	7.7E-05	0.13
Epichlorohydrin	1.8E-03	1300	6.6E-05	0.83
Ethane	1.2E+01	—	7.8E-01	2900
Ethanol	9.3E-02	—	1.4E-03	45000
Ethyl Mercaptan	1.4E-03	—	2.1E-05	3.1
Ethylbenzene	1.0E-01	54000	4.0E-03	1000
Fluoranthene	5.8E-05	—	3.8E-06	—
Fluorene	2.7E-04	—	1.8E-05	—
Formaldehyde	8.9E+00	30	5.8E-01	0.06
Freon 114	1.4E-03	—	2.1E-05	17000
Heptane n-	5.9E-03	210000	8.7E-05	3900
Hexachloro-1,3-butadiene	1.9E-02	—	6.8E-04	0.045
Hexane	9.6E-02	—	5.9E-03	700
Hexanone 2-	1.5E-03	4000	2.5E-05	48
Hydrogen Chloride	1.1E+01	2100	1.7E-01	20
Hydrogen Sulfide	2.4E-01	14	3.5E-03	2
Isobutane	4.2E-02	—	6.2E-04	57000
Isobutanol	4.2E-04	—	9.4E-06	360
Isopentane	2.4E-02	—	3.5E-04	42000
Isopropyl Alcohol	2.4E-02	98000	3.6E-04	7000
Lead	1.3E-03	—	9.5E-06	0.38
Limonene	4.2E-01	—	6.3E-03	0.1
Mercury	3.5E-03	1.8	2.6E-05	0.3
Methacrylonitrile	4.2E-04	—	9.4E-06	6.4
Methyl Ethyl Ketone	8.1E-02	13000	2.9E-03	5000
Methyl Isobutyl Ketone	4.8E-03	31000	1.7E-04	3000

Table 21-5 (cont'd)
Fresh Kills Park Maximum Predicted Air Toxic Concentrations (µg/m3)

Compound	Predicted One-hour Conc. (µg/m^3)	DEC SGC (µg/m^3)	Predicted Annual Conc. (µg/m^3)	DEC AGC (µg/m^3)
Methyl Mercaptan	3.7E-03	14	5.4E-05	2.3
Methyl tert-Butyl Ether	1.9E-03	—	6.7E-05	3000
Methylcyclohexane	4.4E-03	—	6.6E-05	3800
Methylcyclopentane	1.7E-03	—	2.5E-05	700
Methylene Chloride	5.8E-02	14000	2.4E-03	2.1
Naphthalene	3.1E-02	7900	1.6E-03	3
Nonane n-	4.0E-02	—	5.9E-04	25000
Octane n-	9.9E-03	—	1.5E-04	3300
Pentane	2.7E-01	—	1.8E-02	4200
Pentene 1-	9.6E-04	—	1.4E-05	700
Phenanthrene	5.7E-04	—	3.7E-05	0.02
Phenol	6.8E-03	5800	4.4E-04	45
Propane	4.7E+00	—	3.1E-01	43000
Propyl Mercaptan n-	9.0E-04	160	1.3E-05	3.8
Propylbenzene n-	2.2E-02	54000	3.3E-04	1000
Propylene Oxide	1.8E-03	3100	6.6E-05	0.27
Pyrene	9.4E-05	—	6.1E-06	0.02
Styrene	4.1E-02	17000	1.7E-03	1000
Tetrachloroethane 1,1,2,2-	1.3E-02	—	7.7E-04	0.016
Tetrachloroethene	533	1000	2.59	1
Toluene	3.9E-01	37000	1.9E-02	5000
Trichlorobenzene 1,2,4-	2.4E-02	3700	8.7E-04	—
Trichloroethane 1,1,1-	3.8E-03	68000	1.4E-04	1000
Trichloroethane 1,1,2-	1.0E-02	—	6.2E-04	1.4
Trichloroethene	5.9E-03	14000	2.1E-04	0.5
Trichlorofluoromethane	2.1E-02	68000	4.1E-04	1000
Trichlorotrifluoroethane	4.1E-03	960000	6.1E-05	180000
Trimethylbenzene 1,2,3-	2.0E-02	—	3.0E-04	290
Trimethylbenzene 1,3,5-	1.8E-02	29000	2.7E-04	290
Trimethylpentane 2,2,4-	3.0E-03	—	4.4E-05	3300
Vanadium	1.5E-05	—	9.9E-07	0.2
Vinyl Acetate	1.8E-03	5300	6.6E-05	200
Vinyl Chloride	1.1E-02	180000	3.9E-04	0.11
Xylene o-	1.2E-01	4300	4.1E-03	100
Xylenes	2.8E-01	4300	1.1E-02	100
Zinc	1.9E-04	—	1.3E-05	45
Source: AKRF, November, 2007				

Tetrachloroethylene

Based on the above analyses, concentrations of tetrachloroethylene within the proposed park were equal to 0.002 µg/m^3 for the SGC period and 0.00072 µg/m^3 for the AGC period. These results are well below the corresponding SGC guideline of 1,000 µg/m^3 and the AGC guideline of 1.0 µg/m^3. The maximum values presented in Table 21-5 are due to the emissions generated by two dry cleaners on the southwest corner of the Fresh Kills property boundary. Elevated levels of tetrachloroethylene are not unexpected in this case since these two dry cleaners are located immediately adjacent (i.e., less than 100 feet) to the boundary of the proposed park. However, the extent of the area affected by these elevated concentrations is essentially limited to the property boundary in close proximity to the dry cleaners. However, it merits mention that dry cleaners can also be sources of groundwater contamination although no PCE plumes are known to be associated with either of these sites (see also "Groundwater Quality," below).

With regard to these dry cleaning facilities, it is noted that the owners and/or operators of any dry cleaning establishment that use tetrachloroethylene (also known as perchloroethylene or perc) must comply with state air pollution regulations. These rules are codified in 6 NYCRR Part 232. The Part 232 regulations include among other things, the mandatory use of specific air pollution control systems designed to reduce and contain the release of tetrachloroethylene and to minimize the public's exposure to these vapors. As indicated in the NYCDEP air permit, both of these dry cleaning facilities have installed DEC certified fourth generation equipment which is in compliance with Part 232 regulations.

Although the maximum predicted annual concentration of tetrachloroethylene from these facilities exceeds the DEC AGC of 1.0 micrograms per cubic meter ($\mu g/m^3$), this does not represent a significant public health impact. This is because DEC guidance interprets impacts of less than 10 times higher than the AGC for carcinogenic compounds that have a risk-based threshold (which includes tetrachloroethylene) as allowable, as long as BACT is in place. As stated above these sources are equipped with state-of-the-art controls which are designed to minimize the formation and emission of tetrachloroethylene vapors to the atmosphere, and clearly represents BACT.

Acrolein and Formaldehyde

The modeling analysis also indicated that concentrations of acrolein and formaldehyde could exceed the SGC for acrolein and the AGC for acrolein and formaldehyde as indicated in Table 21-5. Source contributions to these predicted ambient concentrations are almost entirely from the existing compressor engines located at the gas recovery plant on Muldoon Avenue (i.e., ambient concentrations from the landfill gas flares are well below the SGC and AGC values). It should also be noted that these predicted concentrations are based on emission rates derived from extremely conservative emission factors obtained from Table 3.2-1 of EPA's AP-42 guidance manual and are not based on actual stack test emissions data. Furthermore, the modeling analysis conservatively assumes that the future processing rates would be equal to those presented in the 2006 emission statement. It is expected that gas generated by the landfill and diverted to the gas recovery plant would be significantly reduced by the proposed build year for the park.

DEC AMBIENT AIR QUALITY MONITORING AT FRESH KILLS

Introduction

As described above and in greater detail in Chapter 1 "Project Description," Fresh Kills Landfill has an active gas collection system to control the release of landfill gases to the atmosphere (see also Figure 21-3). The process includes a mechanical blower to retrieve the landfill gases under negative pressure via collection pipes (i.e., the blower creates a vacuum). The system is designed to have a collection efficiency of 90 percent or greater. However, gaseous emissions not captured by the collection system, particularly in waste areas near the edges of the landfill sections, may not be as efficiently collected and could consequently be released to the atmosphere as fugitive emissions. These fugitive emissions may include gas that escapes through the landfill cover, migrate through underground soil, or are released through the passive vents at the landfill surface if negative pressure is not maintained (see Figure 21-5). To understand the extent of the effect of these emissions on ambient air quality at the landfill and in response to concerns regarding these emissions, DEC has conducted periodic monitoring of ambient air in the vicinity of the Fresh Kills Landfill.

The monitoring program includes an upwind monitoring site called Fresh Kills West (Site No. 7097-17) and a downwind monitoring site called Fresh Kills East (Site No. 7097-19). There were 44 VOCs sampled at each location during the annual period. The analysis of these data and a summary of the conclusions presented in the report "Assessment of Methane and Toxic Compounds over Fresh Kills Landfill and Surrounding Areas of New York City: A Pilot Study," (August 6, 2004), are provided below.

Analysis of Ambient Conditions

A review of the DEC air monitoring data (see Appendix E) disclosed that a total of ten compounds exceeded the AGC in the year 2002 while eleven exceeded the AGC in the year 2003. Four of these compounds had annual average concentrations that were over 10 times the AGC threshold. However, it is noted that only one compound (13-butadiene in 2002) showed a significant increase between the upwind and downwind stations, and for some compounds the monitored concentration was actually less at the downwind station. This data comparison indicates that the landfill is not the only source of these compounds. In addition, the August 2004 DEC report stated that a correlation between measured air toxics at the upwind and downwind monitoring stations and the landfill could not be made and cited the effects of local industries and those in New Jersey (petrochemical facilities in particular) as one reason why it is difficult to discern any specific air toxic contributions from the Fresh Kills Landfill.

An additional detailed review of the monitoring data was made for this public health analysis using the raw 24-hour sample data (i.e., the data used to calculate the annual average concentrations presented in the summary tables). In this review, 24-hour sample data (as available from the DEC website) for the Fresh Kills East and West monitoring stations were correlated with wind direction data from LaGuardia Airport (LGA) and Newark Airport (EWR). Annual concentrations for the Fresh Kills monitoring sites were determined by averaging the concentrations of 24-hour samples collected on every sixth day throughout the year. The data set used in this assessment was the first and fourth quarters of 2002 and first through fourth quarters of 2003. There were approximately fifteen sample dates per quarter. The objective of this analysis was to use wind directions measured at the local airports to see if increases in air toxic concentrations between Fresh Kills West and East could be correlated with the wind passing over the landfill. One limitation to this analysis was that the wind direction data obtained for LGA represented prevailing winds for the day (not an hour by hour account) and the EWR wind data represented the direction of the maximum measured wind speed on that day.

The DEC air toxic database of 24 hour samples was matched to the available wind direction data and a synopsis of the correlation between wind direction in order to determine any increased levels of each air toxic compound for each quarterly sampling period. The results of this review also indicated, as with the DEC report, that there is no definitive relationship between the levels of air toxic compounds measured at either east or west stations and the landfill. Thus, no distinctive pattern could be drawn indicating that the landfill is a source of air toxics. Only in a few isolated instances (for vinyl chloride and dichloromethane) was there an increase in concentrations at the station on the downwind side of the landfill for a certain sample date. Thus, no distinctive definitive pattern could be drawn from the database indicating that the landfill is a source acting as a significant source of air contaminants.

DSNY LANDFILL GAS MONITORING

Test Wells

In addition to the above analysis of ambient air by DEC, DSNY performs quarterly monitoring of subsurface methane concentrations around the landfill perimeter. The purpose of this monitoring program is to detect any migration of landfill gases away from the landfill sections. The latest available reports (Shaw Environmental, October 2007) indicate that several landfill perimeter gas wells had elevated methane concentrations, but that this was not necessarily attributable to the landfill and could be associated with the decomposition of other organic matter below the fill layers.

Surface Monitoring

A review was also performed of the most recent (April 1, 2007 through September 30, 2007) EPA semi-annual compliance certification form (Form A-Comp). The EPA form for the landfill monitoring program presents a compliance record for the period by permit condition (contained in the Title V Permit) and includes notations of deviations from the terms of the air permit. It includes pertinent information regarding the recordkeeping and reporting of data from each section of the landfill (i.e., Sections 6/7, 2/8, 3/4 and 1/9). The information provided indicates that most of the Title V permit conditions are currently being met on a continuous basis with some exceptions where non-compliant situations were monitored and quickly remediated within timeframes allowed by the permit. Most of the reported non-compliant situations were related to wellhead pressure (i.e., negative pressure was not maintained) and surface methane concentrations (i.e., exceeded 500 ppm) on Landfill Section 6/7 or 1/9 and were due to construction/maintenance on the final cover.

