APPENDIX H

NYSDEC RESPONSES TO COMMENTS AND SUPPORTING DATA

Appendix H: Responses to NYSDEC Comments

This appendix provides a separate response to comments addressing the New York State Department of Environmental Conservation (NYSDEC) comments on the Fresh Kills Park DGEIS. A copy of these written comments is provided in Attachment I. The comments are dated June 20, 2008, but were received August 20, 2008. Provided below is a response to each comment. In addition, this Appendix contains additional supporting data (e.g., text, tables, and graphics) that has been requested by the comments. This additional data has also been summarized in the main body of this FGEIS, where referenced by the comment.

CHAPTER 1: PROJECT DESCRIPTION

Comment 1: The DGEIS does not address how the various proposals will be in compliance with the approved Post Closure Care Plan (PCCP) for the Fresh Kills Landfill. This item is of utmost importance since this plan dictates the requirements to properly maintain and upkeep all of the landfill systems for thirty plus years. Without a demonstration of the technical compatibility of the proposals with the PCCP, the viability of the proposals has not yet been determined and therefore an environmental review cannot be completed until its viability has been proven. Given the critical nature of this issue, this must be resolved at this stage rather than in a Supplementary EIS.

Response: As described in the DGEIS (Chapter 1, "Project Description" page 1-79 "Conceptual Impact Avoidance Measures" and Chapter 23: "Impact Avoidance Measures and Mitigation"), the City is committed to implementing and satisfying the requirement of the Fresh Kills Landfill Post Closure Monitoring and Maintenance Operation Manual (PCMMO) at the Fresh Kills site either with or without the proposed park project in-place. With the proposed park, it is expected that each proposed capital project in the Fresh Kills Park capital program would be designed in conjunction with and to meet the needs of DSNY and the City of New York with respect to post-closure obligations at Fresh Kills. As a result, the City expects to demonstrate for each capital project either compatibility with the PCMMO (i.e., no conflicts with its implementation) or the City would need to identify specific elements of the PCMMO that the Fresh Kills project would seek to amend through a review and approval process with NYSDEC. Table H-1 provides an overview of the

currently contemplated DPR capital projects at Fresh Kills along with a review of issues relative to the PCMMO and landfill infrastructure.[1]

The Fresh Kills Park (DGEIS), May 2008, identified a comprehensive range of conceptual measures that would be taken by the project to avoid impacts on the landfill and its associated environmental protection systems (see Chapter 23, "Impact Avoidance Measures and Mitigation"). At this time, of all the currently contemplated DPR Fresh Kills projects, few are that far along in design such that any specific compliance statement or the identification of any necessary modifications to the PCMMO can be identified at this time. North Park Phase A2 is the one exception. Using North Park Phase A2 as a guide, as the individual park capital projects are more fully designed, a compliance statement will be prepared and the need for, and extent of, any modifications to the PCMMO will be identified and appropriate submittals will be made to DEC for review. The submittal for each project would evaluate the capital projects design compatibility with the PCMMO and any issues related to landfill infrastructure systems with the primary objective of demonstrating that each capital project has been designed to avoid impact to the landfill environmental protection systems. Thus, each capital project can avoid impacts and potential threats to human health or the environment in accordance with the requirements of 6NYCRR Part 360-2.15(k)(9). The City would include any remedial measures to avoid such impacts in the park capital project.

As an example of the approaches that would be taken during capital project review, DPR has developed such an evaluation for the North Park Phase A2 project (see Appendix Table H-2). North Park Phase A2 does not involve any modification to the landfill's final closure system. However, in order to provide a comprehensive review with respect to protection of landfill systems and the PCMMO, the evaluation of North Park Phase A2 as presented in Table H-2 identifies each landfill management feature required for the post-closure monitoring, maintenance, or operation of North Mound Section 3/4 that is within the Phase A2 project site or immediate vicinity of North Park Phase A2. Table H-2 also provides the plan objectives for avoiding impacts to landfill elements. This approach, which would similarly be carried out for each park development project, and would be used to demonstrate impact avoidance and compliance with the PCMMO. As stated above, this method for project review and implementation would establish a process for avoiding any potential project impacts to landfill systems, or threat to human health or the environment. Additional text has also been added to the FGEIS to reflect this compliance review process (see page 1-79).

[1] Tables can be found at the end of this Appendix.

It is fully expected that certain capital projects will be more complex than the North Park Phase A2 with respect to demonstrating this compliance. For example, future designs for the road system over Landfill Section 6/7 are expected to require some modification to the landfill's closure system and the PCMMO. Accordingly, the submittal to be made to DEC at a later date for the road project is expected to involve a review of the final cover design for Landfill Section 6/7 (for example) and a detailed evaluation of the manner in which any project-proposed alternate final cover design would meet the performance standards of the approved final cover design and that the requirements of 6NYCRR Part 360-2.15(k)(9) are achieved.

Comment 2: The acceptable chemical levels for cover materials was not addressed at any level of detail and when it was mentioned, it did not correctly represent the regulations and situation. The Brownfield Cleanup Program regulations, 6 NYCRR Part 375, does not directly apply to the Fresh Kills Landfill. Rather, the science of those regulations provide important information for NYSDEC staffs' exercise of agency discretion.

Response: Page 1-38 of the DGEIS stated that 6NYCRR Part 375 does not apply directly to the landfill, but, as stated in the comment above, can be used as a guide. As further stated on page 1-38 of the DGEIS, "although not directly applicable to landfills, [these regulations] can be applied to the use of soils in former industrial areas when conversion to other uses would allow public access." Some minor edits to text have been made in this FGEIS in response to the above comment.

Comment 3: The EIS should be modified such that the acceptable chemical levels for the cover layers shall be the lower of Part 375-6.8(b) residential and groundwater protection Soil Cleanup Objectives (SCOs), with ecological SCO when there are potential impacts to ecological resources. DER TAGM 4046 will be considered if Part 375 has no SCO for a contaminant. Please note, materials meeting unrestricted use Part 375-6.8(a) SCOs are preferred unless there is site-specific justification for using materials meeting the above "residential/groundwater with ecological" criteria. For aspects of the Fresh Kills park project NYSDEC may deem restricted residential acceptable in the Fresh Kills End Use, but Commercial and Industrial Levels will not be allowed.

Response: The Fresh Kills Park project is an extensive, multi-decade, park project that will be comprised of numerous individual capital projects. It will also require large volumes of soil that will serve multiple purposes including, for example, providing a base for recreation, landscaping and structured surfaces, and sub-base for roads and parking. As indicated by the comments, it is not expected that a single application of part 375-6.8 (a) can apply to the entire project. It is

therefore proposed by DPR that the determination of soils used at the site under each capital project be decided on a case-by-case basis and that the identification of the appropriate soil classification for each capital project be dependent on the proposed park uses, final surfaces, and intended purposes of the soils (e.g., recreational turf soils versus foundation soils for structured athletic surfaces, roads and parking, or ecological restoration projects, for example).

Based on these soil management principles, the DGEIS and this FGEIS have established a framework for a soil management plan (see page 1-47 of this FGEIS) for the project that will guide future capital projects. While additional details on soil needs will be developed for each capital project on a case by case basis, in no case is the selection of a soil expected to result in a new or undisclosed significant adverse impact not already addressed in the DGEIS or this FGEIS, nor is a Supplemental Environmental Impact Statement (SEIS) expected to be necessary to address each soil selection decision.

It is expected that DPR will consult Subpart 375 standards for Restricted-Residential with groundwater, ecological, and TAGM overlays providing additional guidance, but that decisions on soils would apply only to individual capital projects, such that a variety of different soil standards would be appropriate for different end-uses. This "project by project" approach is recognized by the New York City Department of Health and Mental Hygiene (NYCDOHMH) as the best approach for project implementation. As stated by NYCDOHMH, the guiding strategy for the soils at Fresh Kills Park can be based on the Title 6 NYCRR Part 375 Environmental Remediation Program which regulates the development of brownfield sites in New York State. Although not directly applicable to landfills, the Part 375 Soil Cleanup Objectives (SCO's) may use used as guidance for sites proposed for land use conversion to a park or open space that would allow public access, as well as projects creating flora and fauna opportunities.

In regard to the reference in the part of the comment addressing soil cover and groundwater, the soils proposals for Fresh Kills would have no deleterious impacts on groundwater conditions. With the proposed project, soil conditions and final land cover would be improved over the current conditions and therefore improving the quality of local groundwater. Moreover, as stated above, in no case is the selection of a cover soil expected to result in new or undisclosed significant adverse impacts not already addressed in the DGEIS and this FGEIS with respect to the proposed project and local groundwater conditions.

Lastly, as stated above, as part of the impact avoidance and protection measures to be implemented with each capital project and compliance with the PCMMO, no impacts to the landfill's groundwater protection systems would occur.

Comment 4: Areas that will be in fact ecological areas even thought they are not called ecological areas must be protected as ecological resources. This issue must be fully and completely addressed before the completion of the EIS rather than in a Supplementary EIS.

Response: As stated above, the proposed capital projects at Fresh Kills will be varied and will continue for an extended period of time (some 30 years). As stated above, future projects include a range of intended uses including passive recreation, active recreation, roads, parking, landscaping, and ecological features. It is the conclusion of DPR that the proposed Fresh Kills Park capital park projects would significantly improve the current ecological habitats at the site and would have no adverse impacts. In addition, other project elements would protect existing ecological areas (e.g., Isle of Meadows). The ecological SCO is not expected to apply to most capital projects given that the park would be largely restoring habitats at a landfill. However, the ecological SCO is expected to be appropriate in limited cases where existing sensitive habitats could be impacted by project activities on lands adjacent to, or within William T. Davis Wildlife Refuge, where ecological enhancements are proposed. However, as stated above, in no case is the selection of such a soil type expected to rise to the level of a significant adverse impact nor would it be expected to require an SEIS. As the landfill mounds require continuing monitoring and maintenance, their ability to serve as habitat areas is limited.

Comment 5: The thickness of the cover layer was not fully addressed and must be done to complete the environmental impact of the cover layer; it should be noted that a minimum of two feet is required except in very special cases which most likely will not apply at the Fresh Kills Landfill.

Response: As stated in the FGEIS, a minimum of two feet of clean soil is proposed at all publicly accessible areas. As discussed above and proposed by DPR, the soil criteria is also expected to vary for each capital project and would be determined on a case by case basis.

Comment 6: Remove all references to "potential amendments to the Order of Consent between NYSDEC and the City of New York, April 24, 1990, as modified (DEC Case #D2-9001-89-03) governing closure of Fresh Kills Landfill." The End Use Plan is subject to SEQR and cannot be authorized under a modification of the Consent Order.

Response: This DGEIS text has been modified in this FGEIS to reflect this comment.

Comment 7: SPDES Permitting (Please refer to DGEIS's Natural Resources, Infrastructure, and Construction Chapter): Based on Part VII, subparagraph K of the SPDES General Permit (GP-0-08-001) for Stormwater Discharges from Construction Activity, it is recommended that stormwater discharges for the Fresh Kills

Park development project be permitted under a SPDES Individual Permit rather than be covered by multiple SPDES General Permits for the various stages of construction or for the different contiguous units. The SPDES Individual Permit is more effective for this Park development project due to the following considerations: extent and volume of soil disturbance activities (i.e., clearing, grading, filling, and excavating), steep slopes to be encountered during construction activity and their proximity to environmentally sensitive areas, such as wetlands and waterbodies, and better monitoring of stormwater discharges from the construction project which is being built on a former landfill. Therefore, the Department requests that the related chapters/sections that describe the SPDES permitting process (e.g., Natural Resources, Infrastructure, and Construction chapters) be revised. The SPDES Individual Permit must include site-specific erosion and sediment control plans and post-construction stormwater controls for each stage/phase of construction.

Response: As stated above, Fresh Kills Park is a multi-year, multi-phase project that over the next 30 years would be comprised of numerous projects with different acreages, land use types and drainage characteristics. Figure H-1 in this FGEIS (Appendix H) presents a preliminary phasing diagram for the proposed project and Table H-3 presents preliminary project phasing providing additional data (as is available at this time) as to areas of land disturbance and proposed coverage, stormwater management, project phase, estimated construction period, and whether the project site is on or off the landfill, and does or does not utilize the existing DSNY Fresh Kills drainage facilities.

As shown in Table H-3, the Fresh Kills Park capital projects would be built over many decades, with a variety of projects, many of which would be small in scale and both on and off the landfill mounds at the site. In addition, the Fresh Kills Park project would reflect the requirements of the proposed stormwater management plan (see FGEIS page 1-74 for a summary of stormwater management principles). Overall, the park projects are not expected to result in negative impacts on drainage or water quality, but by improving final soil and vegetative cover would be expected to result in local water quality benefits.

Given the above, and the currently proposed phasing (as well as discussions with NYSDEC), SPDES Permits would be used to address stormwater permitting for the near-term projects with limited soil grading and a SWPPP (e.g., North Park Phase A, the Arthur Kill Road Parking Lot). These capital projects would not have extensive soil disturbances, would not be developed on sensitive areas such as the landfill sections or steep slopes, and would not affect landfill drainage facilities.

Once larger park projects are moving forward where the existing landfill infrastructure may need to be modified, adaptively reused, or connected to in order to accommodate a park capital project, or where a new outfall may need

to be constructed, the City would apply for an individual permit for the project site as whole. The process of applying for an individual permit is not expected to commence until the larger 2010/2011 projects are more fully designed (see Table H-3).

Lastly, to the extent that any project phase requires post-construction stormwater controls, that requirement would be addressed with DEC on a case-by-case basis.

Comment 8: Page 1-6 – Site History: Please provide complete and detailed [**lists**] of the consent orders, permitting efforts, closure efforts, past, current and future infrastructure and its installation/decommissioning with timelines.

Response: In response to this comment, additional data has been provided in this FGEIS, including:

- A table listing the history of the Fresh Kills Consent Orders, their modifications, and the associated closure efforts (see Table 1-12 in this FGEIS and additional details provided on the pages following in this Appendix);
- A description of current and historic efforts with respect to site permitting (see Chapter 1: Project Description and this appendix);
- Additional information on past, current, and future infrastructure (see Chapter : 1 Project Description and this appendix); and,
- Decommissioning with timelines (see the pages following in this appendix).

Comment 9: Page 1-7 – Project Purpose and Need: Please provide complete and detailed description of each of the project[**s**] listed and their size, age, and end uses with plans. Also, include a chart of the similarities and differences to the Fresh Kills Landfill.

Response: The following table shows available information on sizes, dates, and end-uses for comparable landfill conversions to park land in the United States. Additional written details, including information on landfill conversion and operations, are provided below for Dyer Boulevard Park and Shoreline Park. Pages 1-10 and 1-11 of this FGEIS have also been modified in response to this comment. These pages of the FGEIS were modified to disclose some of the challenges that these and other landfill restoration projects have faced, as well as the challenges that would apply to the proposed Fresh Kills Park.

Dyer Boulevard Park (West Palm Beach, Florida)

Dyer Boulevard Park contains three landfill cells, ranging in size from 43-90 acres, which operated in the 1970s and 1980s, were closed in 1990, and capped with PVC liner and soil. An active gas collection system installed in 1990 captures and flares the methane to prevent hazardous gas buildup and

odors. The cells wrap around a central core area of non-landfill land that contains active recreational facilities and structures.

As early as 1988, the Palm Beach County Solid Waste Authority (SWA) began foresting the site's perimeter and other open areas with 12,000 indigenous trees and 10,000 grasses to provide a habitat for birds and other wildlife. Bicycle paths for traditional cycling and horseback riding paths stretch along a 6–8-foot-high berm along this forested perimeter. The berm is 10–12 feet wide; beyond the fence, interconnecting, runoff-filled lakes that feed the canal system of Palm Beach County. All rainwater from the landfill flows into stormwater ponds that in turn feed a control structure, allowing water to spill over the lakes when it rises.

Landfill Conversion Case Studies

Project	Date Opened	Size	End Uses
Nanji Park Seoul, Korea	2002	910 Ac	Athletic fields, golf course, playgrounds World Cup soccer facilities; performance venue Wetlands restoration Wind Turbine
Norman J. Levy Park Merrick, NY	2000	45 Ac	Kayaking, fishing pier, 3 miles hiking/jogging trails Ampitheater 2 Ac restored wetlands Small-Scale Wind Turbine
Millennium Park Boston, MA	2000	100 Ac	6-mi of trails, baseball fields Amphitheater, picnic areas
Port Washington N. Hempstead, NY	1998	54 Ac	675 residential units 165 Ac nature preserve Golf course, athletic fields
Shoreline Park Mountain View, CA	1998	750 Ac	Golf course, 8-mi biking and running trails Ampitheater (seats 25,000), restaurant and banquet facility (seats 250), museum and gardens complex 226 Ac salt- and freshwater marsh; 50-Ac salt water
Dyer Blvd Park W. Palm Beach, FL	1997	405 Ac	4.1-mi bike and jogging path, 3.4-mi equestrian trail, ballfields, basketball and volleyball courts, children's playgrounds Picnic pavilions, comfort stations Habitat reserve

Source: Field Operations, November, 2008.

Shoreline Regional Park (Mountain View, California)

Prior to conversion to a park, this site contained a 500-acre landfill, a hog farm, auto-wrecking businesses, and a sanitary sewage treatment plant with drying beds for sludge produced by the plant. The landfill portion was active from 1970 to 1983, when final closure and park construction began.

The landfill was laid out as a series of waste-filled cells and a series of engineered landfill cells; the latter cells are where buildings were erected. Early on, some of the landfill gas was cleaned up with molecular sieves and injected into the local utility's natural gas. This process, ongoing for about 15 years, has been discontinued. Now, methane is flared at a station in the middle of the park, hidden behind a masonry block wall.

Much like Fresh Kills, the project site contains 226-acres of wetlands, including two streams already present on the site and the lake and ponds used to irrigate a golf course; 100-acres of engineered fill for building pads and levees; and 87-acres were set aside for commercial development when the city realized real estate values were rising.

Comment 10: Page 1-7 – Project Purpose and Need: Please include in this chapter a justification for the need of the roads throughout the landfill since the surface review of the traffic data does not provide same. Clear explanation and detailed numbers must be included.

Response: As requested in the comment, a detailed "Purpose and Need" section for the proposed park roads has been added to this FGEIS (beginning on page 1-11 of this FGEIS). As stated in the DGEIS and also noted in the added text of this FGEIS, the proposed park roads would provide access to the park for both cars and transit services. These roads would also continue to be used for DSNY maintenance access. In addition, the proposed roads would relieve local traffic congestion and the current condition of circuitous access to a regional highway (the West Shore Expressway) which now requires driving miles around the landfill. All of this data is explained in greater detail in the FGEIS.

Comment 11: Page 1-11 and 1-12 – Current Land Uses, Structures, and Operations at the Project Site: Please provide a far more detailed history as mentioned above.

Response: Additional data has been provided in this FGEIS with respect to the project site history (see FGEIS pages 1-6 through 1-9 and 1-97 through 1-100).

Comment 12: Page 1-17 – Current Land Uses, Structures and Operations at the Project Site: Please provide significantly more details on the deficiencies of the nature clay liner with maps and drawings for the leachate hole under Section 1/9 and broken rock under parts of Section 6/7 with estimates of the lost leachate per day. Also, please supply a chart of the actual leachate collected per year per section and an explanation of the changes especially to the model collection rates. Additionally, please detail the past and current leachate mounds for each section, the reason for the changes, what will be done to reduce them and what will be the consequences of same.

Response: Details on the leachate systems at Fresh Kills were provided in the DGEIS beginning on page 1-19 of Chapter 1, "Project Description." This FGEIS provides additional data on the landfill's leachate control systems beginning on page 1-23. The proposed park would have no effects or impacts on the natural clay liner cited in the comment above. The proposed project would also not affect leachate management, control, or monitoring systems. Park activities proposed at Landfill Selection 1/9 are at least 10 years in the future

with respect to West Park (post-2016). Rather, the proposed park project would potentially reduce impacts from leachate through expanded monitoring of waterways and other mechanisms as presented in Chapter 23 of the DGEIS and this FGEIS "Impact Avoidance and Mitigation Measures." Additional description of the potential leachate flow through the shallow sand layers beneath Landfill Section 1/9 is also described in Chapter 1. Predicted leachate flow values (horizontal and vertical flow) prior to implementation of the NYSDEC approved corrective measures are also described in Chapter 1.

The requested data on leachate collection is also provided on the table following. That table details the leachate flows collected from each of the four landfill sections during the 2008 calendar year.

Fresh Kills Landfill Leachate Collection
Calendar Year 2008

Date	Section 1/9	Section 2/8	Section 3/4	Section 6/7
Jan-08	11,876,303	2,381,933	3,792,960	3,933,936
Feb-08	12,378,298	2,169,230	3,486,240	3,840,036
Mar-08	13,510,139	2,068,934	3,574,080	3,915,648
Apr-08	11,107,272	1,377,288	2,574,720	3,483,677
May-08	10,783,568	1,143,948	3,396,960	3,591,504
Jun-08	7,737,119	301,825	2,003,040	2,953,096
Jul-08	5,966,974	428,861	1,376,640	2,616,525
Aug-08	5,529,443	902,477	1,026,720	2,980,724
Sep-08	5,685,531	1,115,251	1,272,960	2,776,667
Oct-08	6,170,922	1,454,118	1,968,480	2,774,079
Nov-08	6,279,694	1,766,088	2,435,040	2,827,616
Dec-08	10,371,511	2,210,155	3,155,040	3,036,863
Section Totals	107,396,774	17,320,108	30,062,880	38,730,371

Note: Flows from Landfill Section 6/7, 2/8, and 3/4 enter the leachate treatment plans facility as a combined flow and therefore cannot be measured independently by the facilities flow totalizer. Flows from these landfill sections were measured by summing the individual leachate collection well flows associated with each section.
Source: Geosyntec, February, 2009.

Comment 13: Page 1-17 – Current Land Uses, Structures and Operations at the Project Site: Please include in the reasons for gas control is the odor control of the landfill gas which was a significant issue in Staten Island until the Flare Station were installed. Also, provide a detailed discussion of the gas collections system [**effect**] on greenhouse gases and percentage of collected gases out of the total landfill gas generated with justifications for same.

Response: As requested by the comments, the detailed description of the existing landfill gas collection systems that was provided in the DGEIS (pages 1-17 through 1-19) has been expanded in this FGEIS and includes references to odor control. The added text begins on page 1-26 of this FGEIS. The effects of the Fresh Kills gas management system on greenhouse gases and the landfill gas collection as also requested in the comments is also addressed in this added

FGEIS text. As stated in the DGEIS and this FGEIS, Fresh Kills Landfill is already permitted as a Title V facility. The proposed park would not affect the permit and its requirements. Nor would the proposed park affect the gas collection system which collects an estimated 95 percent of the landfill gas generated at the site. However, the proposed park would implement energy saving and renewable energy projects (see page 1-76 of this FGEIS) and would not be a significant source of greenhouse gases.

Comment 14: Table 1-12 – Involved and Interested Agencies: Please correct NYSDEC regulatory role.

Response: A correction has been made in this FGEIS (see Table 1-13).

Comment 15: Figure 1-11 and several other locations: Why is Owl Hollow included in this DGEIS when the City has determined to exclude it from same?

Response: Owl Hollow is not in the GEIS as part of the proposed project. Owl Hollow is a stand alone project and was identified in the DGEIS as a separate No Build project. Figure 1-11 of the FGEIS has been modified to state that Owl Hollow is a No Build project in the GEIS.

Comment 16: Figure 1-13: Please include a complete and detailed description of the tree root depths and its compliance with the PCCP regarding protection of the landfill cover systems.

Response: The reference to the DGEIS figure cited in the comment above shows diagrammatically how habitats can be diversified at the Fresh Kills site over the long term (up to 30 years) through selective planting. As stated in the DGEIS section on landscape soils (page 1-37), a general principle in developing soil cover to support new planting is to ensure that soil depths are adequate to maintain the integrity of landfill cover systems. To that end, as specific park capital projects and their planting palettes are proposed, it is anticipated that DEC will review issues relating to specific tree species and their rooting habits, and proposed planting palettes can be adjusted accordingly. As stated in the landscape soils section (pg 1-38), additional protection measures such as limiting deep-rooted trees to off-mound areas and root-production-method seedings could be implemented at that time. It is noted that all future planting programs on the landfill sections would be provided in detailed designs for review by NYSDEC.

Recommended soil depths for tree growth on the landfill sections at Fresh Kills Park are based on the following information from the most recent research on tree rooting habits:

- Roots grow where water, minerals, and oxygen are found in the soil; the greatest supplies of these materials are located in the surface layer of soil, and therefore most roots exist in this zone.
- In areas where there are two soil types layered on top of each other (as will be the case at Fresh Kills after the placement of a minimum of 2' of clean soils over the existing soils that were used in landfill closure), roots have been found to proliferate at the boundary between two soils with roots predominantly found in the top layer.
- Studies previously conducted on Fresh Kills Landfill have concluded that planted tree species (in typical landfill closures of clay or geomembrane cap and two feet of soil) have not penetrated the landfill liner (Handel et al. 1997). According to Dr. Steven Handel and others, tree roots will avoid the acidic, anoxic, and compacted environment near the landfill liner, and spread laterally in the upper soil horizons where aeration, nutrients, and water is prevalent. Roots will spread laterally rather than penetrate the landfill liner (Handel 2000).

The North and South Mounds have two feet of soil cover over the existing landfill cap as required by New York State regulations. An additional two feet of clean soil will be placed over the North and South Mound to meet DEC regulations for Freshkills Park; in some areas, considerably more than two feet of soil will be placed to meet finished grades. East and West Mounds, currently undergoing the capping process, are receiving approximately 2.5 feet of soil. Two feet of clean soil will also be placed on top of those soils in these areas.

Comment 17: Figure 1-23: Please describe the parking plan on top of Section 1/9 and its compliance with the PCCP.

Response: The proposed small parking facility on top of West Park (approximately 60 spaces) is a long term (post-2016) element of the project and detailed designs have not yet been developed. However, parking on top of Landfill Section 1/9 is proposed primarily to provide limited vehicular access (including ADA access) to the proposed 9/11 monument in West Park. This capital project is not expected to be developed until after 2016. As designs for this parking area are advanced, they will be provided to DEC as will a description of the compliance and any necessary modifications to the final cover and PCCMO. Submittal of plans and plan review is not expected to commence until after 2016.

CHAPTER 10 – NATURAL RESOURCES

Comment 18: The level of detail of impact analysis and discussion in some areas is detailed and in other areas it is lacking. For example, lighting seems to give detailed information and provide references, whereas habitat loss impacts and fishery

impacts sections are not as detailed. Page 10-106 paragraph 3 and page 10-124 do not discuss full potential impacts of bisecting the wetland with roads.

Response: The level of detail in the impact analyses presented in the DGEIS was based on the final scope of work (May 2006) and the determinations of the lead agency, DPR as the DGEIS was being prepared. For example, the potential impact of lighting was given added attention in the DGEIS as the issue was raised by DPR's Natural Resources Group. As a result, this was a special technical area in need of particular focus as the DGEIS impact analyses were being developed. Habitat loss with the project is less of an issue given the overall habitat improvements that would come with converting the project site from a closed landfill to a park; the impacts of the park roads largely occur on developed or altered portions of the site which limits that impact on natural habitats to the extent possible. (The exception here is the impact on the road crossing of wetlands in East Park.)

One of the issues with the analysis of potential road impacts is habitat continuity and fragmentation, as is raised in the comment above. A discussion of habitat fragmentation resulting from road construction was presented on page 10-74 of the DGEIS. Additional analysis on habitat fragmentation is provided in Appendix H of this FGEIS and on pages 10-73 through 10-75 of this FGEIS. This discussion has been expanded in the with respect to impacts on wildlife movement and populations, and also includes a number of measures that could be implemented during final design to minimize such impacts (these measure are also provided in Chapter 23 "Impact Avoidance and Mitigation Measures.")

Habitat issues with respect to potential degradation of habitat quality, impacts on biodiversity, direct loss of wildlife populations, and decreased access to habitat were also addressed in the DGEIS with respect to potential road impacts. These sections also discussed the final design measures that could reduce or avoid such impacts (see pages 10-75 and 10-76 of the DGEIS). These final design measures were further elaborated on page 23-5 of the DGEIS under "Impact Avoidance and Mitigation Measures."

The proposed project is in the unusual position of both designing and creating both new roads and habitats as part of the East Park project, unlike a road project that in and of itself would not have such dual objectives. Thus, the GEIS can provide these measures for use in final design of both habitats and road. To that end, the DGEIS, and this FGEIS, also include measures that avoid or minimize project designs and potential impacts on habitat fragmentation, or "continuity of habitat" (see pages 10-73 through 10-75 of this FGEIS) and also cross-references the impact avoidance and mitigation measures to Chapter 23.

There are also sections of the DGEIS Chapter 10 "Natural Resources" that specifically addressed the potential road impacts of the proposed project. For

example, under "Wetlands" on page 10-104 of the DGEIS, there was a discussion of potential impacts due to both filling and shading impacts on tidal and freshwater wetlands. Details of the road impacts continue on page 10-105 which provides impacts on wetlands for each of the proposed road segments. It is also recognized that the wetland impacts are offset by the wetland enhancement and creation program proposed with the project (see page 10-106) and can also be minimized through the use of viaducts that maintain hydrology and wildlife connections (see page 10-104 the DGEIS with respect to the Forest Hill Road connections and page 10-107 of this FGEIS as well as 10-123 of the DGEIS and 10-126 to 10-127 of the FGEIS and the mitigation measures presented in Chapter 23, "Impact Avoidance and Mitigation Measures.") More developed mitigation measures and designs would be presented as part of the capital project design and the wetland permitting/protection of waters permit processes with DEC/ACOE. Provided in this DGEIS and this FGEIS are acreage impacts and mitigation areas and opportunities. Figure 1-13a in Chapter 1, "Project Description," presents the potential extensive mitigation opportunities that exist within the site.

Under the heading of terrestrial resources on page 10-124 the FGEIS discusses potential impacts to *wildlife* as a result of bisecting wetlands and uplands with fill/roads. Potential impacts to *wetlands* due to road construction are discussed in detail on page 10-103 to 10-105 and 10-123 under "*Wetlands*" and "*Aquatic Resources.*" Additional information is also provided at the end of this appendix.

Comment 19: This chapter did not discuss the possible negative impacts on natural resources by the construction of the roads. Please correct in detail.

Response: As discussed above, the DGEIS provided significant analysis of the potential natural resources impacts of the proposed roads and pedestrian bridges. A summary and overview of impacts from the proposed roads was presented in the DGEIS on pages 10-73 through 10-75. For the 2016 road program, an analysis was provided on DGEIS pages 10-102 to 10-109 with an additional analysis for the 2036 road and bridge program in pages 10-122 to 10-125. The impact analysis examined the potential for impacts on habitat fragmentation, human use along the roads, degradation of habitat quality, direct loss of wildlife, decreased access to habitat, geology soils and groundwater, floodplains, wetlands (impacts were quantified in acres based on current designs by park road segment including the two connections to Richmond Avenue, the Loop Park Roads under the West Shore Expressway and the proposed expressway service roads) as well as the proposed pedestrian/bicycle bridge across Richmond and Main Creeks, road impacts on aquatic resources for the proposed in-water activities (e.g., a viaduct connection with the Forest Hill Road extension) were also analyzed. In addition, completing the CEQR/SEQRA review, impact avoidance and mitigation measures for road

impacts were presented in the DGEIS on page 23-5 of Chapter 23 (see also Table 23-1, which provided wetland impact and mitigation measures). (As stated above, more fully developed mitigation measures would also be developed as part of capital project designs move forward as does the wetland permitting/protection of waters permit processes with DEC/ACOE. In addition, Chapter 20, "Construction," of the DGEIS provided a full analysis of potential construction-period impacts on natural resources from road construction.)

As stated in the response to the comments above, additional text is also provided in this FGEIS with respect to the analysis or road impacts in response to comments. This includes expanded analysis of potential habitat fragmentation and other impacts (see the double underlined text in the FGEIS).

Comment 20: Pages 10-117 and 10-118 do not [**have**] a fully developed discussion of pier effects on continuity of habitat and increase in boat usage effects on habitat and wildlife.

Response: The DGEIS addressed both pier effects on continuity of habitat and impacts of boat usage. It contained a summary discussion of the potential for pier effects, including overwater cover and shading, on page 10-79 through 10-81. It also included impact avoidance measures that could be used to avoid or minimize such impacts (see DGEIS page 10-81) that were also included in Chapter 23, "Impact Avoidance and Mitigation Measures." These measures were drafted into the DGEIS for the purposes of providing guidance during final design that avoid or minimizes impacts from marine structures, including pier effects and shading.