A review was also been performed of the most recent (April 1, 2007 through September 30, 2007) semi-annual landfill gas collection and control system compliance reports for Landfill Sections 2/8 and 3/4 (dated October 30, 2007). Landfill Sections 2/8 and 3/4 have been closed for many years and conditions there are expected to be very stable. The reports contain summaries of information collected by the landfill operators in regards to various recordkeeping requirements imposed by the Title V permit conditions. Relevant points regarding the compliance status at Sections 2/8 and 3/4 include the following notes highlighted in the executive summaries of both reports:

- The flare emission rates were below Title V Permit thresholds;
- The flares operated in compliance with the restrictions imposed by the Title V Permit;
- Routine inspections of the final cover were performed;
- Monthly monitoring and inspection of landfill gas wells were performed and compliance with Title V permit conditions was confirmed; and
- Surface methane monitoring was performed and compliance with Title V permit conditions was confirmed.

In conclusion, the semi-annual compliance reports and EPA certification forms indicate that the Fresh Kills landfill is being operated in a manner consistent with the conditions of the Title V Permit and that issues regarding public health and exposure to contaminants related to the landfill are currently minimized by an effective and proactive monitoring program.

GROUNDWATER CONDITIONS[1]

Because of the project site's history as a municipal solid waste disposal facility, and in accordance with the Fresh Kills Landfill Post Closure Monitoring and Maintenance Program, regular groundwater monitoring is performed by DSNY. Beginning in 1997, leachate control systems were installed at the landfill sections at Fresh Kills Landfill. These systems, along with a constructed final cover (in-place at Landfill Sections 3/4 and 2/8 and under construction at Sections 6/7 and 1/9) limit the generation of leachate and intercept potential leachate discharges to local groundwater. A review of the groundwater monitoring data gathered at the site indicates that for the period after the installation of the leachate control systems (for sampling period 1998 to 2006), the majority of the statistical trends showed decreasing concentrations of pollutants (Shaw, 2007). These data are indicative of the effectiveness of the leachate control systems since their installation. Groundwater analytical results from 2006 indicated certain exceedances of ambient water quality standards and guidance valves for leachate indicator parameters, including VOCs, SVOCs PCBs, pesticides and/or metals in the shallow/refuse monitoring zone, intermediate depth monitoring zone and the deep (bedrock) monitoring zone (Shaw, 2007). Although groundwater conditions beneath the project site exhibit evidence of various organic and inorganic contaminants that in certain cases exceed State groundwater standards, the data also indicates that conditions do not dramatically differ from conditions for the surrounding area and are improving with the environmental control systems in-place (relevant groundwater monitoring data is provided in the above-referenced reports).

SURFACE WATER/SEDIMENT CONDITIONS AND FISHERIES

WATER QUALITY TRENDS IN NEW YORK HARBOR (BOUNDARY CONDITIONS)

The results of recent Harbor Surveys (NYCDEP 2001, 2002, 2003, 2004, 2005, 2006) show that the water quality of New York Harbor has improved significantly since the 1970s as a result of the many water quality improvement projects undertaken by the City of New York and the region as a whole. These measures include eliminating 99 percent of raw dry-weather sewage discharges, reducing illegal discharges, increasing the capture of wet-weather related "floatables," and reducing the toxic metals loadings from industrial sources by 95 percent (NYCDEP 2002). The 1999 and 2000 Interstate Environmental Commission (IEC) 305(b) reports also indicate that the year-round disinfection requirement for discharges to waters within its district (including New York Harbor) has contributed significantly to water quality improvements since the requirement went into effect in 1986 (IEC 2000, 2001). As a result, overall fecal coliform concentrations in this area have declined, significantly improving water quality from the early 1970s, when levels were well above 2,000 colonies/100 mL. The result of these improvements, Inner Harbor waters have been opened for most recreational activities (DEP 2004).

NYCDEP HARBOR SURVEY DATA FOR FRESH KILLS

Recent survey data from the Harbor Survey Station K4: Fresh Kills, in the Arthur Kill and near the project site, indicate that the water quality in this part of the lower Arthur Kill conforms to

[1] Sources: Fresh Kills Landfill 2006 Annual Groundwater Monitoring Report, Environmental Monitoring Program (Shaw Environmental, September 6, 2007); Fresh Kills Landfill 2005 Annual Groundwater Monitoring Report (Shaw Environmental 2005).

NYCRR water quality standards for Use Classification SD (this data is provided in greater detail in Chapter 10 "Natural Resources"). The following is a summary of those conditions.

- **Fecal Coliform.** Recent monitoring data show that the waters of the Inner Harbor Area, which includes the Arthur Kill, complied with fecal coliform standards, although temporary increases in fecal coliform concentrations may occur due to increased runoff containing fecal coliform loadings following a rain event. This is not an unusual condition in an urbanized area with combined sewer overflows and runoff from highly developed areas.
- **Dissolved Oxygen (DO).** DO concentrations in the Inner Harbor Area have increased over the past 30 years from an average that was below 3 mg/L in 1970 to approximately 5.2 mg/L in 2006, (NYCDEP 2006), above the 3.0 mg/L standard for Use Class SD waters. Within the Fresh Kills area, DO concentrations recorded by DSNY during annual late summer sampling at low tide from 2001 through 2004 within Fresh Kills Creek, Main Creek and Richmond Creek, have generally been at or above the 5 mg/L standard for Use Class SC waters (Shaw 2005), but were generally below the 5 mg/L standard during the 2006 annual late summer sampling (Shaw 2007). Unlike other parameters, higher concentrations of dissolved oxygen are indicative of healthier and ecologically productive waterbody.
- **Nutrients.** Although not a public health issue, high levels of nutrients can lead to excessive plant growth (a sign of eutrophication) and depletion of DO. In the Fresh Kills area, chlorophyll concentrations at Fresh Kills Survey Station K4 near the project site have generally been below the level suggestive of a eutrophic system; chlorophyll concentrations may occasionally be elevated at selected times of the year.
- **Transparency.** Although also not a public health issue, secchi transparency is a measure of the clarity of surface waters. In 2006, secchi depths reported at Fresh Kills Station K4 ranged from 2.5 to 6 feet, indicating that at times, transparency at this station was suggestive of poor water quality conditions.

DSNY WATER QUALITY DATA[1]

Since 1991, DSNY has been conducting water and sediment quality monitoring within the Arthur Kill and Fresh Kills estuary (i.e., the Fresh Kills estuary is defined as the Little Fresh Kills, Great Fresh Kills, Fresh Kills, Richmond Creek, and Main Creek waterbodies). As stated above, the landfill environmental control systems installed by DSNY, including a constructed final cover (in-place at Landfill Section 3/4 and 2/8 and under construction at Sections 6/7 and 1/9) limits the generation of leachate. Other components of the environmental protection system for water quality include subsurface hydraulic barriers (i.e. soil-cement or soil-bentonite cutoff walls) and leachate collection drains connected to a series of automated pump stations that collect and transport leachate to the DSNY Fresh Kills Landfill treatment plant. Discharge from the leachate treatment plant is regulated according to an individual SPDES permit that is maintained by DSNY.

Water and sediment samples are analyzed for a variety of chemical parameters including typical water chemistry parameters (i.e., alkalinity, biochemical oxygen demand [BOD], chemical oxygen demand [COD], color, DO, total Kjeldahl nitrogen [TKN], and turbidity), and metals

1 Sources: Fresh Kills Landfill 2004 Annual Surface Water and Sediment Monitoring Report, Environmental Monitoring Program (Shaw Environmental, April 6, 2005); Fresh Kills Landfill 2006 Annual Surface Water and Sediment Monitoring Report (Shaw Environmental, April 18, 2007).

(i.e., arsenic, barium, copper, lead, manganese, nickel, and zinc). Locations of the water quality sampling are shown in Figure 21-4. Results of sampling conducted between 1991 and 1995 indicated that during all seasons, parameters suggestive of leachate contamination were higher in Main and Richmond Creeks, but decreased gradually in the Great Fresh Kills toward the Arthur Kill. Results of sampling conducted after 1998 (and after the installation of the leachate control systems) show that by 2004 and 2006, certain of these parameters were exhibiting downward trends. For example, surface water TKN, ammonia, zinc, lead, alkalinity, copper and nickel have exhibited significant decreasing trends and significantly lower values or averages for the period after 1998 as compared to the period prior to the installation of the leachate collection system.

Only two VOCs were detected in the samples collected in the 2004 surface water quality monitoring program. Toluene was detected at a very low concentration in only one Main Creek sample and acetone, though detected frequently, was highest in the freshwater portion of Main Creek. Only three to five organic parameters have been detected between 1998 and 2004 (Shaw 2005). (Supporting groundwater monitoring data is provided in the above-referenced reports.)

RECREATIONAL AND COMMERCIAL FISHERIES

As stated above, the DEC routinely monitors potentially harmful levels of contaminants in fish and wildlife in New York State waters and the NYSDOH issues advisories on eating sportfish and wildlife on the basis of these testing results. The current health advisory for sportfish in the area is that a person should eat no more than one half pound of fish per week, or six blue crabs per week. Fish not recommended for consumption include American eel, gizzard shad, striped bass and white perch. Fish recommended for consumption no more than one meal per month include Atlantic needlefish, bluefish, and rainbow smelt (NYSDOH 2007). Neither recreational nor commercial fishing is currently allowed within the waters of Fresh Kills. The NYCDOHMH also provides guidance that mirrors the recommendations of NYSDOH and recommends no consumption of fish caught in local waters by women of child bearing age.

SEDIMENT QUALITY

BACKGROUND CONDITIONS IN NEW YORK HARBOR

Typical of all urban watersheds, New York Harbor Estuary sediments, including the Arthur Kill and the other waterways within the Fresh Kills Park project site, have experienced contamination due to a long history of industrial uses in the area. Contaminants found throughout the New York Harbor Estuary included pesticides such as chlordane and DDT, metals such as mercury and copper, and various polycyclic aromatic hydrocarbons (PAHs). Many of these chemical constituents are quite persistent in the environment undergoing little or no transformative biodegeneration, hydrolosis or other degradation-related reactions. Consequently, sediments within and in the vicinity of urban watersheds tend to act as "sinks" for these chemicals and can act as "slow releasing" sources into surface and groundwaters. Adams et al. (1998) found the mean sediment contaminant concentration for 50 of 59 chemicals measured to be statistically higher in the Harbor Estuary than other coastal areas on the East Coast. While the sediments of the New York Harbor Estuary are recognized as contaminated, the levels of most sediment contaminants (e.g., dioxin, DDT, and mercury) have decreased on average by an order of magnitude over the past 30 years (Steinberg, et al., 2002).

SEDIMENT QUALITY IN THE ARTHUR KILL

Arthur Kill sediment has been found to have very high concentrations of PCBs, dioxin, and DDT. Sediment quality data reported in the USEPA National Sediment Database for the Arthur Kill near Goethals Bridge and near the Arthur Kill/Kill van Kull confluence had concentrations of PAHs, metals (lead, mercury, and zinc), PCBs, and total DDT that may affect benthic organisms (Maxus 1991, National Oceanic and Atmospheric Administration (NOAA) 1991, USEPA 1993).

DSNY SEDIMENT QUALITY DATA[1]

As stated above, since 1991, DSNY has been conducting sediment quality monitoring (in addition to water quality monitoring) within the Arthur Kill and Fresh Kills waterbodies (i.e., Little Fresh Kills, Great Fresh Kills, Fresh Kills, Richmond Creek, and Main Creek) to assess the effects of the Fresh Kills Landfill on local sediments. Sediment samples have been collected from subtidal areas and analyzed for the same parameters discussed above under "Surface Water Quality".

For sediment samples collected in 1992, total nitrogen concentrations were found to be significantly higher in the Fresh Kills and Main Creek stations as compared with the Arthur Kill Station. Barium, nickel and zinc concentrations in sediment were also found to be higher in Fresh Kills, Main, and Richmond Creeks as compared with the Arthur Kill. Sulfide concentrations within sediments of the Fresh Kills system creeks were similar to those for Arthur Kill sediments. Sediment COD and total organic carbon (TOC) levels and concentrations of phenols, aluminum, arsenic, chromium, cobalt, copper, iron, lead, manganese, vanadium and total cyanide were similar in the Fresh Kills estuary and the Arthur Kill (DSNY 1996).