The DGEIS discussion cited on the pages in the above comment addressed longer term (2036) public water-access projects that are proposed to be located in the Confluence-The Point. It recognized that designs for this area with respect to fishing piers and the proposed marina are less developed than for the 2016 elements of the project. However, in keeping with the objectives of impact minimization with respect to pier effects, page 10-117 of the DGEIS describes the construction of small footprint, narrow, and overwater structures within tidal wetland habitat (i.e., fishing and picnic piers and overlooks) that would provide public access to the water. Limitations on pier size were identified in the DGEIS and measures were recommended to avoid and minimize impacts that were described on page 23-6 of the DGEIS with respect to marine structures. In the DGEIS, the sizes of pier and in-water structures were estimated based on current preliminary programming, quantified, and included as part of the analysis of wetlands impacts. That data is presented on Table 10-14 of the DGEIS. As shown in that table, the affected areas are very limited (about 0.2 acres by 2016 and 0.4 acres by

2036) and the piers/floating docks would provide small boat launches, public overlooks, a modest sized fishing pier, and a small marina all of which would allow the public to access the water which is an objective consistent with State and City waterfront revitalization goals. Moreover, the pier projects are sited in areas already developed with marine infrastructure that once handled hundreds of DSNY barges and where marine infrastructure could be reused. The effects on "continuity of habitat" from these small publicly accessible structures is minimal and with approximately 210 acres of existing open water at the site (and an estimated 570 acres of existing wetlands) it was concluded in the DGEIS that this limited amount of new infrastructure over a 30-year build-out period is not a significant impact of the proposed project particularly with the proposed impact avoidance measures. This FGEIS also includes additional discussion in this regard.

With respect to impacts from boat usage, the proposed project is largely designed for non-motorized craft with one small 50-slip marina and a ferry/water taxi landing that is proposed in the long term and proposed in an area of the site previously developed with DSNY infrastructure, As such, adverse impacts from such activity are expected to been minimal. That being said, pages 10-117 and 10-118 of the DGEIS discussed that potential for impacts from increased boat traffic at The Confluence as a result of the construction of a marina and ferry landing. Potential impacts to wildlife due to increased human activity (e.g., boating) is addressed in a general discussion of the impacts of human use on pages 10-81 and 10-82. Additionally, page 10-119 of the DGEIS included a discussion of the impacts of increased boat traffic at The Confluence on wildlife (that discussion has been expanded on page 10-122 of this FGEIS). In response to the above comment, the discussion of potential adverse impacts to habitat and wildlife activity within tidal wetlands of the Confluence due to the limited long-term increase in non-motorized and small motorized boat usage has been expanded in the FGEIS (see page 10-120). It remains the conclusion that these impacts will be limited. Measures to reduce or avoid impacts from boating are also presented on page 23-6 of Chapter 23 "Impact Avoidance and Mitigation Measures." These would include control of boat speeds and wakes as well as access control in sensitive habitats such as Isle of Meadows and William T. Davis Wildlife Refuge.

With respect to pier effects and the proposed Signature Bridge it is expected that a Supplemental Environmental Impact Statement (SEIS) would be necessary at the time of the bridge proposal (this is a post 2016 project element) in order to fully characterize the impacts of the proposed bridge aquatic resources.

Comment 21: Page 10-123 states there is no impact to Signature Bridge south shoreline. Please correct.

Response: The proposed Signature Bridge, another long term element of the project, was conceptually designed for the DGEIS as a span bridge that touches down on the uplands along the north and south shores of the Fresh Kills. Such a design minimizes impacts to the waterway and shorelines along the Fresh Kills. The DGEIS text that analyzed and described this impact (see page 10-123 of the DGEIS) has been to clarified in this FGEIS (see pages 10-128 to 10-129 of this FGEIS) to state that the Signature Bridge would have no impact on tidal wetlands along the southern shoreline because preliminary designs for the Signature Bridge indicate the southern bridge pier would be on the developed upland portion of the site, not in the waterway or wetlands. (The south shoreline was developed with DSNY infrastructure and the north shoreline of the Fresh Kills is less developed.) That being said, given the long-term nature of this element of the project and that additional designs would be necessary to fully evaluate impacts of a new bridge at this location, it is expected that the Signature Bridge would be the subject of a separate project-specific SEIS. As requested by DEC, additional text has been added to this FGEIS to confirm that determination by DPR.

Comment 22: Page 10-12, 10-13, and 10-17: Unmapped freshwater wetlands and associated streams and water bodies within the park may be regulated under Article 15 Protection of Waters. Site specific assessment will need to be made as to applicability of Article 15 Protection of Water on the unmapped freshwater wetlands and water bodies within the park/landfill areas.

Response: To address the potential for individual capital projects to be regulated under Article 15 and not Article 24 of the Freshwater Wetlands Program, site-specific assessments of the regulatory issues for each capital project and potential affects on water bodies within the park/landfill areas would be made on a case by case basis during the permitting process for these capital projects (see also the text revisions on page 10-13 of this FGEIS).

Comment 23: There are a number of conclusory statements that are not supported by facts. Statements should be substantiated and referenced. For example: Page 10-27 – Fish, first paragraph: The statement that the Arthur Kill has a low value as fish habitat. How was this conclusion drawn? There is a need to provide sources for the conclusions drawn in this document.

Response: The statement on page 10-27 of the DGEIS was that the Arthur Kill had low value as *"residential"* fish habitat, a statement that is supported by the Arthur Kill's water quality classification (SD) and water quality/fishery characteristics. However, this text has been removed from the FGEIS.

Comment 24: Page 10-60, first paragraph: The statement that *phragmites* [**have**] the potential to invade portions of the *spartina* dominated salt marsh as the site matured. Provide the appropriate reference.

Response: The DGEIS text reference referred to in the comment is in the "No Build" analysis where the conclusion was being made was that if tidal flows become altered or restricted this creates the opportunities for *phragmites* to invade given its aggressive and invasive nature when tidal flows and salinity are altered. A citation has been added to this statement to this FGEIS (Bart et.el, 2006).

Comment 25: Page 10-64: The statement that Owl Hollow Park will not result in significant adverse impacts to natural resources. How was this conclusion drawn? There is likely some impact as the site is currently unused. Provide information from any environmental analysis that was prepared.

Response: This conclusion is based on the EAS for the Owl Hollow Park project for which a Negative Declaration has already been issued. While clearing is proposed, no significant adverse impacts would occur at the Owl Hollow Park site.

Comment 26: Page 10-71: The permanent loss of benthic macro invertebrates within the structure footprints would not have significant impact [**on**] the food supply for foraging fish. Does impact usable habitat for appropriate species. Please provide information to substantiate this, e.g., number of square footage possibly impacted, wildlife possibly impacted, etc.

Response: The DGEIS text cited in the comment above is taken from a summary section of the natural resources analysis that addressed the overall impacts of marine infrastructure. As discussed above (see Comment 20), preliminary sizes of overwater structures and footprints were presented in the DGEIS and the impacts were assessed within the relevant 2016 and 2036 "The Future With The Proposed Project" sections (from pages 10-87 through 10-127).

Page 10-71 of the DGEIS provided a general discussion of impacts as a result of in-water project elements that actually begins on page 10-69. It is the conclusion of the DGEIS and this FGEIS that these impacts are limited. For example, although only in preliminary design, the proposed pedestrian/bike-ways bridges across Main and Richmond Creeks with the four lane road are expected to affect only about 500 square feet of creek bottom (i.e., the benthic community). The additional fishing piers and marina in the Point as well as the proposed boat launch are conservatively assumed to affect about 7,250 square feet of the creek bottom habitat (see pages 10-111, 10-112, and 10-122 of this FGEIS).

As described above under the response to Comment 20 as well as in Chapter 1, "Project Description," the proposed project has limited in-water activities

including small pieces, as floating docks and a boat ramp, that would provide public access to the water and developed over a period of about 30 years. Also proposed, (but only necessary with a four lane road) is the widening of the existing bridges over Richmond and Main Creeks to accommodate pedestrians and bicyclists. Given the size of the Fresh Kills Park project, there are comparatively few structures in the water with few piles and overall, limited in-water disturbance. All impacts of these activities were in the DGEIS. The affected areas amount to only an estimated 0.2 acres (about 8,700 square feet) in 2016 and additional 0.4 acres (about 17,424 acres) by 2036. As stated above, areas affected by piles total about 500 square feet for the widened bikeway/pedestrian bridge in 2016 and about 7,250 square feet of creek bottom by 2036. While these calculations are preliminary, they do support the DGEIS conclusion that a limited in-water impact occurs with the project that is concluded to not be significant. In addition, all in-water activities would be subject to future permitting and review with NYSDEC and ACOE. Capital project-specific information, including pile diameter and locations, would also be addressed in greater during the permitting phase.

To complete the CEQR-SEQR review, mitigation and impact avoidance measures were also presented in the DGEIS and this FGEIS. These measures are presented in Chapter 23, "Impact Avoidance Measures and Mitigation"; Figure 1-13a of the DGEIS also presents the range of extensive mitigation opportunities that exist within the site.

Comment 27: Page 10-98: Not enough detail [is provided] to know that proposed plant enhancements will offset impacts.

Response: The DGEIS page cited in the comment is addressing the terrestrial impacts of the proposed South Park project, which is in the 2016 analysis year. The current upland vegetative cover and habitat in this portion of the site is a mix of disturbed areas, woodland and the grasses and invasive species that comprise the vegetative cover on Landfill Section 2/8. The landfill covers at Fresh Kills were designed for soil stabilization as a final vegetative layer cover (the cover at 2/8 dates from the mid 1990s) and are regularly mowed and maintained by DSNY for that purpose. This management also allows DSNY management and maintenance access to the landfill and its facilities. A description of the current habitat at Landfill Section 2/8 was provided on page 10-38 of the DGEIS and was summarized on Page 10-98. As described in the DGEIS, the vegetated covers at the closed sections (e.g., 3/4 and 2/8) are dominated by grasses and invasive species. They were neither designed for habitat nor are they managed as habitat. As a result, the current vegetative layers on the landfill generally provide a low habitat value. This habitat condition is compared in the DGEIS with conditions under the proposed project, where habitats on the landfill sections would be designed to significantly enhance, diversify, and manage the final cover at the landfill

sections for diversity of vegetative cover and wildlife habitat with specifically designed planting and habitat objectives, rather than a stabilization objective. In addition, the soils would be improved with an additional two feet of new material. All planting programs and habitat designs for the proposed landfill cover would require approval by NYSDEC and additional design details would be provided as part of that process. At this time, the South Park project and restoration of the Landfill Section 2/8 cover is not expected to move forward until 2010/2011. In response to this comment, the text in this FGEIS has been revised to clarify DPR's conclusion as to how the proposed project and the habitat enhancements would be designed to offset impacts and to better describe the habitat improvements on top of Landfill Section 2/8 (see pages 10-100 and 10-101 of this FGEIS).

Comment 28: Page 10-40 – Wildlife, opening paragraph: It is stated that species known to occur within the secondary study area would have the potential to occur within the project site should similar habitat be present. This should also be made clearer within the various tables listing bird species, wildlife, etc.

Response: The text and tables of this FGEIS (see Table 10-6, pages 10-41 through 10-45) have been revised to state the potential for wildlife species from the secondary study area to also occur at the project site.

Comment 29: Page 10-66 – Land Disturbing Activities: The bullet that defines direct and indirect loss of habitat is confusing. Perhaps direct loss of habitat and wildlife should have a separate bullet from indirect loss of habitat and wildlife.

Response: The modifications requested in the comment have been presented in this FGEIS (see page 10-65)

Comment 30: Page 10-68 – Construction Monitoring: Need to include discussion of storm water control monitoring.

Response: The DGEIS text on page 10-67 has been revised in the FGEIS (see page 10-68) to state that monitoring will be conducted to verify compliance with an approved Stormwater Pollution Prevention Plan (SWPPP) that would be prepared for each capital project element.

Comment 31: Page 10-69: Within the section that discusses activities that have the potential to impact aquatic resources and wetlands through direct loss of wetland bottom habitat, etc., fishery impacts need to be listed.

Comment 32: The requested text modification has been made in this FGEIS (see page 10-69).

Comment 33: Page 10-70: In water work impact minimization needs to discuss the possibility of appropriate fishery seasonable restriction and other alternatives to impact minimization.

Comment 34: The requested text has been added to this FGEIS (see page 10-70).

Comment 35: Page 10-82 – Table 10-12: Areas and acreage impacted should be added to this table.

Comment 36: The requested modification to the table has made in this FGEIS (see Tables 10-12 and 10-13 on page 10-84).

Response: Page 10-84: The last paragraph discusses in water fill as enhancement. This should be expanded on as in water fill can be considered habitat exchange and not necessarily recognized as habitat enhancement.

Response: The requested clarification has been made in this FGEIS (see page 10-86).

Comment 37: Page 10-97 – Terrestrial Resources: The final cover planting usually includes establishing beneficial grassland habitat. There is no discussion of impact to established and final cover not yet established.

Response: The referenced DGEIS page in the above comment addresses potential project impacts on terrestrial resources in South Park (see also the response to Comment 27, above). As discussed in Chapter 10 of the DGEIS, "Natural Resources," Section D "The Future Without the Proposed Project: 2016 and 2036," (page 10-59), within South Park (Section 2/8) no additional landfill closure activities are proposed since a final cover and vegetation has been in-place at this landfill section since the mid 1990s, this is also the case at Landfill Section 3/4 to the north. As stated above, by design, the purposes of this vegetative cover are principally to provide soil stability (it is not a habitat cover) and the vegetative layer of cover is regularly maintained and occasionally mowed in order to protect against invasive woody species becoming established and to allow DSNY access.

While final closure activities have been completed at both Landfill Sections 3/4 and 2/8, final closure and installation of a vegetative cover layer, is yet to be completed at Landfill Sections 6/7 and 1/9. However, on all landfill covers, there would be final cover post-closure monitoring and maintenance activities, including management of landfill systems, monitoring, and mowing. Given the long term monitoring and maintenance requirements for the landfill covers, no significant habitat improvements are expected to evolve in the future without the proposed project. Therefore, for example, in the area of South Park, conditions would be expected to be similar to the "Existing Conditions." As described above, (see the response to Comment

27), these conditions were not found to be exemplary or significant habitats and no "beneficial grassland habitat" is expected to establish itself at the site in absence the proposed project (i.e., the Future Without the Proposed Project Condition).

Comment 38: Page 10-99: Threatened or Endangered species may be impacted by the loss of usable habitat and displacement.

Response: The DGEIS presented a full assessment of the potential impacts on threatened and endangered species as well as the necessary impact avoidance and mitigation techniques. These techniques included pre-construction surveys in any areas of potential impacts (see also page 23-18 in Chapter 23 "Impact Avoidance and Mitigation Measures" of the DGEIS and this FGEIS). Post-comment review with NYSDEC concluded that this is the appropriate impact avoidance and mitigation measure in these instances.

CHAPTER 11 – HAZARDOUS MATERIALS

Comment 39: This chapter is significantly deficient in its lack of discussion of the justification of the solid waste nature of the four sections when similar landfills that accepted the same nature of waste from the same source at the same time are being closed as inactive hazardous sites. Also, page 11-19 must be rewritten to incorporate the above Comment #2 (General Comments).

Response: Chapter 11: Hazardous Materials fully meets all requirement of the DGEIS Final Scope of Work which was developed in cooperation with DEC. In accordance with the Final Scope, the DGEIS provided all regulatory information on the Fresh Kills site with respect to hazardous materials based on current records of spills, RCRA sites, and sites listed on the State's listing of inactive hazardous waste sites (see page 11-3). That text fully disclosed spills, air and water discharge permits for the site and surrounding area, any recorded violations, and other relevant data. The DGEIS also provided a complete description of the current regulatory status of Fresh Kills Landfill. Fresh Kills Landfill is not an inactive hazardous waste site, as discussed on page 11-7 of the DGEIS and page 11-8 of the FGEIS. Fresh Kills is not regulated as a hazardous waste site, but is regulated as a closed municipal solid waste landfill by DEC under a Consent Order.

Minor modifications to text have been made on page 11-19 in this FGEIS relative to the response to DEC comments on the proposed soil management plan (see also the responses to Comments 2 through 5, above).

CHAPTER 19: NOISE

Comment 40: Chapter 19 – Noise: An analysis of the noise impacts of the proposed wind turbine was not included. Also, please provide complete and detailed plans on how the wind turbine will be constructed such that there will be no potential negative impact to the landfill cover system. Please note, DEC has previously written to you that placing piling into the waste mound is unacceptable.

Response: As stated in the DGEIS, there are no detailed designs for commercial wind turbines at the site at this time. Site specific impacts of commercial-scale wind turbines, including both noise and landfill cover impacts, will be analyzed based on a site specific wind turbine design. Additional text providing a generic assessment of noise impacts from commercial wind turbines is presented in this FGEIS. The DGEIS and this FGEIS identify the issues of subsurface foundations and piles on the landfill as "to be addressed" in the site-specific design of commercial wind turbines along with the need for any permits and approvals for wind turbines proposed to be placed in these areas.

CHAPTER 20: CONSTRUCTION

Comment 41: This chapter states that the closure of the Fresh Kills Landfill is scheduled for 2012 while in other places of the DGEIS it is stated as 2016. Please explain.

Response: It was stated in this chapter of the DGEIS that landfill closure is expected to be completed by 2012. It was also stated in Chapter 1, "Project Description," and in this chapter, that there are two analysis years in the DGEIS, with the first analysis phase being 2016 (see page 20-3 of the DGEIS and this FGEIS) and the second being 2036.