Results of sampling conducted within the Arthur Kill, Fresh Kill, Main, and Richmond Creeks after 1998 show a pattern that is supported by the results from the 2004 and 2006 sediment monitoring data, where certain parameters are suggestive of a downward trend. For example, ammonia, alkalinity, and total nitrogen exhibit significant decreasing trends at certain monitoring locations (Shaw 2007). These improvements in sediment quality may be indicative of decreasing leachate impacts on the local waterways and improvements in local sediments. Although results of the 2006 sediment sampling detected concentrations of contaminants, they were generally not indicative of leachate. These include strongly hydrophobic, bioaccumulative, and recalcitrant compounds such as alpha-chlordane, gamma chlordane, DDT, DDD, and DDE and the PAHs benzo(a)anthracene, benzo(b)fluoranthene, chrysene, fluoranthene, and pyrene—above the criteria in sediment samples collected from within Fresh Kills, Main, and Richmond Creeks, and from the Arthur Kill. (Shaw 2007).

SOIL CONDITIONS AND HAZARDOUS MATERIALS

INTRODUCTION

As described above, hazardous materials, as defined in the *CEQR Technical Manual*, are substances that pose a threat to human health and the environment including, but not limited to:

[1] Sources: Fresh Kills Landfill 2004 Annual Surface Water and Sediment Monitoring Report, Environmental Monitoring Program (Shaw Environmental, April 6, 2005); Fresh Kills Landfill 2006 Annual Surface Water and Sediment Monitoring Report (Shaw Environmental, April 18, 2007).

heavy metals, VOCs, SVOCs, methane, PCBs, pesticides, and other hazardous wastes. A summary of those conditions is presented below Chapter 11 “Hazardous Materials,” presents a more detailed discussion of these conditions.

SUMMARY OF CONDITIONS

On-Site Sources of Potential Soil Contaminants

Prior activities and uses that have the potential to have impacted soils at the project site and thereby create the potential for public health concerns are the following:

- Approximately 995 acres, or 45 percent of the Fresh Kills Park site is within four delineated and regulated SWMU’s. It is anticipated that soils currently over these landfill sections, in particular the north and south landfill sections, would not meet applicable DEC criteria for recreational and ecological uses. DSNY completed closure capping of the north and south mounds in the mid-1990s. At that time, unrestricted public access to north and south mounds was not envisioned. In accordance with the design plans prepared under the regulatory framework established at the time soils meeting the analytical criteria for industrial use were imported for closure construction. Topsoil and subsoil recommendations were based strictly on engineering parameters. Topsoil was only required to meet two criteria: organic matter at five percent or greater and “no toxic substances in toxic amounts.”
- Up to three brick-making facilities were once located on the project site from 1898 to at least 1917, which is likely to have included the potential for storage and use of petroleum products and chemicals. These manufacturing facilities were located within and at the perimeter of the current locations of Landfill Sections 1/9 and 2/8. Key contaminants potentially associated with historic brick making could include petroleum hydrocarbons and metals.
- In 1917, Lake’s Island Garbage Disposal Plant was located at the current location of Plant 1.
- From 1898 to 1917, up to three segments of railroad tracks were located at the current location of Landfill Section 1/9. Key contaminants potentially associated with historic railways might include petroleum hydrocarbons, PAH’s, herbicides and metals.
- Other historic uses of environmental concern include blacksmiths (1859 to 1887), a paint shop (1874), and a gasoline station (1937 to 1962).
- Aboveground storage tanks (ASTs), underground storage tanks (USTs), equipment and vehicle maintenance buildings, and vehicle fueling and electrical transformers are located at Plants 1 and 2 on the project site. Key contaminants potentially associated with these uses include petroleum hydrocarbons, VOCs and semi-volatile organic chemicals (SVOCs), PAHs, metals, and if any electrical equipment and/or transformers were existent prior to 1979, PCB’s.
- Regulatory databases show that the Fresh Kills Landfill site has a history of chemical storage and spills documented by the Federal and State regulatory databases including petroleum spills, underground storage tanks, aboveground petroleum and chemical storage tanks and waste generator identification numbers.

In addition to the above, a review of literature and historical aerial photography and topography indicates that solid waste disposal may have occurred on the project site in waste cells located outside of the areas now regulated as SWMUs. An historical map and database search reviewed as part of this analysis included a mapping assessment of the project site (*Preliminary Fresh*

Kills Landfill Conceptual Design Report, Subtask 3.2, Mapping and Assessment of Natural Areas, prepared by SCS Engineers, April 1990). That document lists a number of inactive on-site landfills within the project site, in addition to the four identified SWMUs. These areas are identified as:

- Travis Landfill;
- West Shore Expressway Landfill;
- Arden Avenue Landfill; and
- Landfill Section 2/8 base fill.

The 1990 SCS report describes the former Travis Landfill as historically (pre-1950) a tidal marshland. By 1960, the area appears to have undergone earthwork operations (assumed to be landfilling with solid waste), and a drainage swale and berm were constructed parallel to the landfill.

For the Arden Avenue Landfill and West Shore Expressway Landfill, based on historic aerial photography, the 1990 SCS report concluded that ground disturbance for these areas occurred at about the same time as the Travis Landfill. Prior uses in these areas appeared to be farming and open space in meadow or woodland based on historical mapping. Landfilling appears to have occurred between 1951 and 1970. There was also the filling of a stream and realignment of drainage. At the time of the 1990 field inventory, the Arden Avenue Landfill and West Shore Expressway Landfill areas were vegetated. The 2/8 base fill waste cell is identified as a small area southeast of SWMU 2/8.

Soil investigations were performed at the identified Arden Avenue Landfill as part of the *Owl Hollow Park Project Environmental Assessment Statement*. This investigation included geotechnical and analytical soil borings performed in May 2006 and June 2006 with test pits for analytical analysis performed in February 2007. These investigations were undertaken for the purposes of determining the geophysical and chemical conditions of the subsurface soils at the site of the proposed Owl Hollow Park project. Conditions at the site are summarized in the *Site Investigation Report for Owl Hollow Soccer Fields Site* (LiRo, July 2007). These investigations confirmed that a soil and waste layer exists at that site to varying depths below grade beneath cover soils composed principally of silt and clay in a thickness of two feet or more. Samples of both the cover soils and subgrade fill material were collected for laboratory analysis from 24 test pit locations and three soil piles at the site. The results of this sampling showed varying concentrations of SVOCs, PCBs, pesticides and metals. No VOCs above the DEC 6 NYCRR Part 375 Soil Cleanup Objectives for Restricted-Residential Use were identified. A 120 ppm actionable level of PCB concentrations was identified in one soil sample , which is greater than the hazardous waste level of 50 ppm. The remainder of the PCB sample concentrations were less than 8 ppm.

Off-Site Source of Potential Contaminants

Specific off-site uses with the potential to also impact the project site soil and/or groundwater at the project site include the following:

- A property northwest of the project site was historically used for heavy industrial purposes including a manufacturing facility with oil and benzene storage tanks, a paint shop, boiler room and "coal heap" (as depicted on historical maps from 1891 to 1947), a linseed oil manufacturing facility shown on a 1951 map, a Consolidated Edison coal storage facility shown on a 1962 map, and a Consolidated Edison equipment storage facility shown on historical maps from 1983 to 1990.

- Several properties east-adjacent and south-adjacent to the project site that were formerly and/or are currently gasoline stations, auto repair facilities, bulk oil/gasoline storage facility, or dry cleaners. A number of properties adjacent to the project site or in the study area were listed on state and federal databases for the following reasons: petroleum bulk storage, chemical bulk storage, spills, hazardous waste generators, and wastewater discharge facilities. In addition, local dry cleaners are a potential source of tretrachloroethylene.

In addition there is the inactive Brookfield Avenue Landfill to the east of the project site. These off-site sources could have impacted soils and groundwater which could subsequently migrate onto the project site. Typically, contaminant transport of this type is accomplished either as dissolved constituents from the respective source areas or by the transport of contaminated sediments, soils, or particulate matter (e.g., silts, clays, and other low permeability natural materials).

Summary of Potential Soil Conditions

Based on the above, some of the potential soil contaminants of concern that may be present at the project site are as follows:

- Volatile organic compounds (VOCs): These include aromatic compounds—such as benzene, toluene, ethylbenzene, xylene (BTEX), and methyl tertiary butyl ether (MTBE), which are found in petroleum products (especially gasoline)—and chlorinated compounds, such as tetrachloroethene (also known as perchloroethylene or "perc," or PCE) and tricholoroethene (TCE), which are common ingredients in solvents, degreasers, and cleansers.
- SVOCs: The most common SVOCs in urban areas are PAHs, which are constituents of partially combusted coal- or petroleum-derived products, such as coal ash and fuel oil. PAHs are commonly found in New York City urban fill material. In addition, petroleum-related SVOCs could be present from current or former petroleum storage.
- PCBs: Commonly used as a dielectric fluid in transformers, some underground, high-voltage electric pipelines, and hydraulically operated machinery, PCBs are of special concern at electrical transformer yards and rail yard/train maintenance locations where leakage into soil may have occurred. PCBs and/or PCB-containing materials were once widely used in manufacturing and industrial applications (e.g., hydraulic lifts, transformers, and plastics manufacturing). Because of their strong sorptive potential, PCBs tend to travel only short distances in soil, except in unusual circumstances (e.g., large spills of PCB-containing oils over many years).
- Pesticides, herbicides, and rodenticides: These are commonly used to control rodents and/or insects and vegetation in vacant structures or in vegetated lots.
- Metals (including lead, arsenic, cadmium, chromium, and mercury): Metals are often used in smelters, foundries, and metal works and are found as components in paint, ink, petroleum products, and coal ash. These metals tend not to migrate in soil. Therefore, they would be of greatest concern at the site where they were generated. Metals at levels above natural background levels are frequently present in fill material throughout the New York metropolitan area.
- Fill materials of unknown origin: In the past, waste materials, including coal and incinerator ash, demolition debris, and industrial wastes, were commonly used as fill in urban areas.

> Even fill material consisting primarily of soil may exhibit elevated levels of PAHs, metals, PCBs, and other contaminants. Such materials are potentially present at a number of locations on the project site and outside the delineated landfill sections.

In addition to the above soil conditions, older (pre-1980) buildings on the site are expected to contain asbestos and lead paint. For example, friable asbestos materials would be expected in certain structures within the Plant 1 and 2 complexes. Asbestos is a common component of building materials, especially insulation, fireproofing, tile flooring, plaster, sheetrock, tile ceiling, mastic, and roofing materials. In addition to materials within existing structures, subsurface utility lines may be coated with asbestos or encased in “transite,” an asbestos-containing material (ACM). In addition, lead based paint is likely to be present in older building on the site. The use of lead based paint in non-residential buildings and outdoors was severely restricted by the Consumer Products Safety Commission in 1977.

OTHER PUBLIC HEALTH CONDITIONS

In addition to the public health issues discussed above, two additional public health issues have been raised with respect to the potential for human exposure to viral transmission at the proposed park. These are rabies and West Nile Virus, both of which are discussed below.

RABIES

Rabies is an extremely rare occurrence for residents of New York City (i.e., there have been no known occurrences for more than 50 years and only 14 since 1925). However, it can occur in animals and historically has been reported in wild animals in the Bronx. Rabies is a viral disease found in mammals that is most often transmitted through the bite of a rabid animal and ultimately affects the central nervous system. The majority of cases are found in raccoons, skunk, bats, and fox. In the Eastern United States, raccoon are the principal source of rabies and typically transmit the disease to other raccoons. Rabbits and small rodents, including mice and rats, do not typically get infected or transmit rabies. Bats are also a common source in the U.S. In 2006 there were 44 recorded occurrences of rabid animals throughout New York City; however, there was a noted shift in the distribution of occurrences from the Bronx (6 total) to Staten Island (35 total reported). In 2006, NYCDOHMH released Medical Alert No. 11, which identified two rabid raccoons that were captured in the Charleston and Pleasant Plains areas of Staten Island and tested positive for rabies. However, there were no reported human exposures to these animals.

To avoid impacts from rabies and other public health issues relative to rodent populations in public parklands, the City has rodent control programs in City parks. Rodent control in New York City parks comes under the jurisdiction of DPR. The first part of the program is trash management. This includes proper collection and disposal of trash in City parks with extermination programs, when necessary, throughout the five boroughs. The DOHMH Pest Control Services program has assisted DPR by training their exterminators along with key management staff in Best Practices Training. Pesticide applicators must be licensed as per NYS regulations.