CHAPTER 23 –ALTERNATIVES

Comment 42: The document does not consistently discuss the use of an alternatives analysis for all aspects of the project(s). The process of how the various projects were chosen, how any proposed mitigation was determined and also timing of construction of various components and development of habitats and established is not discussed in the context of the SEQRA principle of avoidance, minimalization and mitigation. Project reasonableness in light of alternatives is also not discussed. For example, the roadway analysis on pages 10-74, 10-75, and 10-102 does not discuss alignment alternatives, attempt to minimize footprints or mitigate the loss of habitat of fully discuss possible impacts. Page 10-78 does not discuss over water structure alternatives analysis, reduction of footprint, water dependence or structures, etc., page 10-89 and 10-96 discussion of impacts to wetland do not include alternatives discussion.

Response: As described under CEQR/SEQRA, alternatives to be presented in an EIS are developed for the purposes of describing and evaluating a range of reasonable alternatives in consideration of the objectives and capabilities of the project

sponsor. Also, in accordance with CEQR/SEQRA all alternatives are evaluated in an alternative chapter, which in the DGEIS and this FGEIS is Chapter 22, "Alternatives," not in the technical analysis chapters (e.g., Chapter 10, "Natural Resources") The DGEIS provided an assessment of alternatives for the three major areas of impact assessment with the project, the roads, the landfill and natural resources.

The range of alternatives analyzed under CEQR/SEQRA includes, at a minimum a No Action Alternative (which was provided in the DGEIS). Also to be provided is an analysis of reasonable alternatives that may consider alternative sites, technologies, designs, phasing, uses, and actions that are examined for the purposes of providing a comparative assessment of impacts with the proposed action/project. It is not necessary to provide an alternative for "all aspects of the project," nor is it required under SEQR/CEQR to present the process by which individual projects were selected, the associated mitigation, or project phasing. In fact, in accordance with CEQR/SEQRA, the proposed Fresh Kills Park project avoids impacts to the extent possible, minimizes impacts where they may occur, and proposes mitigation for impacts. DPR has concluded that the project has comprehensively considered all environmental factors in accordance with Part 617 that the project has avoided impacts to the extent feasible and presented mitigation where impacts could not be avoided. A more detailed response follows.

As per the final scope to prepare the DGEIS, a reasonable range of alternatives was evaluated in the DGEIS including a No Action Alternative roadway alignment alternatives and a lesser impact alternative. Impacts of these alternatives were quantified and presented for comparison with the proposed project. In addition to the No Action Alternative, lesser impact alternatives were examined in the DGEIS including; a Two Lane Park Road Alternative (which has a smaller footprint and less of an impact with respect to wetlands); an Alternative Road Alignment around Landfill Section 6/7 (which has less of an impact on the landfill, but a greater potential impacts on wetlands along Main Creek); and a Lesser Impact Alternative which assumes that the proposed park does not include any active recreational facilities or park roads, thereby essentially eliminating the natural resources impacts.

The pages of disclosed impact analysis cited in the comment above, pages 10-74, 10-75, 10-102, for which more alternatives are requested, are addressed in the DGEIS by the presentation of the Two-Lane Road Alternative, the Alternative Alignment (for the Richmond Hill Road Connection, west of Landfill Section 6/7), and the Lesser Impact Alternative all of which focused on reduced natural resources impacts under these alternatives (see DGEIS pages 22-9, 22-12, 22-14, and 22-18 through 22-22 with respect to a comparison of landfill and natural resource impacts relative to the western alignment alternative around Landfill Section 6/7). The Lesser Impact

Alternative eliminates most capital projects and programming at the park including recreational fields and roads in favor of natural resources preservation.

With respect to the overwater shading impacts addressed on DGEIS (pages 10-78, 10-89, and 10-96), the impacts are quite modest and related to the few proposed overwater decks, fishing piers and other structures intended to provide public access to the water as well as the park roads proposed to improve circulation. The Lesser Impact Alternative presented in the DGEIS presents an alternative condition to this impact and, as stated in the DGEIS, this alternative would have no adverse impacts on tidal or freshwater wetlands (page 22-24), while recognizing at the same time this alternative would not meet the project sponsor's goals and objectives to provide new recreational facilities (a key objective of DPR as the project sponsor), nor would this alternative provide new roads that could provide park access and relieve local traffic congestion (see page 22-25 of the DGEIS).

In response to comments from NYSDEC and the Staten Island Borough Presidents Office, additional alternatives have also been presented in this FGEIS. ✷

TABLE H-1

POST-CLOSURE CARE ACCOMMODATIONS FOR PROPOSED PARK PROJECTS

Fresh Kills Landfill
Staten Island, New York

PROJECT	DATE	DESCRIPTION	POTENTIAL CONFLICTS WITH PCCP REQUIREMENTS	APPROACH FOR COMPLYING WITH PCCP
North Park (Phase A) Travis Neighborhood Park	2009/2010	Trails to Main Creek with entry kiosk and bridges over wetland at two entrances, kayak launch, bird observation lower, kayak storage, sunning deck, overlook deck, off-mound upland landscape enhancement (about 20 acres), wetland enhancement (about 2 acres), parking, signage, and lighting.	• Structural fill will be needed in areas where features needed for PCCP exist (e.g., groundwater monitoring wells, LFG migration probes, LCS manholes and LDS Tees, and leachate conveyance pipes) • Security fence around public access areas could restrict access to PCCP features. • See Table 2 for detailed list of potential conflicts.	• Avoid features, or extend features vertically, using approaches used successfully in the past. • Install gates in security fence where needed to ensure access during PCCP period. • See Table 2 for detailed list of approach for complying with PCCP requirements.

TABLE H-1
POST-CLOSURE CARE ACCOMMODATIONS FOR PROPOSED PARK PROJECTS
(continued)

PROJECT	DATE	DESCRIPTION	POTENTIAL CONFLICTS WITH PCCP REQUIREMENTS	APPROACH FOR COMPLYING WITH PCCP
North Park Multi-Use Path and Wetland Enhancement	2013	In general, development of off-mound features including parade grounds (lawn, softball field and picnic area) (about 12 acres), 2 tennis courts, grassy play mounds, picnic woods (about 1 acre), freshwater wetland enhancement, stormwater basin enhancement/skating pond (about 4 acres), outdoor eco-classroom, visitor center, 3 comfort stations, cafe, recreational multi-use path (about two miles) around landfill section 3/4, tidal wetland enhancement along Main Creek, fishing pier, parking, signage and lighting, flare station fence/enclosure, DPR maintenance and operations (secondary).	• Features needed for PCCP exist in the proposed park area, including groundwater monitoring wells, LFG migration wells, LCS manholes and LDS tees, and leachate conveyance pipes. Structural fill or park features may be needed in these areas, which could affect the performance or accessibility of these features. • Structures (i.e., buildings at Plant 2, the Section 3/4 LFG flare station, Condensate Tank 1) located south of North Mound, and leachate collection drain along Main Creek, are currently used for PCC operation and maintenance. These may be in location of proposed venues. • SWM Ponds Q and F, located south of North Mound, and drainage features (channels and culverts) draining to those ponds, may be in location of proposed venues. • Security fence around public access areas could restrict access to PCC monitoring features.	• Avoid features, or extend features vertically, using approaches used successfully in the past such as (i) extending wells or manholes vertically in fill areas; (ii) shortening wells or manholes in cut areas; (iii) covering wells with manholes in areas that will be accessed by the public; and (iv) reinstalling leachate or LFG transmission pipes within concrete or steel carrier pipes (i.e., 'hardening') in areas where traffic will pass over the pipes. • Avoid flare station; reestablish Plant 2 prior to development of venues. Reestablish Condensate Tank at nearby location if needed. Ensure that venues do not obstruct or compromise performance of leachate collection drain along Main Creek. • Redesign Ponds Q and F, and the channels and culverts draining to those ponds, to accommodate post-development runoff; relocate channels if necessary. • Install gates in security fence where needed to ensure access during PCCP period. Ensure that access roads/routes (as appropriate to particular monitoring and maintenance activity) are established and maintained.

TABLE H-1
POST-CLOSURE CARE ACCOMMODATIONS FOR PROPOSED PARK PROJECTS
(continued)

PROJECT	DATE	DESCRIPTION	POTENTIAL CONFLICTS WITH PCCP REQUIREMENTS	APPROACH FOR COMPLYING WITH PCCP
North Park Landfill Section 3/4 Landscape Enhancement and Public Access	2014/2015	Enhancements of existing landfill cover for landscape enhancement, public access on footpath trails and bikeways, parking.	• Features needed for PCCP exist in the proposed development area, including LFG extraction wells, LCS manholes and LDS tees, LFG transmission pipes, and leachate conveyance pipes. Structural fill or park features may be needed in these areas, which could affect the performance or accessibility of these features. • Landfill cover cap will exist in areas where venues are planned. • SWM drainage features (channels and culverts) draining to Ponds E, Q, and F may be in location of proposed venues. • Security fence around public access areas could restrict access to PCC monitoring features. • Access routes to and on Section 3/4 will be impacted by new use.	• Avoid features, or extend features vertically, using approaches used successfully in the past such as (i) extending wells or manholes vertically in fill areas; (ii) shortening wells or manholes in cut areas; (iii) covering wells with manholes in areas that will be accessed by the public; and (iv) reinstalling leachate or LFG transmission pipes within concrete or steel carrier pipes (i.e., 'hardening') in areas where traffic will pass over the pipes. • Ensure that grading activities and constructed venues do not compromise the thickness, integrity, or long-term ability of the cap to minimize infiltration. Ensure that stability of slopes is not compromised by soil fill or venues located on the landfill. • Redesign SWM drainage features to comply with capacity of receiving SWM ponds, relocating features if necessary. Ensure that SWM system routes runoff away from landfill to minimize opportunity for infiltration. • Install gates in security fence where needed to ensure access during PCCP period. • Ensure that access roads/routes (as appropriate to particular monitoring and maintenance activity) are established and maintained.

TABLE H-1
POST-CLOSURE CARE ACCOMMODATIONS FOR PROPOSED PARK PROJECTS
(continued)

PROJECT	DATE	DESCRIPTION	POTENTIAL CONFLICTS WITH PCCP REQUIREMENTS	APPROACH FOR COMPLYING WITH PCCP
South Park Arden Heights Neighborhood Park and Wetland Enhancement	2009/2010	Entrance and parking, information center, enhancement of freshwater wetland (about 2 acres), playground, berm overlooks, picnic area, signage, lighting, DPR maintenance and operations (secondary), plant nursery/seed farm.	• Features needed for PCCP exist in the proposed park area, including groundwater monitoring wells, LFG migration wells, and leachate interceptor trench. Structural fill or park features may be needed in these areas, which could affect the performance or accessibility of these features. • Security fence around public access areas could restrict access to PCCP features.	• Avoid features, or modify features using approaches used successfully in the past such as (i) extending wells or manholes vertically in fill areas; (ii) shortening wells or manholes in cut areas; (iii) covering wells with manholes in areas that will be accessed by the public; and (iv) reinstalling LFG transmission pipes within concrete or steel carrier pipes (i.e., 'hardening') in areas where traffic will pass over the pipes. • Install gates in security fence where needed to ensure access during PCCP period.

TABLE H-1
POST-CLOSURE CARE ACCOMMODATIONS FOR PROPOSED PARK PROJECTS
(continued)

PROJECT	DATE	DESCRIPTION	POTENTIAL CONFLICTS WITH PCCP REQUIREMENTS	APPROACH FOR COMPLYING WITH PCCP
South Park Multi-Use Paths and Recreation Facilities	2010/2014	Generally off-mound features including recreational multi-use path (about 8 miles) around landfill section 2/8, pedestrian and high-speed bikeways, equestrian center and stable, horseback riding trails, indoor track and field facility and sports barn, tennis center, cafe, comfort stations, entrance and parking, signage and lighting.	• Features needed during PCC exist in the proposed park area, including groundwater monitoring wells, LFG migration wells, LCS manholes and LDS tees, and leachate from pump station at Section 6/7 and the forcemain crossing to Section 6/7 at southeast portion of Section 2/8. Structural fill or park features may be needed in these areas, which could affect the performance or accessibility of these features.	• Avoid features, or extend features vertically, using approaches used successfully in the past such as (i) extending wells or manholes vertically in fill areas; (ii) shortening wells or manholes in cut areas; (iii) covering wells with manholes in areas that will be accessed by the public; and (iv) reinstalling leachate or LFG transmission pipes within concrete or steel carrier pipes (i.e., 'hardening') in areas where traffic will pass over the pipes.
			• Structures (e.g., the LFG flare station north of 'little' Section 2/8,) located south of North Mound, and leachate collection drain along Main Creek, all currently used for PCC operation and maintenance, may be in location of proposed venues.	• Avoid LFG flare station. Reestablish or reconfigure other features at nearby location if needed. Ensure that venues do not obstruct or compromise performance of leachate collection drain along Richmond Creek or Basin H.
			• SWM Basins H, J, and P, located around the South Mound, and drainage features (channels and culverts) draining to those ponds, may be in locations of proposed venues.	• Redesign Ponds O and F, and the channels and culverts draining to those ponds, to accommodate post-development runoff; relocate channels if necessary.
			• Security fence around public access areas and limitations on access to service roads around landfill could restrict access to PCC monitoring and maintenance features.	• Install gates in security fence where needed to ensure access during PCCP period. Ensure that access roads/routes (as appropriate to particular monitoring and maintenance activity) are established and maintained.

TABLE H-1
POST-CLOSURE CARE ACCOMMODATIONS FOR PROPOSED PARK PROJECTS
(continued)

PROJECT	DATE	DESCRIPTION	POTENTIAL CONFLICTS WITH PCCP REQUIREMENTS	APPROACH FOR COMPLYING WITH PCCP
South Park Landfill Section 2/8 Enhancement	2010/2011	Enhancements of existing landfill cover for landscape enhancement and public access on top landfill section mounds 2/8 with mountain biking and pedestrian trails, hilltop overlook deck, comfort stations.	• Features needed for PCCP exist in the proposed development area, including LFG extraction wells, leachate extraction wells, LCS manholes and LDS tees, and leachate conveyance pipes. Structural fill or park features may be needed in these areas, which could affect the performance or accessibility of these features. • Landfill cover cap will exist in areas where venues are planned. • SWM drainage features (channels and culverts) draining to Ponds H, J, and P may be in location of proposed venues. • Security fence around public access areas could restrict access to PCC monitoring features. • Access routes to and on Section 2/8 will be impacted by new use.	• Avoid features, or extend features vertically, using approaches used successfully in the past such as (i) extending wells or manholes vertically in fill areas; (ii) shortening wells or manholes in cut areas; (iii) covering wells with manholes in areas that will be accessed by the public; and (iv) reinstalling leachate or LFG transmission pipes within concrete or steel carrier pipes (i.e., 'hardening') in areas where traffic will pass over the pipes. • Ensure that grading activities and constructed venues do not compromise the thickness, integrity, or long-term ability of the cap to minimize infiltration. Ensure that stability of slopes is not compromised by soil fill or venues located on the landfill. • Redesign SWM drainage features to comply with capacity of receiving SWM ponds, relocating features if necessary. Ensure that SWM system routes runoff away from landfill to minimize opportunity for infiltration. • Install gates in security fence where needed to ensure access during PCCP period. • Ensure that access roads/routes (as appropriate to particular monitoring and maintenance activity) are established and maintained.

TABLE H-1
POST-CLOSURE CARE ACCOMMODATIONS FOR PROPOSED PARK PROJECTS
(continued)

PROJECT	DATE	DESCRIPTION	POTENTIAL CONFLICTS WITH PCCP REQUIREMENTS	APPROACH FOR COMPLYING WITH PCCP
Confluence – the Marsh, Terrace, and Sunken Forest	2012	Freshwater wetland improvements and possible tidal wetland enhancement within two stormwater basins at the Marsh – the Sunken Forest (2 acres) with boardwalk pedestrian and bike paths; and a freshwater pond/emergent wetland (2 acres), and freshwater wetlands developed within a stormwater basin at the Terrace (1 acre).	• Features needed during PCC exist in the proposed park area, including groundwater monitoring wells, LFG migration wells, LCS manholes and LDS tees, and leachate conveyance pipes. Structural fill or park features may be needed in these areas, which could affect the performance or accessibility of these features. • Structures (i.e., buildings at Plants 1 and 2, the Section 2/8 LFG flare station, Section 2/8 leachate pump station) all currently used for PCC operation and maintenance, may be in location of proposed venues. • SWM Basins Q, F, C1, C2, K1, K2, L, and J, located around the Confluence, and drainage features (channels and culverts) draining to those ponds, may conflict with locations of proposed venues. • Security fence around public access areas could restrict access to PCC monitoring features.	• Avoid features, or extend features vertically, using approaches used successfully in the past such as (i) extending wells or manholes vertically in fill areas; (ii) shortening wells or manholes in cut areas; (iii) covering wells with manholes in areas that will be accessed by the public; and (iv) reinstalling leachate or LFG transmission pipes within concrete or steel carrier pipes (i.e., 'hardening') in areas where traffic will pass over the pipes. • Avoid flare stations; reestablish Plants 1 and 2 prior to development of venues in those areas. Ensure that venues do not obstruct or compromise performance of leachate or LFG system features. • Redesign ponds as needed, and the channels and culverts draining to those ponds, to accommodate post-development runoff; relocate channels if necessary. • Install gates in security fence where needed to ensure access during PCCP period. Ensure that access roads/routes (as appropriate to particular monitoring and maintenance activity) are established and maintained.