The City also has an adopted Integrated Pest Management (IPM) approach to rodent control. In parks, a key element to the IPM approach is the development and implementation of a Sanitation Plan—a plan to ensure adequate numbers, placement and maintenance (timely emptying) of trash receptacles. Complaints pertaining to rat activity in parks are routed from 311 directly to DPR. In addition, a plan for using anti-coagulants rodenticides in parks and around parks buildings is one component of rodent control. These applications typically occur more frequently in the winter than in the summer.

WEST NILE VIRUS

The City's DOHMH prepares a mosquito control plan on an annual basis with the purpose of protecting public health from the impacts of West Nile Virus transmitted by mosquitoes. DPR is a key partner working on both developing and reviewing of the plan as well as participating by identifying potential mosquito breeding sites and placing larvicides in catch basins within parks properties. Currently, biological larvicides are applied aerially to large marsh areas within the Fresh Kills Landfill. These applications are conducted bi-weekly during the time period between June and mid-September when mosquitoes are most active in NYC. This amounts to six applications per year.

E. PRIOR PUBLIC HEALTH STUDIES PERFORMED AT FRESH KILLS

INTRODUCTION

Over the last 25 years, there have been a number of public health investigations of Fresh Kills Landfill to determine its effect on the environment. In many cases, these studies have shown that other sources of air and water pollution in this area (i.e., industrial facilities, vehicle emissions) cause difficulty in isolating any effects Fresh Kills Landfill may have on the local environment. Two of these studies, one conducted by the Agency for Toxic Substances and Disease Registry (ATSDR) and the other conducted by DSNY, are summarized below.

ATSDR STUDY[1]

In 2000, the ATSDR prepared a Petitioned Public Health Assessment of the Fresh Kills Landfill. That study compiled eight years of data developed through site investigations, community outreach, agency coordination, as well as health research, investigations, consultations, and education. This compilation was performed while the landfill was operating.

A number of health concerns were raised by local residents during the ATSDR study, including cancer risk. Local physicians also perceived higher asthma rates among Staten Island residents of the area. ATSDR also found that the local community was concerned that the air emissions from Fresh Kills landfill, in particular, were causing health problems and noted that this may be associated with the long history of odor complaints.

ATSDR gathered the most extensive set of air monitoring data ever reviewed for a municipal landfill and concluded that the airborne levels of contaminants detected during that monitoring did not exceed health standards. In particular, ATSDR's investigation found that hydrogen sulfide, PM, and ozone levels were below concentrations believed to result in adverse health effects. However, the ATSDR study did recognize that Fresh Kills Landfill generates large quantities of landfill gas and that landfill gas can pose a serious threat particularly when it accumulates in confined spaces.

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[1] Source: *Petitioned Public Health Assessment, Fresh Kills Landfill, State Island, Richmond County, New York*, EPA Facility ID: NYD980506943, prepared by the Petition Response Section, Agency for Toxic Substances and Disease Registry, May 3, 2000.

Because local Staten Island residents were particularly concerned with children's health problems, the ATSDR study also focused on potential impacts to children. Children are more likely to experience adverse health effects due to environmental exposure because they have less body mass, their bodies are in a developmental stage, and since they play outdoors, are more likely to be exposed to contaminated soil. The ATSDR study considered these factors when conducting the study and concluded that there was no evidence to indicate that children living in the vicinity of the Fresh Kills Landfill were exposed to unique or special site-related hazards.

The ATSDR report also reviewed and evaluated the NYCDOH 1996 Staten Island Cancer Incidence Rate Study. That study indicated that the incidence of cancer among residents living in near the Fresh Kills Landfill was not statistically significantly elevated as compared to Staten Island as a whole.

The ATSDR report found that groundwater beneath Fresh Kills Landfill contained trace levels of pollutants (e.g., arsenic, barium, benzene, boron, manganese, ammonia, and zinc) that originate from various sources, including the landfill. It recognized that in addition to the landfill there are industrial uses in the area that also have the potential to adversely impact local groundwater.

In sum, the ATSDR study concluded that no apparent public health hazards were presented by the landfill to local residents. Because Staten Island residents do not come in contact with contaminated groundwater, surface water, sediment, or fish and shellfish in the vicinity of the Fresh Kills Landfill, no apparent public health hazard exists related to groundwater, surface water, or sediments according to the ATSDR study. Ambient air was not found to present a significant health risk. Moreover, as the landfill completes final closure and with the passing of time, there will be decreased levels of releases of landfill gas, leachate, and dust. The ATSDR study recommended that the environmental engineering controls and public access management along with regular monitoring be continued and that the landfill should satisfy all local and state environmental regulations and guidelines in order to continue to protect public health in the long term.

FRESH KILLS LANDFILL DEIS (1996)[1]

In March 1996, DSNY released a DEIS that examined the continued operation of Landfill Sections 6/7 and 1/9 and the installation of environmental control systems at Fresh Kills Landfill. That DEIS also included an examination of "Public Health" in accordance with the City's *CEQR Technical Manual*. The examination focused on surface water, groundwater and ambient air quality, and, since the park project was not proposed at that time, the focus of the analysis was an examination of the landfill's potential public health impact on the surrounding community (no public access on to the site was under consideration at that time). The analysis included air monitoring and sampling of groundwater and surface waters and fisheries in Fresh Kills, Richmond and Main Creeks, locations upstream of the landfill, the Arthur Kill, and the Rahway River in New Jersey as background. Air monitoring data were evaluated for 11 monitoring stations. Measured values gathered during the analysis were compared to groundwater, surface water, and air quality standards and guidelines at City, state, and federal levels as a way of determining potential public health impacts.

The approach used to characterize public health exposure was a contaminant pathway analysis that was developed based on principles developed by EPA for evaluating landfill impacts. This

[1] *Fresh Kills Landfill DEIS*, CEQR Number 95DOS001R, DSNY, March 15, 1996.

approach considers the completeness of each exposure pathway through various release and transport mechanisms and contaminant media (e.g., soil, air, and water), and the potential exposure routes (e.g., inhalation, ingestion, dermal contact), to local residents. Collected information was reviewed to determine which exposure pathways are complete (i.e., allowing the landfill-based contaminants to reach the exposed off-site population). The potential contribution of the landfill to local ambient surface water, groundwater, and air quality conditions was also considered. The DEIS analysis concluded the following with respect to public health:

- For groundwater, an extensive groundwater sampling investigation was performed at Landfill Sections 6/7 and 1/9 which disclosed various exceedances of standards for the GA groundwater standards (i.e., standards for water that are potential drinking water only). Many of the inorganics in the groundwater were believed to be attributable to seawater intrusion and naturally occurring minerals. However, it was concluded there was no potential human health risk because of the absence of a direct or indirect human exposure pathway to groundwater.
- For surface water and sediments, while there were limited exceedances of standards and guidelines related to surface water quality including those for potentially carcinogenic chemicals (e.g., arsenic, cadmium, thallium) these concentrations, in some cases, were consistent with background levels (e.g., both upstream and in New York Harbor) and the potential for a pathway exposure to surface waters was very low, given that the waters at Fresh Kills Landfill were not designated or used for fishing or swimming. Therefore, potential carcinogenic effects or non-carcinogenic health effects due to these exceedances was concluded to be very unlikely since a human exposure pathway did not exist.
- For air quality, there were recorded exceedances of VOCs at some air monitoring stations. Constituents included trichloroehtane, dichloroethane, benzene, carbon tetrachloride, tetrachloroethylene, and vinyl chloride. However, the observed exceedances were not found to be related to VOCs generated by the landfill, but did reflect regional air quality conditions at that time. An upwind/downwind analysis performed for the DEIS found that VOCs from the landfill did not significantly impact overall ambient air quality with respect to inorganics and respirable dusts. Metals were also detected and there were exceedances of AGCs, but no exceedances of SGCs. With respect to other parameters, the data were also indicative of regional air quality and were not found to be affected in a measurable way or influenced by the landfill. Thus, it was concluded that the inhalation of dust or vapor emissions from the landfill did not present a significant increase in public health exposure or potential public health impacts.

In addition, the DEIS further examined the potential for public health impacts through the year 2017. It was the conclusion of the DEIS that any potential for public health impacts would only diminish as the leachate and gas collection systems were installed and the biodegradation process of the landfill materials continued. As a result, leachate releases into groundwater and surface water would be significantly reduced, as would VOC emissions. Moreover, in addition to the landfill gas collection system, there would be a reduction in landfill gas that is formed due to the discontinuation of landfilling and the continuation of the decomposition process. Modeling disclosed that the significant reductions in leachate discharges and gas emissions would occur over time (i.e., it was projected that leachate flows at Landfill Section 1/9 would decrease by 40 percent and at Landfill Section 6/7 they would be negligible and that the landfill gas emissions controls would reduce VOCs by 97 percent).

F. THE FUTURE WITHOUT THE PROPOSED PROJECT: 2016 AND 2036

In the future without the proposed project, it is assumed that landfill closure will be completed in accordance with approved DSNY closure plans with oversight by DEC. It is expected that closure construction at Landfill Sections 6/7 and 1/9 will be completed by 2016. The leachate collection and containment and landfill gas management systems are expected to continue to operate for a period of approximately 30 years following landfill closure construction or as long as required by DEC. Operation of these systems would continue through 2036, as required by DEC, or as long as the required maintenance and monitoring obligations of the City are deemed necessary with respect to Fresh Kills Landfill. In the absence of the proposed Fresh Kills Park Project, no other development programs are expected on the project site through the 2016 and 2036 analysis years.

It would also be expected that tank closures, and active status spills investigation and remediation would continue. Without the proposed project there would likely be minimal potential exposure to subsurface contamination fro local residents. Overall, without the proposed project, there would be a low potential for a public health issue and no potential for public access by local residents to the site that could alter the current exposure pathways.

G. PROBABLE IMPACTS OF THE PROPOSED PROJECT

INTRODUCTION

The proposed project would provide access to the Fresh Kills project site that would provide both direct and indirect exposure and potential new pathways for park users and DPR personnel with respect to public health issues. As such, this chapter describes the additional protection measures that are proposed to ensure public safety and make the site suitable for public access as parkland. The chapter will address a number of potential public health issues associated with public access on the Fresh Kills Landfill site, including the security and maintenance of the landfill's environmental protection infrastructure as well the ambient air quality, surface water, groundwater, and soil/sediment conditions. This assessment begins with a presentation of the landfill-related environmental infrastructure, describes the added public health protection commitments of the proposed project and then assesses the potential impacts of exposure to air emissions, groundwater, surface water, sediments, and soils with the proposed park in place. A summary conclusion is provided at the end of the chapter.

EXISTING LANDFILL INFRASTRUCTURE AND EXPANDED PROTECTION MEASURES

OVERVIEW

A description of the existing environmental control infrastructure at Fresh Kills Landfill was presented in Chapter 1 "Project Description." Provided below is a summary description of that infrastructure as well as a description of potential improvements that could be undertaken to protect public health as the site becomes a public park.

LEACHATE MANAGEMENT SYSTEM

Currently a full-time DSNY staff of trained personnel monitors, operates, and maintains the various electrical and mechanical components of the leachate management system. An electronic control system monitors leachate management system mechanical components from a control center located at the Fresh Kills Leachate Treatment Plant. This system monitors the status of leachate collection well pumps located throughout the site with leak detection monitoring probes located along the leachate transmission forcemain.

To protect against leakage of leachate out of the transmission forcemain, the force main uses a dual pipe design, which involves transmitting leachate inside an HDPE pipe which is then placed inside of a secondary containment HDPE pipe. Leak detection monitoring probes monitor the secondary containment pipe for the presence of liquid, which could indicate a leak in the system.

Considering that the proposed Fresh Kills Park project would provide the public with the opportunity to come into closer contact with the surface features associated with the leachate management system, and that park development may induce new loading conditions on the subsurface features, the following preliminary conceptual measures could be part of the park design to provide an added layer of protection for public health:

- Develop park designs that do not adversely affect the leachate control systems or final cover soil stability.
- Provide instrumentation to monitor for any small deformations of the cutoff wall that would provide data to DSNY/DPR if any park programs are adversely affecting the cutoff wall.
- Install locks at leachate collection well vaults, leachate collection well valve chambers, and associated electronic control panels. These measures would be intended to minimize the risk of the public’s entry into confined spaces, where potentially unsafe atmospheric conditions may occur, and to protect the public from potential electrical hazards.
- Install security fences, locked gates or appropriate warning signs around leachate collection well vaults, valve chambers, and associated electronic control panels. These measures would be intended to serve as a deterrent against public interference with leachate management system features. The design of additional fencing and locks at the leachate management system features will require that designs do not conflict with existing post-closure care maintenance and operation program procedures.
- Install locking manhole covers at manholes located along the leachate transmission forcemain route.
- Install perimeter security fence around the Fresh Kills Leachate Treatment Plant and around the Landfill Section 6/7 leachate transmission forcemain pump station. The design of fencing around these leachate management system features will require that designs do not conflict with the existing post-closure care maintenance and operation program procedures.
- Provide park grounds keepers and security personnel to deter malicious acts or vandalism of leachate management system features. The grounds keepers and security personnel would receive training regarding identification of landfill infrastructure and would be provided with emergency contact information for responsible landfill personnel.