TABLE H-1
POST-CLOSURE CARE ACCOMMODATIONS FOR PROPOSED PARK PROJECTS
(continued)

PROJECT	DATE	DESCRIPTION	POTENTIAL CONFLICTS WITH PCCP REQUIREMENTS	APPROACH FOR COMPLYING WITH PCCP
Confluence – Creek Landing Elements	2016	Off-mound activities on existing built surfaces and reuse of existing bulkhead for market roof area of private concessions including boathouse, kayak and canoe rental, cafe, and cultural space; lawn; possible tidal wetland creation in areas of bulkhead deterioration (about 1 acre of enhancement), parking, DPR maintenance and operations (secondary), and lighting.	• Features needed during PCC exist in the proposed park area, including groundwater monitoring wells and LFG migration wells.	• Avoid features, or extend features vertically, using approaches used successfully in the past such as (i) extending wells or manholes vertically in fill areas; (ii) shortening wells or manholes in cut areas; (iii) covering wells with manholes in areas that will be accessed by the public; and (iv) reinstalling leachate or LFG transmission pipes within concrete or steel carrier pipes (i.e., 'hardening') in areas where traffic will pass over the pipes.
			• Structures (i.e., buildings at Plant 2, the Section 3/4 LFG flare station, Condensate Tank 1) located south of North Mound, and leachate collection drain along Main Creek, all currently used for PCC operation and maintenance, may be in location of proposed venues.	• Avoid flare station; reestablish Plant 2 prior to development of venues. Reestablish Condensate Tank at nearby location if needed. Ensure that venues do not obstruct or compromise performance of leachate collection drain along Main Creek.
			• SWM Ponds E, Q, and F, located south of North Mound, and drainage features (channels and culverts) draining to those ponds, may be in location of proposed venues.	• Redesign Ponds E, Q, and F, and the channels and culverts draining to those ponds, to accommodate post-development runoff; relocate channels if necessary.
			• Security fence around public access areas could restrict access to PCC monitoring features.	• Install gates in security fence where needed to ensure access during PCCP period. Ensure that access roads/routes (as appropriate to particular monitoring and maintenance activity) are established and maintained.

TABLE H-1
POST-CLOSURE CARE ACCOMMODATIONS FOR PROPOSED PARK PROJECTS
(continued)

PROJECT	DATE	DESCRIPTION	POTENTIAL CONFLICTS WITH PCCP REQUIREMENTS	APPROACH FOR COMPLYING WITH PCCP
Wind Turbine Systems	N/A	Concrete pads with wind turbines on landfill sections within North, South, and East Parks.	• Features needed during PCC exist in the proposed park area, including LFG extraction wells and transmission pipes, leachate extraction wells, LCS manholes and LDS tees, and leachate conveyance pipes. Structural fill or park features may be needed in these areas, which could affect the performance or accessibility of these features.	• Avoid features, or extend features vertically, using approaches used successfully in the past such as (i) extending wells or manholes vertically in fill areas; (ii) shortening wells or manholes in cut areas; (iii) covering wells with manholes in areas that will be accessed by the public; and (iv) reinstalling leachate or LFG transmission pipes within concrete or steel carrier pipes (i.e., 'hardening') in areas where traffic will pass over the pipes.
			• Landfill cover cap will exist in areas where venues are planned.	• Ensure that grading activities and constructed venues do not compromise the thickness, integrity, or long-term ability of the cap to minimize infiltration. Ensure that stability of slopes is not compromised by soil fill or venues located on the landfill. Comply with project-specific requirements of DEC regarding modifications to cap necessitated by the wind turbine foundation design.
			• SWM drainage features (channels and culverts) draining to basins around the mounds on which wind turbines are installed may be in location of proposed venues.	• Redesign SWM drainage features to comply with capacity of receiving SWM ponds, relocating features if necessary.
			• Access route patterns to and on landfill mounds may be impacted by new use.	• Ensure that access roads/routes (as appropriate to particular monitoring and maintenance activity) are established and maintained.

TABLE H-1
POST-CLOSURE CARE ACCOMMODATIONS FOR PROPOSED PARK PROJECTS
(continued)

PROJECT	DATE	DESCRIPTION	POTENTIAL CONFLICTS WITH PCCP REQUIREMENTS	APPROACH FOR COMPLYING WITH PCCP
Proposed Park Roads and West Shore Expressway Connections	2016	Forest Hill Road connection extending from Forest Hill Road/Richmond Avenue to Confluence Loop Park Road; the south, east, and north legs of Confluence Loop Park Road, including modifications to Richmond Creek Bridge and Main Creek Bridge and access improvements along the West Shore Expressway, including extensions of the service roads.	• Features needed for PCCP exist in the proposed development area, including LFG extraction wells and transmission pipes, LCS manholes and LDS tees, leachate conveyance pipes, groundwater and LFG and geotechnical monitoring features. Structural fill or park features may be needed in these areas, which could affect the performance or accessibility of these features. • Landfill cover cap will exist in areas where venues are planned. • SWM drainage features (channels and culverts) draining to Basins B1, B2, E, F, J, Q, R, and C1, and C2, may be in location of proposed roadways. • Security fence around public access areas could restrict access to PCC monitoring features. • Access routes to and on Section 6/7 (and possibly Sections 1/9 and 2/8) will be impacted by new roadways. These routes are centrally located and critical to access to all PCC features. Also, roadways over East Mound could impact access to PCC features.	• Avoid features, or extend features vertically, using approaches used successfully in the past such as (i) extending wells or manholes vertically in fill areas; (ii) shortening wells or manholes in cut areas; (iii) covering wells with manholes in areas that will be accessed by the public; and (iv) reinstalling leachate or LFG transmission pipes within concrete or steel carrier pipes (i.e., 'hardening') in areas where traffic will pass over the pipes; and (iv) constructing roadways (where unavoidable) over leachate collection drain and soil-bentonite wall that are reinforced and designed to minimize stress and deformation of the wall. • Ensure that grading activities and constructed venues do not compromise the thickness, integrity, or long-term ability of the cap to minimize infiltration. Ensure that stability of slopes is not compromised by soil fill or venues located on the landfill. • Redesign SWM drainage features to comply with capacity of receiving SWM ponds, relocating features if necessary. Ensure that SWM system routes runoff away from landfill to minimize opportunity for infiltration. • Install gates in security fence where needed to ensure access during PCCP period. • Ensure that access roads/routes (as appropriate to particular monitoring and maintenance activity) are established and maintained. As needed, design features (including roadway) to avoid PCC features or reestablish PCC features outside of such features, ensuring that access to features is maintained.

TABLE H-1
POST-CLOSURE CARE ACCOMMODATIONS FOR PROPOSED PARK PROJECTS
(continued)

PROJECT	DATE	DESCRIPTION	POTENTIAL CONFLICTS WITH PCCP REQUIREMENTS	APPROACH FOR COMPLYING WITH PCCP
East Park	2016 to 2036	On-mound and off-mound development consisting of hilltop field (23 acres), recreational fields or golf course within a successional meadow (187 acres), mixed woodland community (187 acres), freshwater wetland enhancement/enhancement and boardwalk (13 acres), freshwater wetland enhancement/enhancement (21 acres), with a nature education center (outdoor classroom, 600 square feet), and nature education center (4,000 square feet), tidal marsh restoration/enhancement (28 acres), multiuse recreational path (12 miles), picnic lawn (2 acres), a flare station screen, parking along the eastern stormwater basin and additional parking along the Loop Road.	• Features needed for PCCP exist in the proposed development area, including LFG extraction wells and transmission pipes, LCS manholes and LDS tees, leachate conveyance pipes, groundwater and LFG and geotechnical monitoring features. Structural fill or park features may be needed in these areas, which could affect the performance or accessibility of these features. • Landfill cover cap will exist in areas where venues are planned. • SWM drainage features (channels and culverts) draining to Basins A, B1, B2, R, and C1, and C2, may be in location of proposed venues. • Security fence around public access areas could restrict access to PCC monitoring features. • Access routes to and on Section 6/7 will be impacted by new use. These routes are centrally located and critical to access to all PCC features. Also, roadways over East Mound could impact access to PCC features.	• Avoid features, or extend features vertically, using approaches used successfully in the past such as (i) extending wells or manholes vertically in fill areas; (ii) shortening wells or manholes in cut areas; (iii) covering wells with manholes in areas that will be accessed by the public; and (iv) reinstalling leachate or LFG transmission pipes within concrete or steel carrier pipes (i.e., 'hardening') in areas where traffic will pass over the pipes; and (iv) constructing roadways (where unavoidable) over leachate collection drain and soil-bentonite wall that are reinforced and designed to minimize stress and deformation of the wall. • Ensure that grading activities and constructed venues do not compromise the thickness, integrity, or long-term ability of the cap to minimize infiltration. Ensure that stability of slopes is not compromised by soil fill or venues located on the landfill. • Redesign SWM drainage features to comply with capacity of receiving SWM ponds, relocating features if necessary. Ensure that SWM system routes runoff away from landfill to minimize opportunity for infiltration. • Install gates in security fence where needed to ensure access during PCCP period. • Ensure that access roads/routes (as appropriate to particular monitoring and maintenance activity) are established and maintained. As needed, design features (including roadway) to avoid PCC features or reestablish PCC features outside of such features, ensuring that access to features is maintained.

TABLE H-1
POST-CLOSURE CARE ACCOMMODATIONS FOR PROPOSED PARK PROJECTS
(continued)

PROJECT	DATE	DESCRIPTION	POTENTIAL CONFLICTS WITH PCCP REQUIREMENTS	APPROACH FOR COMPLYING WITH PCCP
West Park	2016 to 2036	On-mound and off-mound development consisting of hilltop monument (12 acres), successional grassland (173 acres), woodlands (200 acres), recreational loop path (3 miles), Arthur Kill dock (450 square feet), and Isle of Meadows overlook (450 square feet). West Park, North Section – hilltop field (3 acres), earthwork art feature (2 acres) with an overlook (about 450 square feet), meadow (5 acres), meadow seating (2,000 persons), woodland buffer (20 acres).	• Features needed for PCCP exist in the proposed development area, including LFG extraction wells and transmission pipes, LCS manholes and LDS tees, leachate conveyance pipes, groundwater and LFG and geotechnical monitoring features. Structural fill or park features may be needed in these areas, which could affect the performance or accessibility of these features. • Landfill cover cap will exist in areas where venues are planned. • Structures (i.e., buildings at Plant 1, the DSNY maintenance facility, the LFG processing facility, leachate treatment plant) located around West Mound, and leachate collection drain around the landfill, all currently used for PCC operation and maintenance, may be in location of proposed venues. • SWM drainage features (channels and culverts) draining to Basins L, N, and O may be in location of proposed venues. • Security fence around public access areas could restrict access to PCC monitoring features. • Access routes to and on Section 1/9 may be impacted by new use. Some routes are near DSNY maintenance facility and Route 440.	• Avoid features, or extend features vertically, using approaches used successfully in the past such as (i) extending wells or manholes vertically in fill areas; (ii) shortening wells or manholes in cut areas; (iii) covering wells with manholes in areas that will be accessed by the public; and (iv) reinstalling leachate or LFG transmission pipes within concrete or steel carrier pipes (i.e., 'hardening') in areas where traffic will pass over the pipes; and (iv) constructing roadways (where unavoidable) over leachate collection drain and soil-bentonite wall that are reinforced and designed to minimize stress and deformation of the wall. • Ensure that grading activities and constructed venues do not compromise the thickness, integrity, or long-term ability of the cap to minimize infiltration. Ensure that stability of slopes is not compromised by soil fill or venues located on the landfill. • Avoid flare station and avoid Plant 1 (which will be addressed as part of development of 'The Point' venues). Ensure that venues do not obstruct or compromise performance of leachate collection drain around West Mound. • Redesign SWM drainage features to comply with capacity of receiving SWM ponds, relocating features if necessary. Ensure that SWM system routes runoff away from landfill to minimize opportunity for infiltration. • Install gates in security fence where needed to ensure access during PCCP period. • Ensure that access roads/routes (as appropriate to particular monitoring and maintenance activity) are established and maintained. As needed, design features (including roadway) to avoid PCC features or reestablish PCC features outside of such features, ensuring that access to features is maintained.

TABLE H-1
POST-CLOSURE CARE ACCOMMODATIONS FOR PROPOSED PARK PROJECTS
(continued)

PROJECT	DATE	DESCRIPTION	POTENTIAL CONFLICTS WITH PCCP REQUIREMENTS	APPROACH FOR COMPLYING WITH PCCP
Confluence Area – The Point	2016 to 2036	Off-mound development of The Point – central multi-use field area (14 acres, 1,000 seats), created swamp forest exhibit and basin (2 acres). Arthur Kill tidal wetland restoration (3 acres), exhibition hall (8,590 square feet), family fishing and picnic pier (4,100 square feet), pier overlook (3,500 square feet), fishing pier (4,900 square feet), esplanade (37,300 square feet), market roof (32,700 square feet), restaurant row (20,000 square feet), barge garden (43,500 square feet), marina/boating center (50 slips, 2 acres), boat launch (6,750 square feet), banquet hall with maintenance facilities (13,750 square feet), event lawn (10 acres), discovery center (32,700 square feet), ferry landing (6,000 square feet) and parking.	• Features needed for PCCP exist in the proposed development area, including groundwater monitoring wells and LFG monitoring and transmission main pipes, and geotechnical monitoring features. Structural fill or park features may be needed in these areas, which could affect the performance or accessibility of these features. • SWM drainage features (channels and culverts) draining to Basins L, K1, and K2 may be in location of proposed venues. • Security fence around public access areas could restrict access to PCC monitoring features. • Access routes near and on Section 1/9 will be impacted by new use. These routes may be needed for access to PCC features and for access to the Landfill Gas Recovery Facility.	• Avoid features, or extend features vertically, using approaches used successfully in the past such as (i) extending wells or manholes vertically in fill areas; (ii) shortening wells or manholes in cut areas; (iii) covering wells with manholes in areas that will be accessed by the public; and (iv) reinstalling leachate or LFG transmission pipes within concrete or steel carrier pipes (i.e., 'hardening') in areas where traffic will pass over the pipes; and (iv) constructing roadways (where unavoidable) over leachate collection drain and soil-bentonite wall that are reinforced and designed to minimize stress and deformation of the wall. • Redesign SWM drainage features to comply with capacity of receiving SWM ponds, relocating features if necessary. Ensure that SWM system routes runoff away from landfill to minimize opportunity for infiltration. • Install gates in security fence where needed to ensure access during PCCP period. • Ensure that access roads/routes (as appropriate to particular monitoring and maintenance activity) are established and maintained. As needed, design features (including roadway) to avoid PCC features or reestablish PCC features outside of such features, ensuring that access to features is maintained.

TABLE H-1
POST-CLOSURE CARE ACCOMMODATIONS FOR PROPOSED PARK PROJECTS
(continued)

PROJECT	DATE	DESCRIPTION	POTENTIAL CONFLICTS WITH PCCP REQUIREMENTS	APPROACH FOR COMPLYING WITH PCCP
The Confluence – Creek Landing	2016 to 2036	Off-mound development of visitor center (5,200 square feet), fishing pier (about 1,350 square feet), waterfront esplanade (22,850 square feet), boating lawn and terrace (2 acres), restaurant (1,000 square feet), DPR greenhouses (25,500 square feet).	• Features needed during PCC exist in the proposed Creek Landing area, including groundwater monitoring wells and LFG migration wells. • Structures (i.e., buildings at Plant 2, the Section 3/4 LFG flare station, Condensate Tank 1) located south of North Mound, all currently used for PCC operation and maintenance, may be in location of proposed venues. • SWM Ponds E, Q, and F, located south of North Mound, and drainage features (channels and culverts) draining to those ponds, may be in location of proposed venues. • Security fence around public access areas could restrict access to PCC monitoring features.	• Avoid features, or extend features vertically, using approaches used successfully in the past such as (i) extending wells or manholes vertically in fill areas; (ii) shortening wells or manholes in cut areas; (iii) covering wells with manholes in areas that will be accessed by the public; and (iv) reinstalling leachate or LFG transmission pipes within concrete or steel carrier pipes (i.e., 'hardening') in areas where traffic will pass over the pipes. • Avoid flare station. Plant 2 relocation and condensate tank relocation will most likely have been accomplished prior to development of earlier Creek Landing development. Ensure that venues do not obstruct or compromise performance of leachate collection drain along Main Creek. • Redesign Ponds Q and F, and the channels and culverts draining to those ponds, to accommodate post-development runoff; relocate channels if necessary. • Install gates in security fence where needed to ensure access during PCCP period. Ensure that access roads/routes (as appropriate to particular monitoring and maintenance activity) are established and maintained.