LANDFILL GAS MANAGEMENT SYSTEM

The landfill gas management system includes both active and passive features to control and monitor landfill gas generated by the decomposition of waste within the landfill. In general, the active system includes over 400 gas extraction wells, a network of gas transmission pipes, a vacuum blower system, three ground flares, multiple condensate traps, and a landfill gas purification plant. Passive components generally include over 400 passive gas vents, a landfill gas interceptor venting system, and perimeter monitoring probes. See Figures 1-8a through 1-8e in Chapter 1, "Project Description."

The landfill gas management system is operated under a Title V Permit and in accordance with a DEC Part 360 permit. The air emission permits require that the DSNY monitor and record data regarding various aspects of the system, which on a broad level, are intended to protect the environment and/or human health. Some of the specific aspects of the system that DSNY is required to monitor include:

- Flare emissions;
- System operation, gas flow, start-up, shut-down, and malfunction events;
- Condensate accumulation rates;
- Landfill final cover inspections;
- Landfill gas extraction well monitoring;
- Landfill gas composition; and
- Landfill surface monitoring for methane.

A full-time staff of trained professionals operates, maintains, and monitors the various components of the landfill gas management system at the site.

Considering that the proposed Fresh Kills Park development would create the opportunity for the public to more closely approach the landfill infrastructure including the landfill gas management system, the following measures are presented as techniques to avoid public health impacts as they relate to park development and the DSNY landfill gas management system:

- Develop park capital project designs with DSNY and DPR coordination to avoid conflicts with the landfill gas management system features. Measures could include selection of road alignments that avoid flare locations or use of fences or landscaping (i.e., thorn bushes) that discourage activity on or along the landfill gas interceptor venting trench, for example. The design would take into consideration any added post-closure care maintenance and monitoring activities that occur at the various landfill gas management system features.
- Redesign and retrofitting of existing landfill gas extraction well heads and passive gas vents for placement within securable subsurface vaults. This measure would be used to deter park users from interfering with landfill gas features and avoid potential hazards related to combustion of landfill gas.
- Install permeable gas venting layers (i.e., gravel layers) across interceptor venting trenches where park development features would cover the interceptor venting trenches.
- Maintain a seal on landfill gas vents to prevent escape of landfill gas into the atmosphere. Unsealing of the gas vents would not be allowed without modification to the existing Title V and Part 360 air permits, which would involve review and approval by the DEC.
- Install vapor barriers beneath all park structures and install methane monitoring equipment within park structures, as necessary. The installation of new methane monitoring equipment would require a change to the post-closure care maintenance and operations plan.

- Install security fencing and locking gates around landfill gas flare pads and around the landfill gas purification plant.
- Install locking manhole covers on manholes associated with the landfill gas transmission main.
- Provide DPR staff and security personnel with the authority to deter malicious acts of vandalism of landfill gas management system features. The grounds keepers and security personnel would receive training regarding identification of landfill infrastructure and would be provided with emergency contact information for responsible landfill personnel.
- Post signage to inform the public regarding hazards associated with landfill gas.

Final Cover and Stormwater Management

The landfill final cover system is predominately a surface layer feature that is used to reduce infiltration into the waste, provide for removal of water that infiltrates the upper soil layers of the cover system, provide a physical barrier to contacting waste within the landfill and create a seal that prevents uncontrolled release of landfill gas to the atmosphere. The stormwater management system includes vegetation, swales, channels, culverts and sediment basins that convey water from the landfill cover in an efficient manner and treat the runoff by short-term detention (i.e., providing time for suspended sediments to settle) within the stormwater basins (see Figures 21-5 and 21-6). In accordance with the Consent Order the landfill final cover and stormwater management system is monitored on a periodic basis and the results submitted to DEC as part of a quarterly inspection report.

A full-time staff of trained personnel will provide inspection, operation and maintenance of the final cover and stormwater management systems. Considering that the Fresh Kills park development would bring the public over the final cover, open up access to the stormwater management systems, and increase loads on the cover system, the following mitigation measures may be adopted as part of the park development.

- Place surcharge loads over waste prior to final cover construction to induce and accelerate settlement.
- Install monitoring equipment to measure strain in the landfill cover system geosynthetic materials.
- Develop on-mound programs features that minimize the use of large loads, or designing features that use lightweight fill.
- Develop landscape features to discourage park users from entering drainage channel.
- Post of signage that informs park users that the stormwater management basins are not publicly accessible (until so designed) and that entry into stormwater culverts is prohibited.
- Provide DPR personnel with the authority to deter malicious acts or vandalism of final cover and stormwater management features. The grounds keepers and security personnel would receive training regarding identification of landfill infrastructure and would be provided with emergency contact information for responsible landfill personnel.

OTHER PROTECTION MEASURES

In addition, since public access would be allowed for the first time at the site, new site security measures would be necessary to protect important landfill infrastructure. Among Fresh Kills

Landfill infrastructure systems that would need to be physically separated from the proposed park are:

- Leachate control plant;
- Gas collection and treatment plant;
- Flare stations; and
- Above-ground transformers and pumping stations.

As the details of the public access plan are developed, it is expected that modifications to the post closure monitoring and maintenance plan may be necessary, which will be developed in close coordination with DSNY and DPR. This plan may include:

- More intensive surface sampling for landfill gas in areas of the site that become publically accessible to the public;
- Subsurface Vapor monitoring in the basements of new buildings;
- Coordination and exchange of monitoring data for water quality and sediments between DSNY and DPR including park ecologists and managers;
- Additional monitoring in areas not currently monitored where dermal contact could occur under the proposed park project such as the streams that would be restored and stormwater basins, particularly in places where eco-classrooms and public access is being proposed; and
- Additional security personnel.

Increased signage would also be an important component of the park's public health protection program. Examples of the content of this signage would include:

- Warnings to the public about landfill infrastructure and systems;
- Only catch and release fishing and the State health advisories on consumption;
- No swimming or water access unless accompanied by DPR personnel;
- Security signs on fencing provided around DSNY infrastructure and at limits of public access;[1] and
- Signage regarding rabies or other concerns that may arise over time.

POTENTIAL EXPOSURE TO AIR EMISSIONS FROM MOBILE SOURCES

Based on source emissions modeling, it has been determined that the proposed project would not have any adverse impacts on air quality with respect to mobile source traffic. Thus, no exceedance of public health standards would occur as a result of vehicle trips associated with the proposed project.

[1] As stated in Chapter 1, "Project Description," the project would be phased in over a number of decades. Therefore, fencing and access control would be provided at the secure limits of each capital project to ensure that the public does not have uncontrolled access to portions of the site that may still be undergoing closure construction, or have not been properly prepared yet for public access.

POTENTIAL EXPOSURE TO AIR EMISSIONS FROM STATIONARY SOURCES

Criteria Pollutants

With the conversion of the site to a public park, potential sources of air emissions that could affect public health are local stationary (point) sources of emissions from landfill environmental control systems (e.g., leachate and gas treatment facilities), off-site DSNY facilities (e.g. the Staten Island Solid Waste Transfer Station), and local small industrial and commercial operations. As described in greater detail above, each of these point sources were modeled for potential air quality impacts on park users. Based on the results of the analysis, the combined impacts from these sources would not be anticipated to result in any significant adverse air quality impacts on the park users.

Non-Criteria Pollutants

In addition to the criteria pollutants discussed above, the non-criteria pollutants were evaluated as well. Although the maximum predicted annual concentration of tetrachloroethylene from these facilities exceeds the DEC AGC of 1.0 micrograms per cubic meter (µg/m3), this does not represent a significant public health exposure risk. This is based on DEC guidance which interprets impacts of less than 1 order of magnitude (i.e. 10 times) higher than the AGC for carcinogenic compounds with a risk-based threshold (which includes tetrachloroethylene) as allowable, as long as best available control technologies (BACT) are in place. As stated above these sources are equipped with state-of-the-art controls that are designed to minimize the formation and emission of tetrachloroethylene vapors to the atmosphere, and clearly represents BACT. Therefore, since these control technologies are employed and the maximum projected values are within the acceptable range based on DEC guidance, the impacts of tetrachloroethylene on the proposed park are not considered a significant public health impact.

POTENTIAL EXPOSURE TO AIR EMISSIONS FROM AREA SOURCES

Ambient Air

With the conversion of the site to a public park, potential fugitive sources of air emissions that could affect public access were evaluated. As discussed above, the fugitive emissions include landfill gases, particularly methane, in areas of the mounds most distant from the gas collection infrastructure. The design gas collection efficiency of the system is 90 percent or greater, which indicates that some fugitive losses through the passive vents, landfill cover, and subsurface soils is inevitable. However, DEC periodic monitoring of the ambient air in the vicinity of the Fresh Kills Landfill has been conducted in the past and would be expected to continue in the future pursuant to DEC regulatory requirements. While certain regulated compounds have been detected, historical monitoring has not resulted in the formulation of a definitive pattern or correlation indicative of the landfill serving as a significant source of air contaminants.

Vapor Infiltration

In light of the potential for leachate and/or groundwater to contain to contain NMOCs or VOCs from landfill and/or off-site industrial and commercial activities, appropriate sub-slab venting systems and/or vapor barriers is expected to be necessary for use beneath all buildings and structures at the Fresh Kills Park site. Additional monitoring at building locations may also be necessary.

POTENTIAL EXPOSURE TO GROUNDWATER

As stated above, groundwater has not been used as a potable water source on Staten Island since the 1970s. Moreover, because future use of groundwater for consumption is unlikely, it is not expected that Staten Island residents would come into contact with groundwater contaminants. The proposed park would not create any new pathway conditions that would result in any increased human exposure to groundwater at the site. Groundwater is not used in the area for consumption, nor is it expected to be used in the future given the existence of the existing NYCDEP water supply. In addition, local groundwater is not expected to be used for consumption or irrigation in the proposed park. Thus, there would not be an exposure pathway to groundwater with the proposed project and no public health impacts would be expected. Chapter 20, "Construction," examines if there would be any potential temporary impacts (i.e., managing potentially contaminated groundwater during excavation and/or dewatering activities) with respect to groundwater that need to be considered as part of the proposed project in 2016. These findings are consistent with conclusions of other public health studies performed at Fresh Kills.

Although no impacts are expected with the proposed park, post-closure groundwater sampling will continue at Fresh Kills and be performed in order to monitor site conditions and effectiveness of the corrective measures.

EXPOSURE TO SURFACE WATER/FISHERIES

IMPACTS OF THE PROPOSED PROJECT ON WATER QUALITY CONDITIONS

The proposed project would not result in any adverse impacts on local water quality conditions in 2016. Surface water quality sampling will continue at Fresh Kills and be performed in order to monitor site conditions and effectiveness of the corrective measures and it is expected that data would be shared with DPR and park managers and ecologists.

IMPACTS DUE TO POTENTIAL INCREASED PUBLIC ACCESS TO WATER

On-Water Recreation

There are about 210 acres of water area at the project site comprised of Great Fresh Kills, Little Fresh Kills, Main, and Richmond Creeks. Potential exposures to contaminants in surface waters or sediments can include dermal contact, as well as ingestions with the consumption of finfish or shellfish. This type of exposure at Fresh Kills is limited by several factors. Foremost, the surface waters are not used or suitable for drinking water purposes as part of the proposed project. In addition, the waters are not suitable nor are they designated for fishing of finfish or shellfish. Advisories at the State level through the New York State Department of Health warn residents of the potential for exposure to contaminants from the consumption of fish in New York Harbor. In addition, the waters at Fresh Kills are not designated for swimming. As part of the proposed project, signage would be posted in strategic areas of the park and water courses, where feasible, reminding park users that the water is not potable, that finfish and shellfish obtained from park watercourses should not be consumed in excess of advisory levels, and that the waterways are not designated as swimming areas. It is not expected that the occasional or unintentional contact event that may occur when kayaking, for example, would present a significant public health risk.