TABLE H-1
POST-CLOSURE CARE ACCOMMODATIONS FOR PROPOSED PARK PROJECTS
(continued)

PROJECT	DATE	DESCRIPTION	POTENTIAL CONFLICTS WITH PCCP REQUIREMENTS	APPROACH FOR COMPLYING WITH PCCP
Park Road North and Completed Confluence Central Loop Park Road and Landscape Ribbons	2016 to 2036	Completion of the Park Road System: construction of Park Road North, providing a second connection to Richmond Road and about 40 parking spaces, construction of the west leg of the Confluence Loop Park Road with bikeway/walkways, corridor landscaping, and a Signature Bridge over Fresh Kills Creek near the Point.	• Features needed for PCCP exist in the proposed development area, including LFG extraction wells and transmission pipes, LCS manholes and LDS tees, leachate conveyance pipes, groundwater and LFG and geotechnical monitoring features. Structural fill or park features may be needed in these areas, which could affect the performance or accessibility of these features. • SWM drainage features (channels and culverts) draining to Basins A, B1, B2, K1, and K2 may be in location of proposed roadways. • Security fence around public access areas could restrict access to PCC monitoring features. • Access routes to and on all landfill sections may be impacted by new roadways. The proposed routes are centrally located and cold be critical to access to all PCC features.	• Avoid features, or extend features vertically, using approaches used successfully in the past such as (i) extending wells or manholes vertically in fill areas; (ii) shortening wells or manholes in cut areas; (iii) covering wells with manholes in areas that will be accessed by the public; and (iv) reinstalling leachate or LFG transmission pipes within concrete or steel carrier pipes (i.e., 'hardening') in areas where traffic will pass over the pipes; and (iv) constructing roadways (where unavoidable) over leachate collection drain and soil-bentonite wall that are reinforced and designed to minimize stress and deformation of the wall. • Redesign SWM drainage features to comply with capacity of receiving SWM ponds, relocating features if necessary. Ensure that SWM system routes runoff away from landfill to minimize opportunity for infiltration. • Install gates in security fence where needed to ensure access during PCCP period. • Ensure that access roads/routes (as appropriate to particular monitoring and maintenance activity) are established and maintained. As needed, design features (including roadway) to avoid PCC features or reestablish PCC features outside of such features, ensuring that access to features is maintained.

TABLE H-2
POST-CLOSURE CARE ACCOMMODATIONS: NORTH PARK PHASE A2 PROJECT
Fresh Kills Landfill
Staten Island, New York

LANDFILL MONITORING PROGRAM	ID NUMBER	PRESENT WITHIN NP A2 DEVELOPMENT LIMITS?	PHYSICAL CHANGES NEEDED	APPROACH FOR ACCOMODATING PCC OPERATION AND MAINTANENCE OF FEATURE
Groundwater	401S	Yes	Yes	Location can be accessed (drive or on foot) by bike/pedestrian path. Raise wells from 1 to 7 ft (see schedule on Drawing 15.01 in Appendix A) during construction to match new grades.
	401D			
	411S			
	412S			
	MW 403 D	No	No	Locations are adjacent to limits of disturbance but not in areas requiring grading. Locations can be accessed (drive or on foot) by bike/pedestrian path and will be protected during construction.
	MW 403 S			
	MW GX-51			
Surface Water and Sediment	Investigation Sampling Station 13	No	No	Will remain accessible via existing pathways.
Landfill Gas Migration	GZ-102	No	No	Will remain accessible via existing pathways.
	G-23R			
	G-26			
	GX-51			
	GX-50R			
Leachate Collection System	Collection well and pump station	No	No	Location can be accessed (drive or on foot) by bike/pedestrian path. Gate will be placed along fence.
	Manhole CMH-1	Yes	Yes	Location can be accessed (drive or on foot) by bike/pedestrian path. Raise manhole by approximately 5 ft during construction to match new grades.
	Manhole CMH-2	No	No	Manhole is at the limit of grading and not within area of fill. Manhole to be protected during construction and to remain accessible (drive or by foot) by bike/pedestrian path.

TABLE H-2
POST-CLOSURE CARE ACCOMMODATIONS: NORTH PARK PHASE A2 PROJECT

(continued)

LANDFILL MONITORING PROGRAM	ID NUMBER	PRESENT WITHIN NP A2 DEVELOPMENT LIMITS?	PHYSICAL CHANGES NEEDED	APPROACH FOR ACCOMODATING PCC OPERATION AND MAINTANENCE OF FEATURE
	TEE 4-03	Yes	Yes	Locations can be accessed (drive or on foot) by bike/pedestrian path. Raise tees from 1 to 7 ft (see schedule on Drawing 15.01 in Appendix A) during construction to match new grades.
	TEE 4-04			
	TEE 4-05			
	TEE 4-15			
	TEE 4-16			
	TEE 4-17			
	TEE 4-21			
	TEE 4-02	No	No	Locations are adjacent to limits of disturbance but not in areas requiring grading. Locations can be accessed (drive or on foot) by bike/pedestrian path. Protect tees during construction.
	TEE 4-18			
	TEE 4-19			
	TEE 4-20			
	TEE 4-22			

TABLE H-2
POST-CLOSURE CARE ACCOMMODATIONS: NORTH PARK PHASE A2 PROJECT

(continued)

LANDFILL MONITORING PROGRAM	ID NUMBER	PRESENT WITHIN NP A2 DEVELOPMENT LIMITS?	PHYSICAL CHANGES NEEDED	APPROACH FOR ACCOMODATING PCC OPERATION AND MAINTANENCE OF FEATURE
	TEE 4-23			
Leachate Conveyance System	LDDT 4-03	Yes	Yes	Location can be accessed (drive or on foot) by bike/pedestrian path.
	LDDT 4-04			
	LDDT 4-05			
	LDDT 4-15			
	LDDT 4-16			
	LDDT 4-02			
	LDDT 4-17	No	No	Location can be accessed (drive or on foot) by bike/pedestrian path. Gate will be placed along fence.
	LDDT 4-18			
	LDDT 4-19			
	LDDT 4-20			
	LDDT 4-21			
	LDDT 4-22			
	LDDT 4-23			
	Cleanout Manholes	Yes	Yes	Location can be accessed (drive or on foot) by bike/pedestrian path.
	Air Valve Manhole	Yes	Yes	Location can be accessed (drive or on foot) by bike/pedestrian path.
Drainage Infrastructure		Yes	No	Drainage features can be accessed (drive or on foot) by bike/pedestrian path.
Stormwater Management Manhole	MH-D6	Yes	Yes	Location can be accessed (drive or on foot) by bike/pedestrian path. Raise manhole by approximately 2.5 ft during construction to match new grades.
Landfill Gas Vent Trench		Yes	Yes	Vent trench features can be accessed (drive or on foot) by bike/pedestrian path.

TABLE H-2
POST-CLOSURE CARE ACCOMMODATIONS: NORTH PARK PHASE A2 PROJECT

(continued)

LANDFILL MONITORING PROGRAM	ID NUMBER	PRESENT WITHIN NP A2 DEVELOPMENT LIMITS?	PHYSICAL CHANGES NEEDED	APPROACH FOR ACCOMODATING PCC OPERATION AND MAINTANENCE OF FEATURE
Electrical and Communication Wiring	EMH-1, EMH-2, EMH-3	Yes	No	Electrical and communication wiring can be accessed (drive or on foot) by bike/pedestrian path. Raise manholes EMH-2 and EMH-3 to match new grades; replace EMH-1 cover with watertight frame and cover.

Table H-3

Preliminary Project Schedule and Stormwater Permitting Data

Map Key	Project	Estimated Construction period	Approximate Size/Area of Disturbance	Principal Cover Types	On or off landfill section/ Potential for Use of landfill drainage facilities
2036 Projects					
B	North Park Phase A2	2009-2010	26.3 acres	Arc path (approximately 16,000 square feet) Parking lot (approximately 32,670 square feet) Overlook and observation tower (about 1,500 square feet) Landscape and seed farm (about 4.5 acres)	Off mound/no use of DSNY drainage facilities
P	Arthur Kill Road Parking Lot	2009-2010	2.15 acres	Parking lot (about 2.5 acres) Landscaping (about 0.5 acres)	Off mound/no use of DSNY drainage facilities
L.K	South Park Arden Heights Neighborhood Park (Wetland Enhancement)	2010-2011	17.14 acres	Wetland enhancement between the Landfill Section 2/8 mounds	Off mound/no use of landfill drainage systems
M	South Park Arden Heights Neighborhood Park	2010-2011	31.58 acres	Entrance and parking, information center, freshwater wetland enhancement (about 2 acres), playground, restoration of berms and overlooks, picnic area, signage, lighting, DPR maintenance and operations (secondary), plant nursery/seed farm.	Off mound/no use of landfill drainage systems
N	South Park Multi-Use paths	2010-2011	6.24 acres	Recreational multi-use path (about 8 miles and 20 feet wide) around landfill section 2/8, including pedestrian and high-speed bikeways.	Off mound/no use of landfill drainage systems
O	South Park Recreation Facilities	2010-2011	35.54 acres	Equestrian center and stable, horseback riding trails, indoor track and field facility and sports barn, tennis center, cafe, comfort stations, entrance and parking, signage and lighting.	Off mound/no use of landfill drainage systems
I	South Park Landfill Section 2/8 Enhancement (west section)	2010-2011	30.13 acres	Enhancement of existing landfill cover at Landfill Section 2/8 (west section) to provide landscape enhancement and public access with footpaths, hilltop overlook deck, and comfort stations.	On mound/potential use of DSNY landfill drainage collection systems and basins (e.g., Basin J)
J	South Park Landfill Section 2/8 Enhancement (east section)	2010-2011	98.02 acres	Enhancement of existing landfill cover at Landfill Section 2/8 (east section) to provide landscape enhancement and public access with mountain biking, footpaths hilltop overlook deck, and comfort stations.	On mound/potential use of DSNY landfill drainage collection systems and basins (e.g., Basin P)
D	North Park Multi-Use Path	2012-2013	7.8 acres	Recreational multi-use path (about two miles) around landfill section 3/4, including pedestrian and high-speed bikeways.	Off mound/no use of landfill drainage systems

Table H-3

Preliminary Project Schedule and Stormwater Permitting Data

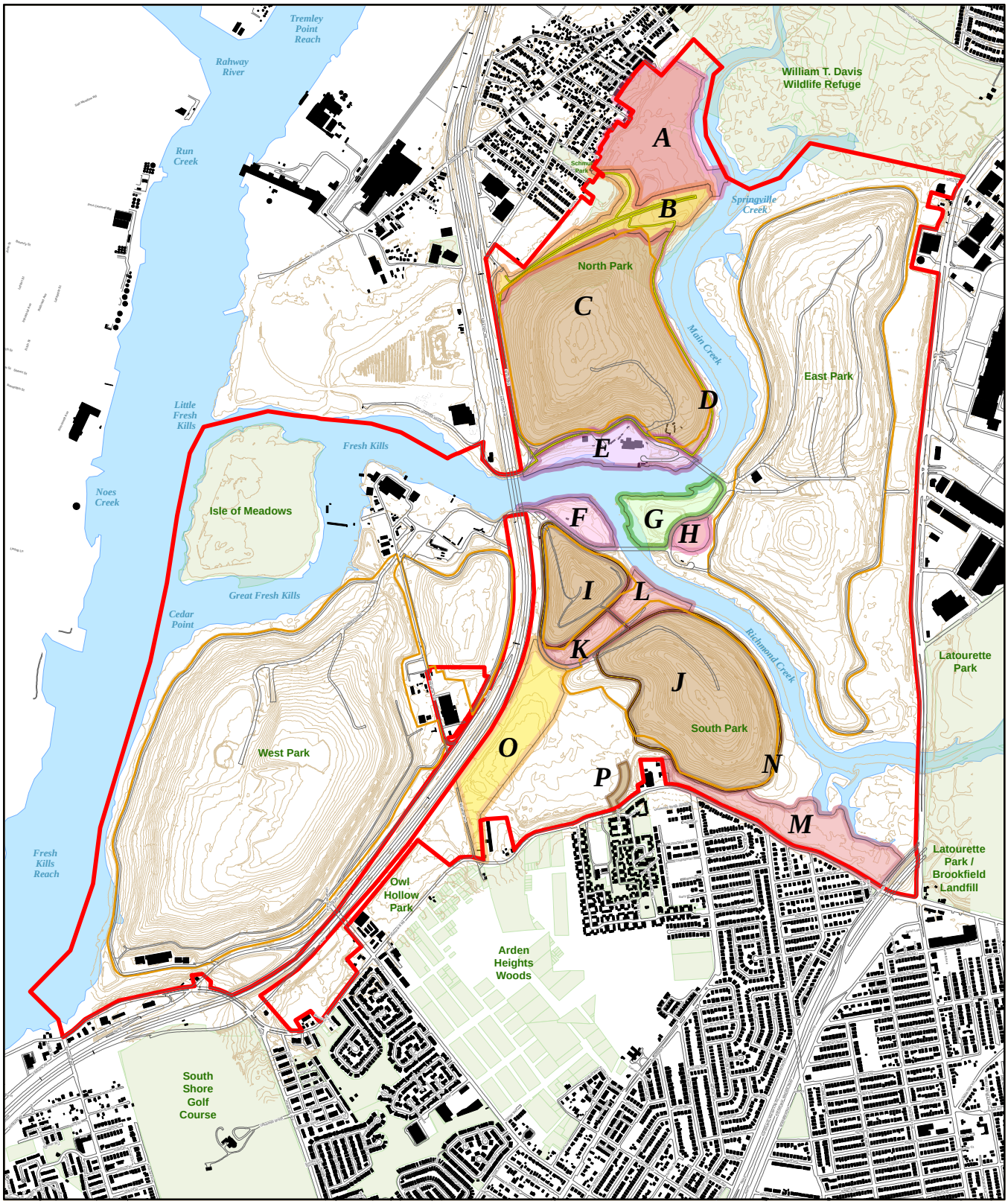
Map Key	Project	Estimated Construction period	Approximate Size/Area of Disturbance	Principal Cover Types	On or off landfill section/ Potential for Use of landfill drainage facilities
A	North Park Recreational Facilities and Wetland Enhancement	2012-2013	47.69 acres	Parade grounds (lawn, softball field and picnic area) (about 12 acres), 2 tennis courts, grassy play mounds, picnic woods (about 1 acre), freshwater wetland enhancement, stormwater basin enhancement/skating pond (about 4 acres), outdoor eco-classroom, visitor center, 3 comfort stations, cafe, tidal wetland enhancement along Main Creek, fishing pier, parking, signage and lighting, flare station fence/enclosure, DPR maintenance and operations (secondary).	Off mound/potential use of DSNY drainage facilities (e.g., Basins D)
G	Confluence – the Marsh	2012-2013	15.83 acres	Freshwater enhancement within stormwater basin and possible tidal wetland	Off mound/potential use of DSNY drainage basins (e.g., Basins C1)
F	Confluence – the Terrace	2012-2013	10.11 acres	Freshwater wetlands developed within a stormwater basin at the Terrace (1 acre)	Off mound/no use of landfill drainage systems
H	Confluence –Sunken Forest	2012-2013	4.39 acres	Freshwater wetland enhancements (2 acres) with boardwalk pedestrian and bike paths; and a freshwater pond/emergent wetland (2 acres),	Off mound/potential use of DSNY drainage basins (e.g., Basins C2)
C	North Park Landfill Section 3/4 Landscape Enhancement and Public Access	2014-2015	149.38 acres	Enhancements of existing landfill cover for landscape enhancement, public access on footpath trails and bikeways, parking.	On mound/potential use of DSNY drainage collections systems and basins (e.g., Basins D, E, F and Q)
E	Confluence – Creek Landing	2016	21.75 acres	Activities on existing built surfaces and reuse of existing bulkhead for market roof area of private concessions including boathouse, kayak and canoe rental, cafe, and cultural space; lawn; possible tidal wetland creation in areas of bulkhead deterioration (about 1 acre of enhancement), parking, DPR maintenance and operations (secondary), and lighting.	Off mound/no use of landfill drainage systems
NA	Wind Turbine Systems	NA	NA	Concrete pads with wind turbines on landfill sections within North, South, and East Parks.	NA
NA	Proposed Park Roads and West Shore Expressway Connections	2016	NA	Forest Hill Road connection extending from Forest Hill Road/Richmond Avenue to Confluence Loop Park Road; the south, east, and north legs of Confluence Loop Park Road, including modifications to Richmond Creek Bridge and Main Creek Bridge and access improvements along the West Shore Expressway, including extensions of the service roads.	On mound and off mound /potential use of DSNY drainage facilities (e.g., multiple drainage basins including B1 and B2)