Potential Impacts from Commercial and Recreational Fishing

No commercial fishing would be permitted in the proposed park, although recreational "catch and release" fishing may be allowed. As stated above, signage would be posted by DPR and enforced regarding the prohibition on the take home of any fish and regulations and health advisories would also be posted in the park so that the public would be aware of the health concerns related to the consumption of fish caught recreationally.

EXPOSURE TO SEDIMENTS

IMPACTS OF THE PROPOSED PROJECT DUE TO INCREASED ACCESS TO SEDIMENT

The proposed project would not be anticipated to adversely impact local sediment conditions and potential contaminant loadings. However, since it is recognized that sediments serve as “sinks” for contaminants, particularly those which are environmentally persistent (i.e. do not readily biodegrade, undergo hydrolysis, or other attenuating reactions), park users would be advised not to unnecessarily interact with accessible sediment areas. Signage to this extent should be sufficient to address this potential exposure concern.

Post-closure sediment sampling will continue at Fresh Kills and will be performed pursuant to applicable DEC requirements in order to monitor site conditions and effectiveness of the corrective measures.

On-Water Recreation

The proposed project includes facilities that would allow the public access to the water, particularly along Richmond and Main Creeks, as well as trails and ecological/educational facilities that would allow for field visits to the coastal and freshwater wetland landscapes at Fresh Kills. It is expected that that this access would be limited to specific locations and in most cases would be controlled or managed by DPR personnel. Thus, occasional contact with sediments are not expected to result in any significant impacts.

POTENTIAL EXPOSURE TO CONTAMINATED SOILS

It is the conclusion of this analysis with respect to on-site soils that nearly the entire project site has the potential to have been impacted by hazardous materials as defined under CEQR. Therefore, for site-specific capital project areas where soil and/or groundwater disturbance is proposed (e.g., excavation), significant adverse impacts could occur due to hazardous materials. As stated above, the proposed project would be built in multiple phases over a number of decades. Therefore, recommendations for individual project-specific subsurface investigation and, if necessary, remediation, are proposed to avoid this impact. This conclusion is also presented in Chapter 20, “Construction Impacts,” and Chapter 23, “Impact Avoidance and Environmental Protection Measures” (Chapter 21, “Public Health,” also addresses hazardous materials issues). As discussed below with this individual project site investigation and testing program, any impacts due to hazardous materials would therefore be avoided during the implementation of the project. In addition, in accordance with local, state, and federal laws, the demolition or reuse of any buildings would need to comply with environmental regulations relative to the handling and disposal of asbestos and lead paint.

With respect to the final soil cover material at the site and the importation of soil, there are no soil standards in the State of New York that are directly applicable to soil cover for landfills when the end use is proposed as parkland. New York State environmental regulations that do apply include the Title 6 New York State Codified Rules and Regulations (NYCRR) at Part 360, which governs Solid Waste Management Facilities. These regulations currently mandate the final closure and post-closure design, operation, maintenance, and monitoring of solid waste landfills in New York State and are implemented at Fresh Kills via the Consent Order. Also guiding the soil strategy for Fresh Kills Park is Title 6 NYCRR Part 375 Environmental Remediation Program (hereinafter referred to as subpart 375) which regulates the redevelopment of “brownfield” sites Although not directly applicable to landfills, Part 375 can be used as guidance for sites involving land use conversion.

Given the diversity of existing conditions on the site, varying hydrology of wetland landscape areas, and the wide range of uses proposed for the site, project-by-project review of soil selection will include various soil criteria, largely driven by proposed programming. Conformance to the various criteria will be demonstrated through an approval process. Thus the final soil layer cover at the site would comply both with DEC requirements for closed landfill covers as well as criteria for soils to ensure that it is sufficiently protective for public access. It is the objective of the proposed project to establish various criteria, based on 6 NYCRR Part 375 Soil Cleanup Objectives, for the soil cover material with consideration of human and ecologic exposure pathways relative to the planned future uses. The criteria would ensure protection of both public health and safety in the park.

OTHER PUBLIC HEALTH CONCERNS

RABIES

As described above, humans can contract rabies from a bite by an infected mammal. It is also possible, but very rare, for a human to contract the disease from a scratch or from direct contact with the saliva of a rabid animal if it gets into the eyes, nose, mouth, or an open wound.

It is not expected that the proposed project would result in a significant impact with respect to exposure to rabies. Rabies is an extremely rare occurrence in New York City. While the proposed project would increase public exposure to wildlife populations, the transmission of rabies through biting or scratching is not expected to be a significant impact at the proposed Fresh Kills Park. In addition, to the extent necessary the proposed project could incorporate signage to alert park users with respect to avoiding wildlife contact (the potential for rabies being just one of the concerns) and DPR personnel could be trained in protection and avoidance methods as well.

In addition, as stated above, rodent control in NYC parks is managed by DPR, with advice from DOHMH. This includes sanitation control and use of rodenticides, as necessary. In addition, major pesticide issues, pertaining to City Parks, include the control of weeds, fungus and insect infestations. As with any park, at Fresh Kills an IPM approach would take into consideration park usage (turf, landscape, trees, and structural/rodent) and consider least-toxic methods to controlling pests. Given that the proposed Fresh Kills Park would have wetland components, this would influence what specific rodent control programs should/can be conducted. Baiting procedures (if any, for certain areas of the park), and bait formulation, rodent inspections, for example, would likely need to be customized for the wetlands area park (and perhaps beyond). An emerging issue that DPR is confronting is protection of raptors and birds of prey from rodenticide exposure.

It is expected that the Fresh Kills Park program would encourage emphasis on non-chemical control of any of the commensal species of rats (e.g., Norway rat) near any of the wetlands.

WEST NILE VIRUS

As stated above, the DOHMH prepares an annual mosquito control plan and provides mosquito management in City Parks under this program. In order to avoid impacts from the West Nile Virus, DPR would begin coordination efforts with DOHMH relative to the control of mosquitoes in accordance with that plan at sites with the proposed Fresh Kills Park. The aggressiveness or intensity of the project would be comprehensive, as necessary, to protect the public from any potential health impacts due to West Nile Virus.

CONFORMANCE WITH FEDERAL, STATE AND LOCAL ENVIRONMENTAL STANDARDS AND GUIDANCE

Based on the above, including the modeling, monitoring, and technical analyses presented in this section, the proposed project would not result in any exceedances of federal, state, or City standards as they related to environmental protection or the protection of public health.

CONCLUSIONS

While municipal solid waste landfills are well documented as potential sources of pollution, environmental control and management and techniques, such as those practiced at Fresh Kills, including landfill leachate treatment and gas collection and treatment as well as stormwater management, coupled with regular groundwater and air monitoring significantly reduce environmental impacts, facilitate the timely identification of potential problems associated with the control management systems, and thus minimize the transmission of pollutants to humans along the known exposure pathways. As described in Chapter 1, “Project Description,” the existing environmental protection infrastructure at Fresh Kills includes an active landfill gas collection system complete with underground piping to collect the gas and direct it to the landfill gas recovery plant or flares, as well as leachate and stormwater control systems and an extensive monitoring and maintenance program.

These in-place protections will continue to operate for at least 30 years, and will be protected and maintained during the park construction phases and as the park becomes accessible to the public, it is expected that it will be necessary to implement additional measures to both protect the landfill infrastructure (e.g., protections and replacement of infrastructure due to the construction of roads and park facilities, restricting public access, and increased monitoring of air and water conditions) and to ensure that as areas of the proposed park become publicly accessible, they do not present a public health risk or safety concern. Therefore, continued coordination between DPR and DSNY related to implementing these measures as well as the completion of closure construction and the post-closure landfill monitoring and maintenance activities is vital not only to the proposed project, but also to the successful completion of the City’s post-closure monitoring and maintenance obligations with respect to Fresh Kills Landfill.

Critical to the conclusions of this public health analysis are the existing environmental controls, protections, and monitoring at Fresh Kills Landfill. As described in detail in Chapter 1 “Project Description,” DSNY has installed a final cover protection that encapsulates the waste layer and physically isolates it from the environment above, along with an extensive network of environmental controls to capture leachate and landfill gases. DSNY will implement a comprehensive maintenance and monitoring program that will be in-place for at least 30 years. Additional measures necessary for park development include, as stated in Chapter 1, “Project Description,” a new layer of clean soils, and additional measures that would make access to the park safe with respect to public health protections for park users and DPR personnel.

As described in detail in Chapter 1, "Project Description" the environmental control infrastructure associated with the closed landfill mounds includes leachate management, landfill gas management, and final cover/drainage systems. The new measures presented below for the proposed park are intended to provide additional protections with respect to allowing public access onto the site. These measures include additional infrastructure protections, monitoring, training, and signage, for example. A detailed evaluation was performed as part of this GEIS to evaluate the future conditions with respect to air quality, groundwater, surface water, and sediments/soils and the potential contaminant pathways and possible public health effects. The principal conclusions of that analysis are summarized below:

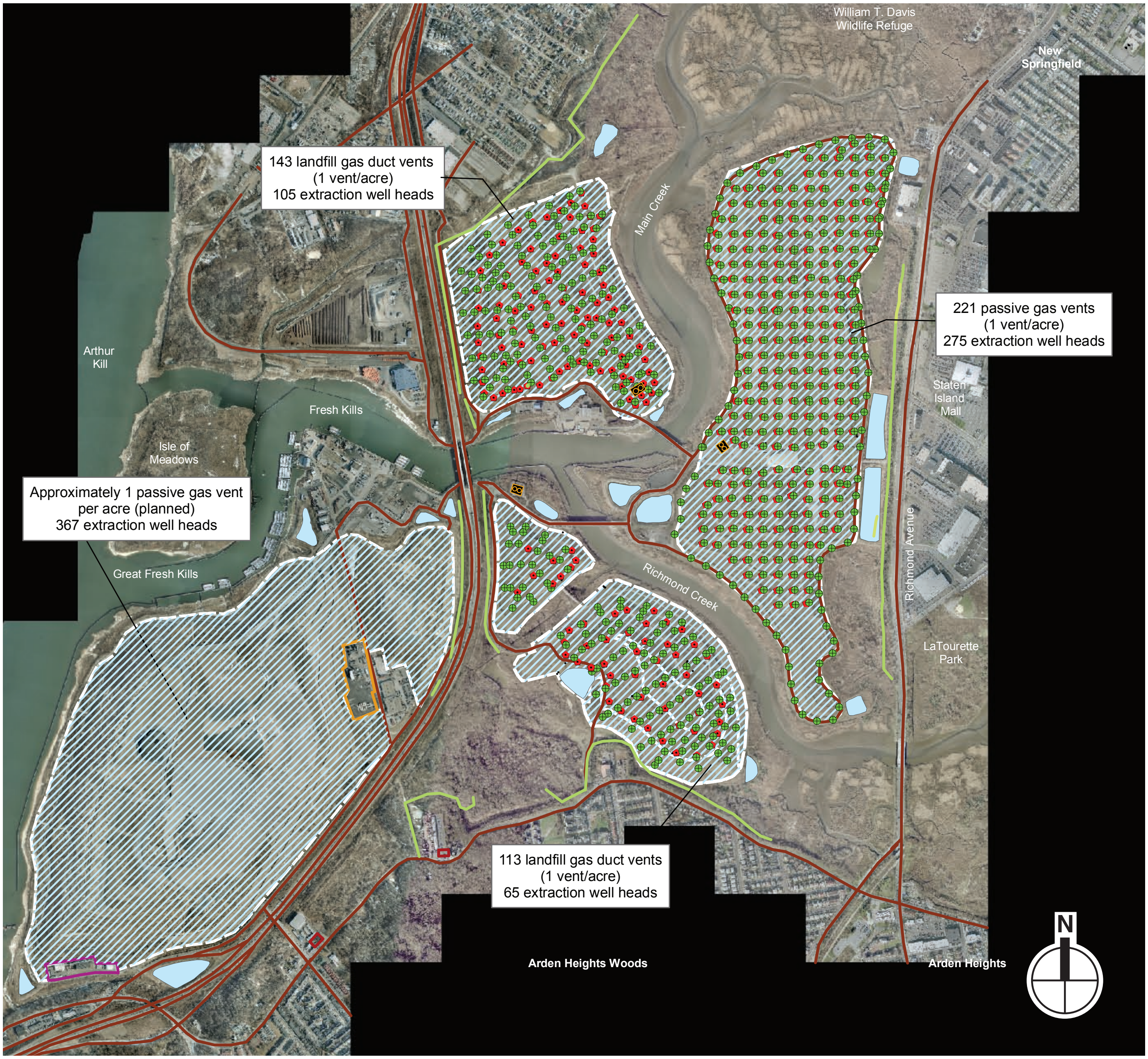
- Air emissions: criteria pollutants from local stationary sources including the landfill environmental control infrastructure would not be expected to result in any significant adverse air quality impacts on park users. Despite the fact that the maximum predicted annual concentration of tetrachloroethylene from local dry cleaning establishments exceeds the DEC AGC of 1 $\mu g/m^3$, it is not expected to represent a significant public health concern based on regulatory guidance and the required utilization of BACT. Therefore, with respect to tetrachloroethylene and other non-criteria air pollutants, modeling of point sources within and in the near vicinity of the proposed project did not identify any significant public health risks.
- Groundwater: while contaminated groundwater is known to exist within the boundaries of the proposed project area, the analysis performed as part of this EIS suggests that it does not pose a significant public health risk to park users. This is based on the fact that groundwater is not currently, nor is it envisioned in the future, to be utilized as a supply of potable water. Leachate treatment systems for the closed landfill mounds will continue to be operational with the proposed park. Local groundwater is not expected to pose a risk to park users due to the lack of direct exposure pathways. Signage warning park users of the potential risks associated with consuming water and swimming represent appropriate mitigation measures to be included as part of the development process. Other mitigation measures include the periodic sampling of monitoring wells associated with the closed landfill, in accordance with applicable permit requirements, as this data can facilitate the identification and correction of potential problems associated with the environmental control infrastructure associated with the landfill.
- Surface water: park development would entail limited possible uses and potential public health exposures associated with surface water usage including recreational fishing and boating. As stated above, surface waters in the vicinity of the proposed project are neither designated for use as potable waters nor are they expected to be used in that way for the foreseeable future. In addition, no park use assumes use of the surface water for irrigation. Moreover, water quality is not sufficient to support swimming within the park boundaries. Consumption of shellfish and of finfish is actively discouraged by public health advisories that warn residents of the potential hazards associated with these exposures. The proposed park would include management efforts and signage as additional measures to preclude swimming and the consumption of fish. Additional measures include: sharing the water quality sampling data collected by DSNY with park managers and ecologists or possibly expanding the sampling effort in surface streams and ponds on the site that would be made publicly accessible.
- Sediments: Sediments are another potential public health risk in that they serve as sinks for many environmentally persistent contaminants including PCBs, pesticides, toxic metals, and other anthropogenic pollutants. Measures to avoid public health impacts from sediments