Table H-3
Preliminary Project Schedule and Stormwater Permitting Data

Map Key	Project	Estimated Construction period	Approximate Size/Area of Disturbance	Principal Cover Types	On or off landfill section/ Potential for Use of landfill drainage facilities
2036 Projects					
NA	East Park	2016 to 2036	NA	Hilltop field (23 acres), recreational fields or golf course within a successional meadow (187 acres), mixed woodland community (187 acres), freshwater wetland enhancement/enhancement and boardwalk (13 acres), freshwater wetland enhancement/enhancement (21 acres), with a nature education center (outdoor classroom, 600 square feet), and nature education center (4,000 square feet), tidal marsh restoration/enhancement (28 acres), multi-use recreational path (12 miles), picnic lawn (2 acres), a flare station screen, parking along the eastern stormwater basin and additional parking along the Loop Road.	On mound and off mound /potential use of DSNY drainage facilities (e.g., multiple drainage basins including B1 and B2)
NA	West Park	2016 to 2036	NA	Hilltop monument (12 acres), successional grassland (173 acres), woodlands (200 acres), recreational loop path (3 miles), Arthur Kill dock (450 square feet), and Isle of Meadows overlook (450 square feet). West Park, North Section – hilltop field (3 acres), earthwork art feature (2 acres) with an overlook (about 450 square feet), meadow (5 acres), meadow seating (2,000 persons), woodland buffer (20 acres).	On mound and off mound /potential use of DSNY drainage facilities (e.g., multiple drainage basins around West Park)
NA	The Confluence	2016 to 2036	NA	The Point – central multi-use field area (14 acres, 1,000 seats), created swamp forest exhibit and basin (2 acres). Arthur Kill tidal wetland restoration (3 acres), exhibition hall (8,590 square feet), family fishing and picnic pier (4,100 square feet), pier overlook (3,500 square feet), fishing pier (4,900 square feet), esplanade (37,300 square feet), market roof (32,700 square feet), restaurant row (20,000 square feet), barge garden (43,500 square feet), marina/boating center (50 slips, 2 acres), boat launch (6,750 square feet), banquet hall with maintenance facilities (13,750 square feet), event lawn (10 acres), discovery center (32,700 square feet), ferry landing (6,000 square feet) and parking.	Off mound/potential use of DSNY drainage basins
NA	The Confluence – Creek Landing	2016 to 2036	NA	Visitor center (5,200 square feet), fishing pier (about 1,350 square feet), waterfront esplanade (22,850 square feet), boating lawn and terrace (2 acres), restaurant (1,000 square feet), DPR greenhouses (25,500 square feet).	Off mound/potential use of DSNY drainage basins (e.g., Basins E,F,Q)

Table H-3
Preliminary Project Schedule and Stormwater Permitting Data

Map Key	Project	Estimated Construction period	Approximate Size/Area of Disturbance	Principal Cover Types	On or off landfill section/ Potential for Use of landfill drainage facilities
NA	Park Road North and Completed Confluence Central Loop Park Road and Landscape Ribbons	2016 to 2036	NA	Completion of the Park Road System: construction of Park Road North, providing a second connection to Richmond Road and about 40 parking spaces, construction of the west leg of the Confluence Loop Park Road with bikeway/walkways, corridor landscaping, and a Signature Bridge over Fresh Kills Creek near the Point.	On mound and off mound /potential use of DSNY drainage facilities (e.g., Basins A, B1)



Solid Waste Management Unit Area | Fresh Kills Park Study Area | 5 Foot Contours (2007)

0 1,000 2,000 Ft

Park Phasing:

A - North Park Recreational Facilities & Wetlands	**47.69 ac**	**I** - South Park Landfill Section 2/8 West Enhancement	**30.13 ac**
B - North Park Phase A	**27.05 ac**	**J** - South Park Landfill Section 2/8 East Enhancement	**98.02 ac**
C - North Park Landfill Section 3/4 Landscape Enhancements	**149.38 ac**	**K** - South Park Arden Heights Neighborhood Park / Wetland Enhancement Part A	**8.03 ac**
D - North Park Multi Use Path	**7.76 ac**	**L** - South Park Arden Heights Neighborhood Park / Wetland Enhancement Part B	**9.11 ac**
E - Confluence - Creek Landing / North Park	**21.75 ac**	**M** - South Park Arden Heights Neighborhood Park / Wetland Enhancement Part C	**31.58 ac**
F - Confluence - The Terrace - South Park	**10.11 ac**	**N**- South Park Multi Use Paths	**6.24 ac**
G - Confluence - The Marsh - East Park	**15.83 ac**	**O** - South Park Recreational Facilities	**35.54 ac**
H - Confluence - Sunken Forest - East Park	**4.39 ac**	**P** - Arthur Kill Road North Parking Lot	**2.13 ac**

Fresh Kills Park, Project Phasing Areas: 2016
Figure H-1

I. SITE HISTORY

A. Consent Orders and Modifications

The New York City Department of Sanitation (DSNY), operator of the Fresh Kills Landfill (the Landfill), consented to the issuance by the New York State Department of Environmental Conservation (NYSDEC) of an Order on Consent (CO) dated October 23, 1980 (the 1980 CO) wherein it agreed, among other things, to apply for a Solid Waste Management permit under the provisions of 6 NYCRR Part 360 in existence at that time; apply for a State Pollution Discharge Elimination System (SPDES) permit under 6 NYCRR Parts 750-758; apply for a Tidal Wetlands permit under 6 NYCRR Part 661; prepare an Environmental Impact Statement under 6 NYCRR Part 617; and comply with a series of remedial measures and submit various plans as listed in the 1980 CO.

The DSNY agreed to the issuance of a new CO by the NYSDEC on April 19, 1990 (the 1990 CO, NYSDEC Case # D2 9001 89 03), which superseded and replaced the 1980 CO and 1985 CO amendments. The 1990 CO prescribed several investigations, studies, reports and designs to be completed at the Landfill by the DSNY and submitted to the NYSDEC for review, comment and acceptance. The required deliverables are described in the 1990 CO under the Compliance Schedule Series 'A' Appendices headings (Appendices A-14 and A-15 were added to the Compliance Schedule by 1990 CO modifications #6 and #7, respectively). Each of the appendices is identified below, and a summary of the provisions of each appendix is provided following the list.

Series A Appendices	Subjects
A-1	Operations and Maintenance Plan
A-2	Applications for the Fresh Kills Landfill
A-3	Landfill Final Cover Design
A-4	Landfill Leachate Mitigation of Sections 1/9 and 6/7
A-5	Waste Transport and Unloading Facilities
A-6	Hydrogeological Investigation
A-7	Surface Water and Sediment Investigation
A-8	Landfill Gas Migration Mitigation
A-9	Local Solid Waste Management Plan
A-10	Slope Stability Investigation
A-11	Remediation Funding Upon Non-Submittal of Complete Application

A-12	Actions Upon Permit Denial
A-13	Environmental Benefits Projects
A-14*	Landfill Leachate Mitigation of Sections 2/8 and 3/4
A-15#	Landfill Closure and Post Closure

* Added to compliance schedule by 1990 CO modification #6
# Added to compliance schedule by 1990 CO modification #7

Appendix A-1: Operations and Maintenance Plan

Under the terms of Appendix A-1 the DSNY was required to submit to the NYSDEC a final acceptable version of an Operations and Maintenance (O&M) plan for the Landfill (Subject 1). The O&M plan was required to include a description of the personnel requirements for the Landfill, a description of all machinery and equipment used on the Landfill, a description of the operational controls in force at the Landfill, and a description of how winter and inclement weather operations were to be conducted at the Landfill. The DSNY was also required to submit revisions of the O&M plan to the NYSDEC on an annual basis (Subject 2). According to the DSNY, the DSNY submitted an O&M plan to the NYSDEC as well as annual updates of the O&M plan, in fulfillment of Subjects 1 and 2. Per 1990 CO modification #7, dated April 27, 2000, the DSNY was no longer required to submit annual O&M plan updates after December 31, 2001. According to the DSNY, as of December 2005 all of the activities required under Appendix A-1 had been completed and approved by the NYSDEC.

Appendix A-2: Applications for the Fresh Kills Landfill

Under the terms of Appendix A-2 the DSNY was required to submit complete acceptable applications to the NYSDEC for a Solid Waste Management permit, pursuant to 6 NYCRR Part 360, a SPDES permit, as required by 6 NYCRR Part 750-758, and a Tidal Wetlands permit, as required by 6 NYCRR Part 661 (Subject 2 in original 1990 CO, Subject 5 in modification #1 and subsequent). 1990 CO modification #1, dated September 21, 1990, supplemented the requirements of Appendix A-2 with the condition that the DSNY also submit to the NYSDEC a Contingency Plan for the Landfill based on, to the maximum extent possible, the applicable requirements of 6 NYCRR Part 360 Sections 1.9(h) and 2.10 (Subject 3 in 1990 CO modification #1). The DSNY was required to update the Contingency Plan annually. According to the DSNY, a final acceptable Contingency Plan was submitted to the NYSDEC, in fulfillment of 1990 CO modification #1 Subject 3. Under the terms of 1990 CO modification #7, dated April 27, 2000, no further annual updates of the Contingency Plan were required after July 21, 2001.

1990 CO modification #5, dated July 26, 1995, extended the milestone date for the submission of a Solid Waste Management permit application for the Landfill to March 15, 1996. According to 1990 CO modification #7, the DSNY submitted to the NYSDEC

a complete application for a Solid Waste Management permit by the milestone date. However, on June 2, 1996, a law was passed barring the disposal of waste at the Landfill after January 1, 2002. Therefore, in light of the plans to close the Landfill, on September 15, 1996, the DSNY formally requested that the NYSDEC suspend review of the Solid Waste Management permit application.

A review of NYSDEC permit databases conducted on November 20, 2008, found that the DSNY currently holds active Solid Waste Management (NYSDEC ID: 2-6499-00029/00097), SPDES (NYSDEC ID: 2-6499-00029/00037, SPDES ID: NY 020 0867), and Tidal Wetlands (NYSDEC ID: 2-6499-00029/00248) permits for the Landfill, in accordance with 1990 CO modification #1 Subject 5. According to the DSNY, as of December 2005 all of the activities required under Appendix A-2 had been completed and approved by the NYSDEC.

Appendix A-3: Landfill Final Cover Design

Under the terms of Appendix A-3 the DSNY was required to submit to the NYSDEC a report on the final cover which had been placed on the Landfill as of May 1, 1990 (Subject 1). The DSNY was also required to submit a final cover design for all Sections of the Landfill in accordance with 6 NYCRR Part 360 (Subject 6). The final cover design submission was required to be in compliance with 6 NYCRR 36O-2.l3(p) and 6 NYCRR 360-2 .l3(q) or (r), and include a Qua1ity Assurance/Quality Control (QA/QC) Report in compliance with 6 NYCRR 360-2.8 and a construction schedule. Finally, the DSNY was required to submit closure plans for all Sections of the Landfill in accordance with 6 NYCRR Part 360 Section 2.15. The NYSDEC specified that the DSNY should submit closure plans for Sections 2/8 and 3/4 (Subject 9 in original 1990 CO and modification #2, Subject 10 in modification #3 and subsequent) and Sections 1/9 and 6/7 (Subject 11 in original 1990 CO and modification #2, Subject 12 in modification #3 and subsequent) as separate reports.

Under the terms of Appendix A-3 the DSNY was also required to cease disposal of solid waste at Sections 2/8 and 3/4 when either the solid waste mounds reached elevations of 151 and 140 ft, respectively, or by December 31, 1993, whichever occurred first. 1990 CO modification #2, dated April 22, 1992, increased the maximum allowable height of the Section 3/4 waste mound from 140 ft to 170 ft. 1990 CO modification #2 also stipulated that the disposal of solid waste at Section 3/4 was to cease as soon as the Main Creek Bridge replacement was completed, or November 20, 1992, whichever occurred first (contingent on the maximum waste mound elevation not being reached in the interim). Additionally, 1990 CO modification #2 extended the milestone date for the submittal of the Closure Plan for Landfill Section 3/4 from May 3, 1992, to May 18, 1992. 1990 CO modification #3, dated November 18, 1993, extended the milestone dates for submittal of hydrogeological information related to the closure of Landfill Sections 2/8 and 3/4.

According to the DSNY, the DSNY submitted the results of the final cover as-built performance analysis to the NYSDEC in a letter report dated August 1990, in compliance

with Subject 1. On September 6, 1991, in fulfillment of Subject 6, the DSNY submitted to the NYSDEC a Final Cover Design Report prepared by SCS Engineers, P.C. (SCS) which detailed final cover designs for all Sections of the Landfill. In response to comments from the NYSDEC, on February 28, 1992, the DSNY submitted an Addendum to the Final Cover Design Report, also prepared by SCS. The DSNY submitted a Final Closure Plan for Sections 2/8 and 3/4 on May 18, 1992, and a Final Closure Plan for Sections 1/9 and 6/7 on December 4, 1992. These final closure plans were prepared by SCS and fulfilled 1990 CO modification #3 Subjects 10 and 12. According to the DSNY, as of December 2005 all of the activities required under Appendix A-3 had been completed and approved by the NYSDEC.

Appendix A-4: Landfill Leachate Mitigation of Sections 1/9 and 6/7

Under the terms of Appendix A-4 the NYSDEC directed the DSNY to undertake landfill leachate mitigation activities at Sections 1/9 and 6/7 of the Landfill. The required activities were to include:

- an investigation of subsurface geology and hydrogeology;
- characterization of leachate quality and quantity;
- design of a complete perimeter leachate collection and containment system;
- design of the leachate treatment system;
- construction of an approved perimeter leachate collection and containment system; and
- construction of an approved leachate treatment system.

The deliverables required under Appendix A-4 included final acceptable versions of a Leachate Mitigation Investigation Workplan (Subject 8), a Leachate Mitigation Report (Subject 13), and an Engineering Plan, Engineering Report, and QA/QC Report (Subject 15). All field investigations and design and construction activities were required to be performed in accordance with 6 NYCRR Part 360 Section 2 and all other applicable regulations. 1990 CO modification #3, dated November 18, 1993, extended the milestone dates for some of the submittals required under Appendix A-4. 1990 CO modification #6, dated October 20, 1998, extended the milestone dates for the leachate collection and treatment requirements for Sections 1/9 and 6/7.

On March 7, 1994, in fulfillment of Subject 13, the DSNY submitted to the NYSDEC a Final Leachate Mitigation Report and Corrective Measures Assessment Report prepared by International Technology Corp (IT Corp.). According to the DSNY, as of December 2005 all of the activities required under Appendix A-4 had been completed and approved by the NYSDEC.

Appendix A-5: Waste Transport and Unloading Facilities

Under the terms of Appendix A-5 the DSNY was required to submit to the NYSDEC a final acceptable report containing proposed actions to achieve (1) a reduction, to the

greatest extent practicable, of the deposition of solid waste into surface waters; (2) the containment and removal of waste that does enter surface waters despite these efforts; (3) the transition to rubber tire vehicles to transport solid waste from the barges to the open Landfill Sections and the construction of passable roadways for said vehicles; and (4) the installation of barriers or other control measures to prevent unauthorized access to the Landfill property (all Subject 2).

The DSNY requested the addition of milestones to Appendix A-5 to allow for the construction of an enclosed barge unloading facility and the completion of roadway related projects, as well as the purchase and delivery of two skimmer boats, thirteen additional refuse haulers, and two hydraulic cranes. In 1990 CO modification #3, dated November 18, 1993, the NYSDEC granted this request. According to the DSNY, as of December 2005 all of the activities required under Appendix A-5 had been completed and approved by the NYSDEC.

Appendix A-6: Hydrogeological Investigation

Under the terms of Appendix A-6 the DSNY was required to perform a comprehensive Hydrogeological Investigation at the Landfill in conformance with the procedures and informational requirements of 6 NYCRR Part 360, especially Section 2.11(a), (b) and (c). The deliverables required under Appendix A-6 included final acceptable versions of a Site Investigation Plan (Subject 7), a Groundwater Monitoring Well and Piezometer Survey Report (Subject 8), a Supply Well Survey Report (Subject 10), a Hydrogeological Literature Review Report (Subject 11), and a Hydrogeological Report (Subject 15). 1990 CO modification #3, dated November 18, 1993, extended the milestone dates for some of the submittals required under Appendix A-6.