include design and management elements that would limit potential interactions between sediments and users based on road, parking, and park amenities locations. For example, no major dredging projects are proposed with Fresh Kills Park.

- Site testing: Site testing is recommended as capital projects move forward and individual capital projects would develop a testing program based on areas where soil/ground water disturbance may be proposed. Based on site-specific project designs and individual testing protocols, remediation, if necessary, may be proposed to avoid impacts.
- Soils: The park development process envisions use of soils that meet the various criteria contained in 6 NYCRR Part 375 standards appropriate to the specific capital park project and program elements for the proposed project. Soils imported to the park and used for final soil cover would also be analyzed to verify that they meet the criteria for the park which could be developed on a case by case basis using Park 375 as a guide.

In-place monitoring and maintenance programs for the control of rodents and mosquitoes should be adequate for public health protections from rabies and West Nile Virus at the proposed park.✷

3.11.09



0 2000 FEET

SCALE

Legend

Potential Stormwater Exposure Sources

Stormwater Basin

Stormwater Capture Area (contains swales and downchutes)

Potential Landfill Gas Exposure Sources

Landfill Gas Flare Station

Landfill Gas Interceptor Venting System

Extraction Well Heads

Passive Vents

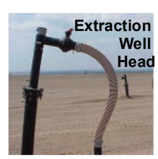
Landfill Gas Recovery Facility

Other Potential Air Pollution Exposure Sources

Existing Roads

Off-Site Industry

Leachate Treatment Plant

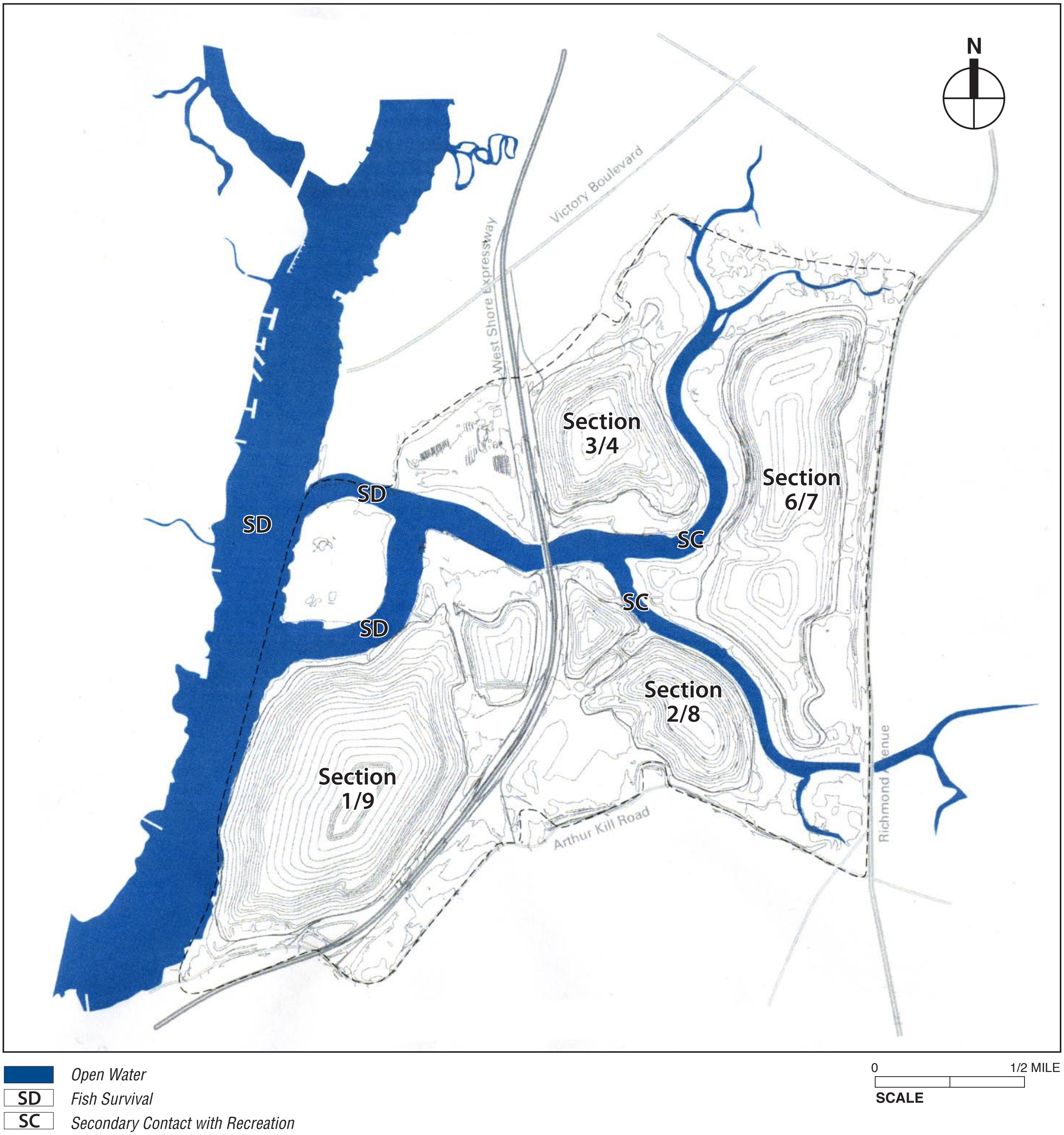


Notes

Landfill gas passive vent and extraction well head details obtained from the Fresh Kills Landfill Final Closure Plan (Weston Solutions of New York 2003)
Fresh Kills Landfill 2007 Financial Assurance Plan and Cost Estimate Detail (Annual Update) (Weston Solutions of New York 2007)
Fresh Kills Landfill Section 1/9 Final Cover Design Report Appendix D: Engineering Plans, Overall Conceptual Design (URS Corporation 2002)

Potential Public Health Exposure Pathways

Figure 21-1



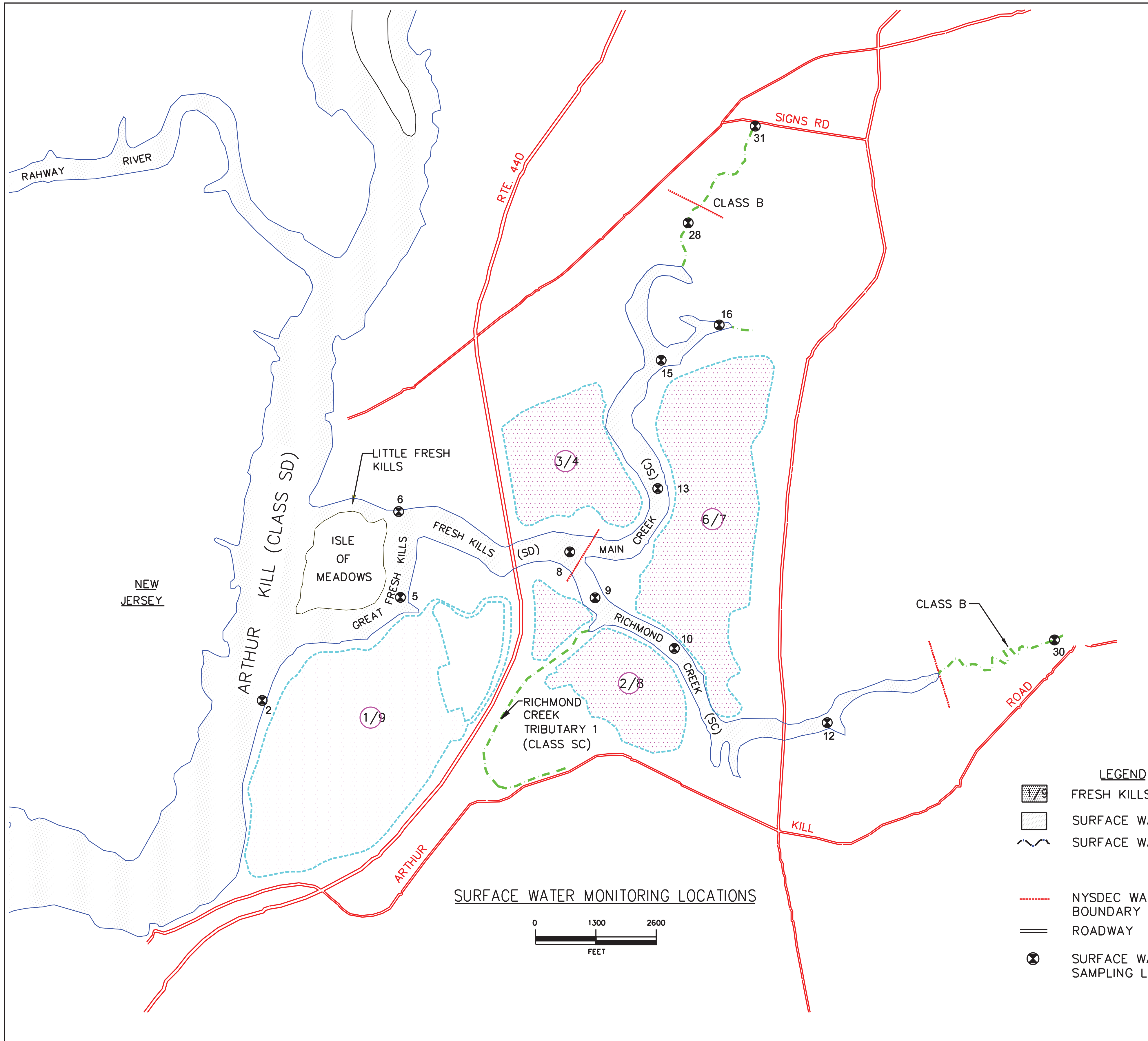
Water Use Classifications

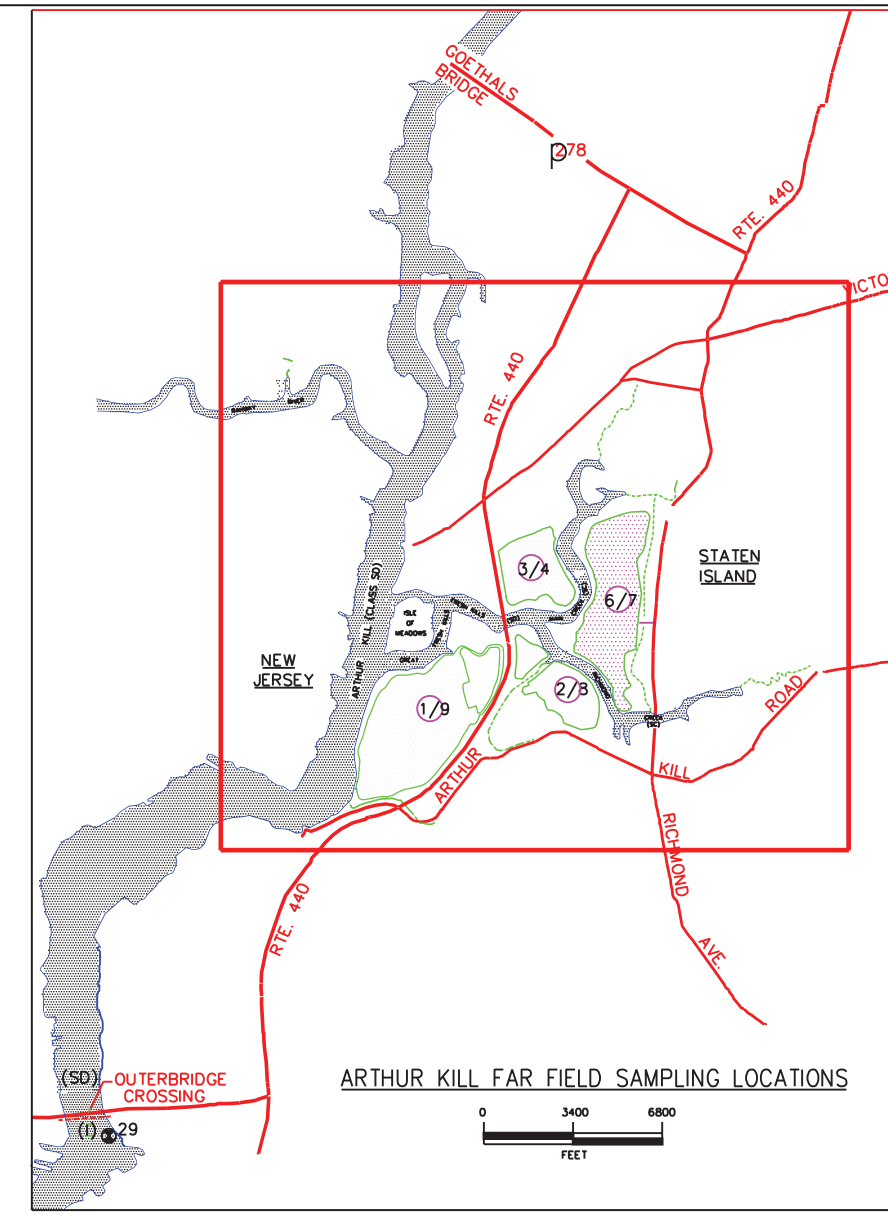
Figure 21-2

3.11.09

Source: DSNY

Landfill Gas Collection System
Figure 21-3





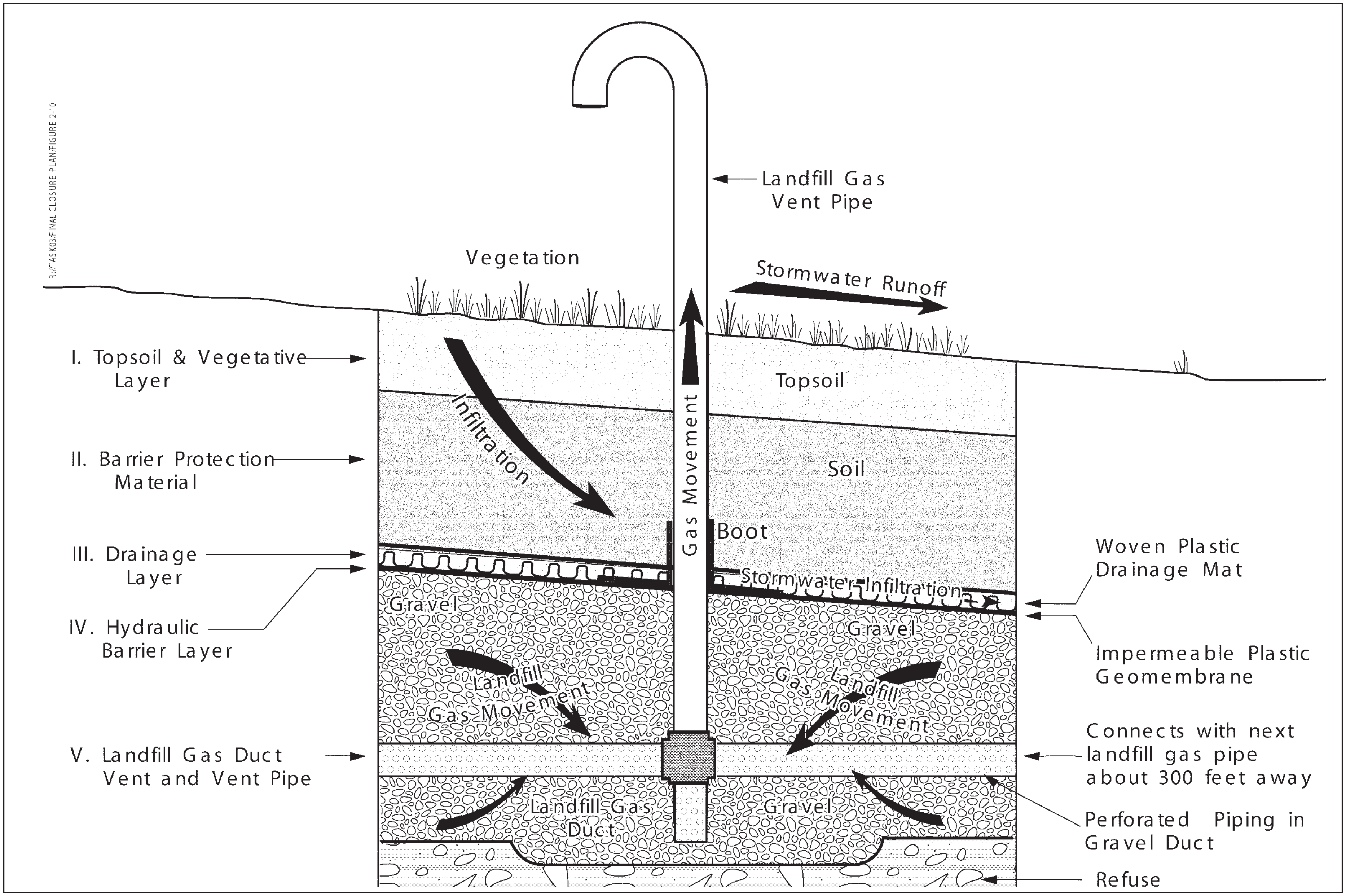
LEGEND

- 1/9 FRESH KILLS LANDFILL SECTION
- SURFACE WATER
- SURFACE WATER TRIBUTARY
- NYSDEC WATER CLASSIFICATION BOUNDARY LINE
- ROADWAY
- SURFACE WATER/SEDIMENT CHEMISTRY SAMPLING LOCATION

NYSDEC WATER QUALITY CLASSIFICATIONS AND USES

CLASS SD = SALINE WATERS (FISHING)
CLASS SC = SALINE WATERS (PRIMARY AND SECONDARY CONTACT RECREATION, FISH PROPAGATION)
CLASS B = FRESHWATERS (PRIMARY AND SECONDARY CONTACT RECREATION, FISH PROPAGATION)
CLASS C = FRESHWATERS (FISHING, PRIMARY AND SECONDARY RECREATION, BUT SUCH USES ARE LIMITED BY OTHER FACTORS)
CLASS I = THE WATER SHALL BE SUITABLE FOR SECONDARY CONTACT RECREATION AND FISHING
CLASS SC* = MARSHES CREEK HAS A NJDEP CLASSIFICATION WHICH IS COMPARABLE TO NYSDEC'S SC CLASSIFICATION

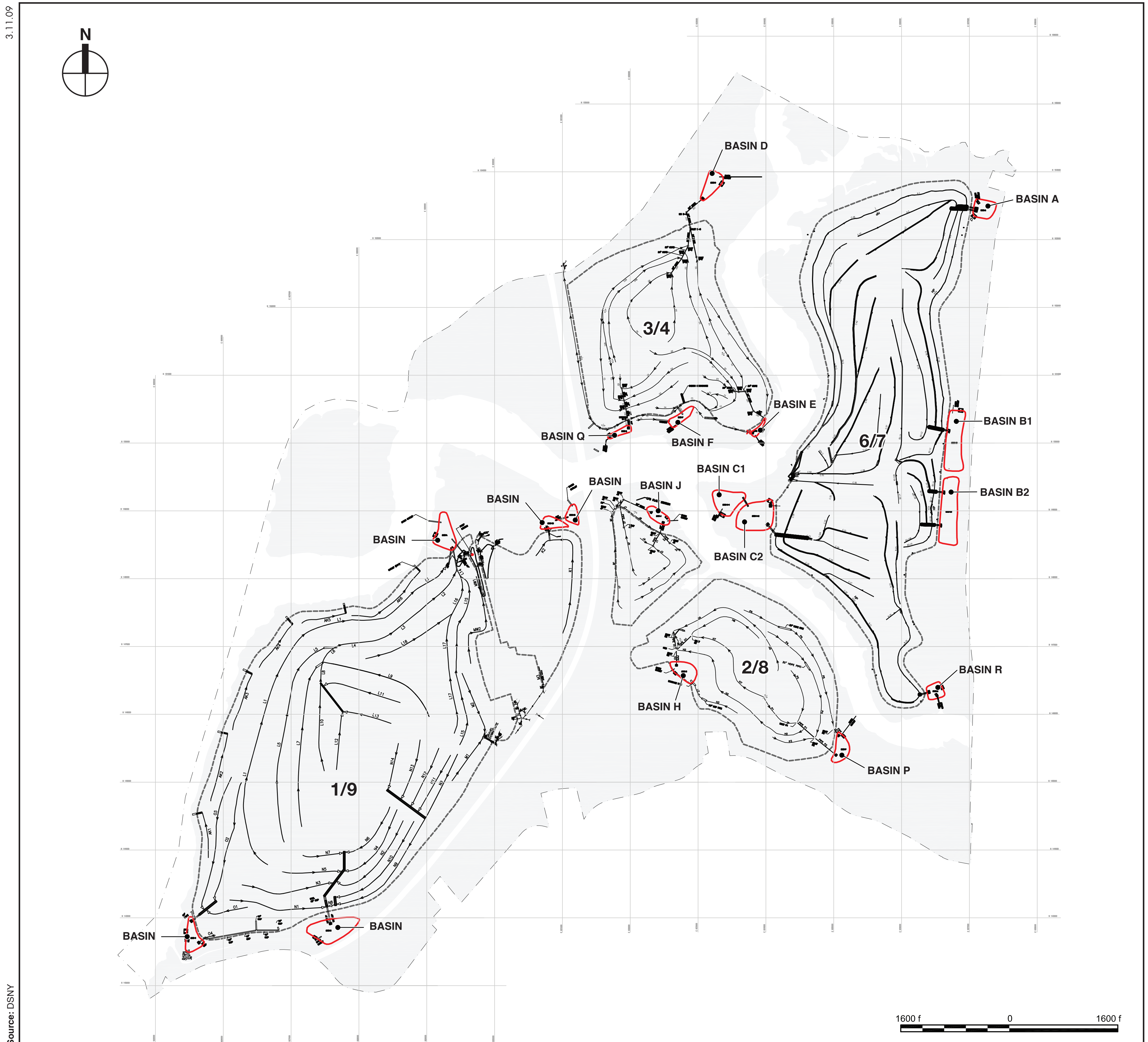
Surface Water Monitoring Locations and Water Quality Classifications
Figure 21-4



Source: DSNY

Final Cover and Landfill Gas Venting System:
Landfill Sections 2/8 and 3/4

Figure 21-5



SOLID WASTE MANAGEMENT UNIT BOUNDARY
DRAINAGE SWALE
DOWNCHUTE
CULVERT
BASINS

(SEE ALSO FIGURE 21-4)

Existing Landfill Stormwater Management System
Figure 21-6