On December 31, 1990, in fulfillment of Subjects 7 and 8, the DSNY submitted to the NYSDEC a Hydrogeological Site Investigation Plan and a Groundwater Monitoring Well and Piezometer Survey Report. In response to comments from the NYSDEC, on July 26, 1991, the DSNY submitted a Revised Hydrogeological Site Investigation Plan. On March 15, 1991, in fulfillment of Subjects 10 and 11, the DSNY submitted a Supply Well Survey Report and a Hydrogeological Literature Review Report. Finally, on July 25, 1993, in fulfillment of Subject 15, the DSNY submitted a Final Hydrogeological Report. All of the submittals listed above were prepared by IT Corp. According to the DSNY, as of December 2005 all of the activities required under Appendix A-6 had been completed and approved by the NYSDEC.

Appendix A-7: Surface Water and Sediment Investigation

Under the terms of Appendix A-7 the DSNY was required to perform a comprehensive Surface Water and Sediment Investigation to determine the impact of the Landfill and related landfill leachate discharges on the quality of aqueous and sub-aqueous environments, in accordance with the procedures and informational requirements of 6 NYCRR Part 360, especially Section 2.11(a), (b), and (c). The deliverables required by the NYDEC included final acceptable versions of a Surface Water and Sediment

Investigation Plan (Subject 6), a Surface Water and Sediment Literature Review Report (Subject 9), and a Surface Water and Sediment Report (Subject 14).

On December 31, 1990, in fulfillment of Subject 6, the DSNY submitted to the NYSDEC a Surface Water and Sediment Investigation Plan. In response to comments from the NYSDEC, on July 26, 1991, the DSNY submitted a Revised Surface Water and Sediment Investigation Plan. On April 1, 1991, in fulfillment of Subject 9, the DSNY submitted a Surface Water and Sediment Literature Review Report. Finally, on December 23, 1993, in fulfillment of Subject 14, the DSNY submitted a Final Surface Water and Sediment Report. All of the submittals listed above were prepared by IT Corp. According to the DSNY, as of December 2005 all of the activities required under Appendix A-7 had been completed and approved by the NYSDEC.

Appendix A-8: Landfill Gas Migration Mitigation

Under the terms of Appendix A-8 the DSNY was required to initiate a landfill gas monitoring program based on the requirements of 6 NYCRR Part 360 Section 2 in order to ensure that the gas concentration standards described in Appendix B-2 of the 1990 CO are met. The NYSDEC required the DSNY to perform a Landfill Gas Migration Investigation following the requirements outlined in 6 NYCRR Part 360 Section 2.15(a)(2). The intent of this investigation was to identify the presence and concentration of explosive gases at or near the Landfill; determine the extent of actual or potential gas migration off-site; and identify the soil stratigraphy beneath and around the Landfill. The type and frequency of monitoring was approved by the NYSDEC. The DSNY was required to submit to the NYSDEC a final acceptable version of a Landfill Gas Migration Mitigation Report (Subject 2).

The DSNY requested the addition of milestones to Appendix A-8 to allow for the design and construction of perimeter gas vent trenches. In 1990 CO modification #3, dated November 18, 1993, the NYSDEC granted this request. According to the DSNY, as of December 2005 all of the activities required under Appendix A-8 had been completed and approved by the NYSDEC.

Appendix A-9: Local Solid Waste Management Plan

Under the terms of Appendix A-9 the DSNY was required to submit a final acceptable Local Solid Waste Management Plan for the City of New York (Subject 2 of 1990 CO modification #3) that addressed all of the matters identified in 6 NYCRR Part 360 Section 15.9. According to the DSNY, as of December 2005 all of the activities required under Appendix A-9 had been completed and approved by the NYSDEC.

Appendix A-10: Slope Stability Investigation

Under the terms of Appendix A-10 the DSNY was required to perform a Slope Stability Investigation to analyze the refuse slope stability and foundation consolidation and stability in relation to the grading plan and waste placement rates proposed for all the

Sections of the Landfill. The deliverables required under Appendix A-10 included final acceptable versions of a Field Investigation Report (Subject 7), a Geotechnical Testing Data Report (Subject 8), a Geotechnical Site Characterization Report (Subject 11), a Geotechnical Analysis Report (Subject 12), and a Monitoring System Design Report and Monitoring System Installation Plans and Specifications (Subject 14). 1990 CO modification #3, dated November 18, 1993, extended the milestone dates for some of the submittals required under Appendix A-10. 1990 CO modification #3 also added updating requirements for the Geotechnical Analysis Report, which was to be updated annually using the field monitoring data collected during the preceding year, and to the Monitoring System Design and Monitoring System Installation Plans and Specifications, which was to be updated to reflect different phases of Landfill development.

The DSNY has submitted to the NYSDEC multiple geotechnically related reports prepared by Woodward-Clyde Consultants, Inc., URS Grenier Woodward-Clyde, and URS. According to the DSNY, as of December 2005 all of the activities required under Appendix A-10 had been completed and approved by the NYSDEC.

Appendix A-11: Remediation Funding Upon Non-Submittal of Complete Application

Appendix A-11 describes the actions that the NYSDEC would have taken if the DSNY had failed to submit a complete acceptable Solid Waste Management permit application pursuant to 6 NYCRR Part 621 as required under Appendix A-3. Since the DSNY did submit a complete Solid Waste Management permit application, the actions stipulated under Appendix A-11 are no longer pertinent.

Appendix A-12: Actions Upon Permit Denial

Appendix A-12 describes the actions that the NYSDEC would have taken if the DSNY was denied a Solid Waste Management permit. Since, under 1990 CO modification #7, the DSNY withdrew its application for a Solid Waste Management permit, in light of the Landfill being slated for closure, the actions stipulated under Appendix A-12 are no longer pertinent.

Appendix A-13: Environmental Benefit Projects

Under the terms of Appendix A-13 the DSNY was required to submit an Environmental Benefit Plan to the NYSDEC. The NYSDEC stipulated that the Environmental Benefit Plan should detail the prospective implementation of projects directed at the following goals: (1) acquisition of fee titles or conservation easements over wetlands regulated pursuant to Article 24 of the ECL, (2) use of indigenous plants for vegetative cover, (3) development of wildlife habitat areas, and (4) development of tidal and freshwater wetlands in and about Staten Island. According to the DSNY, as of December 2005 all of the activities required under Appendix A-13 had been completed and approved by the NYSDEC.

Appendix A-14: Landfill Leachate Mitigation of Sections 2/8 and 3/4

The DSNY submitted a Final Closure Plan for Landfill Sections 2/8 and 3/4 on May 18, 1992. However, the NYSDEC judged the Final Closure Plan to be inadequate because it did not provide for any collection or treatment of leachate from Landfill Sections 2/8 and 3/4. The DSNY subsequently agreed to construct leachate controls at Sections 2/8 and 3/4. On April 22, 1996, the DSNY submitted a proposed implementation schedule for leachate controls at Sections 2/8 and 3/4 and an Engineering Report and Plan detailing a new leachate recovery and collection system. 1990 CO modification #6, dated October 20, 1998, set forth a compliance schedule under Appendix A-14 for the implementation of leachate controls at Sections 2/8 and 3/4. According to the DSNY, as of December 2005 all of the activities required under Appendix A-14 had been completed and approved by the NYSDEC.

Appendix A-15: Landfill Closure and Post Closure

On June 2, 1996, a law was passed barring the disposal of waste at the Landfill after January 1, 2002. In light of the plans to close the Landfill, on September 15, 1996, the DSNY formally requested that the NYSDEC suspend review of the Solid Waste Management permit application. 1990 CO modification #7, dated April 27, 2000, formalized the withdrawal of the Solid Waste Management permit application. Modification #7 also set forth a compliance schedule under Appendix A-15 for the closure of the Landfill. The deliverables required under Appendix A-15 included final acceptable versions of a Closure and Post-Closure Registration Report (Subject 2), a Section 6/7 Final Cover Design Report (Subject 4), a Section 1/9 Final Cover Design Report (Subject 6), a Closure Construction Certification Report (Subject 9), a Post-Closure Monitoring and Maintenance Operations Manual (Subject 11), and a Final Closure Plan (Subject 14).

In January 2001, in fulfillment of Subject 4, the DSNY submitted to the NYSDEC a Landfill Section 6/7 Final Cover Design Report prepared by Malcolm Pirnie, Inc., and in January 2002, in fulfillment of Subject 6, the DSNY submitted a Landfill Section 1/9 Final Cover Design Report prepared by URS. In compliance with Subject 9, the DSNY has submitted multiple Closure Construction Certification Reports for Landfill Sections 2/8 and 3/4. The reports for Section 2/8 were submitted between November 1995 and March 1997, while the reports for Section 3/4 were submitted between February 1996 and May 1997. The DSNY submitted a Post-Closure Monitoring and Maintenance Operations Manual for the Landfill, in accordance with Subject 11, on December 13, 2002. Finally, the DSNY submitted a Final Closure Plan for the Landfill, in accordance with Subject 14, on June 5, 2003. These two latter reports were both prepared by Weston Solutions of New York, Inc. According to the DSNY, as of December 2005, with the exception of the Closure Construction Certification Reports for Landfill Sections 1/9 and 6/7, all of the activities required under Appendix A-7 had been completed and approved by the NYSDEC. Additionally, until the landfill closure is complete the DSNY is required to submit Annual Landfill Closure Progress Reports (Subject 7).

B. Landfill Closure Efforts

Since 1980, the Fresh Kills Landfill has been comprised of four operating units: Sections 1/9, 2/8, 3/4, and 6/7. The DSNY initiated the placement of final cover at the Fresh Kills Landfill in 1986. For this initial phase of cover placement, a 12- to 18-inch-thick layer of low-permeability clay was used to prevent precipitation from infiltrating into the waste (hydraulic barrier). By 1990, portions of the side slopes on Section 2/8 and 3/4 were covered. This clay final cover, with a total area of approximately 22.8 acres (for Section 2/8) and 44.6 acres (for Section 3/4), was previously approved by NYSDEC.

Under the terms of the 1990 CO all Sections of the Landfill were required to be closed. Appendix A-3 of the 1990 CO addressed landfill final cover design. Under the terms of Appendix A-3 the DSNY was required to submit a final acceptable closure plan for Sections 2/8 and 3/4 in accordance with 6 NYCRR Part 360-2.15 by May 3, 1992 (Subject 9) and cease disposal of waste at the sections when set elevations were reached or by December 31, 1993 (Subject 8).

The design of the remaining final cover at Section 2/8 and 3/4 was presented in the *Final Closure Plan for Sections 2/8 and 3/4* (prepared by SCS Engineers, P.C., May 18, 1992), which was approved by NYSDEC in correspondence dated September 30, 1992.

The contract for the remaining final cover construction at Section 2/8 was awarded in August 1994 to Interstate Industrial Corp. Construction was substantially completed in 1996. The contract for the remaining final cover construction at Section 3/4 was awarded in July 1993 to Petosa Bros., Inc. Construction was substantially completed in 1997.

Final closure construction is underway at Landfill Section 6/7 in accordance with a NYSDEC approved design. Final closure design has also been approved by the NYSDEC for Landfill Section 1/9 and sub-base grading, an early stage of closure construction, has begun. Final closure construction includes a final cover designed to minimize water infiltration with a soil/geomembrane layer and vegetative cover that minimizes erosion. There is also a comprehensive network of drainage structures to collect surface water runoff. It is expected that the final closure construction of Landfill Sections 1/9 and 6/7 will be completed by 2016.

C. Existing Permits

Under the terms of Appendix A-2 of the 1990 CO, the DSNY was required to obtain for the Landfill a Solid Waste Management permit, pursuant to 6 NYCRR Part 360, a SPDES permit, as required by 6 NYCRR Parts 750-758, and a Tidal Wetlands permit, as required by 6 NYCRR Part 661. According to a review of NYSDEC permit databases conducted on November 20, 2008, the DSNY currently holds active Solid Waste Management, SPDES, and Tidal Wetlands permits for the Landfill.

The current Solid Waste Management permit (NYSDEC ID: 2-6499-00029/00097) was issued June 26, 2008, and expires June 26, 2013. The current Tidal Wetlands permit (NYSDEC ID: 2-6499-00029/00248) was issued May 26, 2004, and expires May 26, 2014. The current SPDES permit (NYSDEC ID: 2-6499-00029/00037, SPDES ID: NY 020 0867) was issued July 25, 2007, and expires February 28, 2013, however, the NYSDEC is currently pursuing a Department Initiated Modification (DIM) of the SPDES permit. The major changes to the SPDES proposed by the NYSDEC include the alteration of the types of samples to be collected for certain parameters as well as modifications to the action levels for certain compounds. As of November 20, 2008, the changes to the SPDES have not been implemented by the NYSDEC.

At the Landfill, six flares are operated in conjunction with a LFG processing facility to control LFG emissions. Additionally, landfill leachate is collected from all Landfill Sections and processed in a leachate treatment plant. The DSNY has obtained a Title V Air permit to cover all of these activities. The current Title V Air permit (NYSDEC ID: 2-6499-00029/00151) was issued August 16, 2006, and expires August 15, 2011.

II. PRECEDENTS

A. Natural Resources: Planting and Soils Strategies

Two former New York City landfills—the 90-Acre former Pennsylvania Avenue landfill and the 280 Acre former Fountain Avenue landfill, both closed in 1985—were studied extensively to determine planting and soil strategies that could be applicable at Fresh Kills. Through site visits and discussions with ecologists familiar with these projects, a number of issues regarding planting and soil strategies were raised that will significantly impact the success or failure of vegetation, habitat, and wildlife at Fresh Kills. These include the following:

- Soil strategies to discourage invasive species and encourage native plants: The chemical and nutrient composition and the structure of landscape soils are critical elements in the Fresh Kills restoration process. The properties of soil determine the type of plant species able to thrive, which in turn directly influences the amount and types of vegetation and animal communities that can be supported. Based on the precedents at Pennsylvania, Fountain, and other landfills, for general planting in upland areas, imported soils must be low in pH and nutrient levels to discourage invasive species. Where soil manufacture is necessary, the compost used in this process should not include food compost, which raises nutrient levels.

- Planting and Soil Hydrology: at Fountain and Pennsylvania landfills, trees that are not tolerant of wet soils have been impacted by poor drainage on capped mounds. Project managers have been forced to replace certain tree species with species that are wet-tolerant, such as *Nyssa sylvatica*. In anticipation of such conditions, specifications at Fresh Kills call for coarse, sand-dominant general planting soil to

help ensure adequate drainage. Furthermore, it is believed that the existing waste topography will also help prevent oversaturation of soils.

- A number of important maintenance issues were identified at Pennyslvania and Fountain landfills that will affect planting success or failure. For instance, voles have been identified at Pennsylvania and Fountain landfills as a major factor in harming new trees. Similarly, in areas exposed to high winds, dessication has been identified as a key problem for new trees. Accordingly, specifications at Fresh Kills will include anti-dessication and vole control measures.

B. Landfill Operations

a. *Cesar Chavez Park, Berkeley, CA.* This park was constructed at the site of the former Berkeley Landfill, which that was operated from 1957 to 1991, when the landfill was closed. The waste covers an area of about 90 acres. In 1988, a landfill gas collection and flare system was installed. Shortly after the landfill was closed, the park was opened. The facility is prominently featured in the City's web site and includes multi-purpose turf areas, picnic areas, hiking trails, a 1.25-mile walking trail around the park's perimeter that is fully wheelchair accessible, shoreline and wetland areas, kite flying (site of annual Kite Festival in July), and a wildlife sanctuary at the undeveloped northern end of park. The park is located in a unique setting along San Francisco Bay and offers views of the Golden Gate and Bay Bridges, Alcatraz Island, and the bay. The post-closure care of the facility is conducted by the City of Berkeley Department of Public Works in accordance with a Landfill Postclosure Monitoring and Maintenance plan. Recently, the City began a program to reevaluate the perform periodic repairs of the LFG management system and to perform periodic maintenance of the landfill cover to address settlement and ponding issues, with no reported impact to overall park operations.

b. *Mt. Trashmore, Virginia Beach, VA.* This park was constructed on the site of the former Mount Trashmore landfill in Virginia Beach, which was closed in 1970. The park was opened in 1973, making it one of the first major parks developed at a closed landfill. The park covers and area of about 165 acres, including the two waste disposal mounds which rise about 65 feet above the surrounding area, and from which LFG is passively vented. The park includes four large and 11 small picnic shelters, skate park, a playground areas, a basketball court, four volleyball areas, parking, vending machines and restrooms, and also two lakes. The walking trail is measured at approximately 1.45 miles. Since it was opened in the 1973, it has been one of the most popular parks in Virginia Beach, with over one million visitors per year. Maintenance activities are

routinely conducted by the City of Virginia Beach Department of Parks and Recreation, which coordinates with the Virginia Department of Environmental Quality on maintenance issues when required.

C. Landfill roads

Roads are routinely constructed over waste fills in the United States and in other countries. In the United States, the performance of several roadway fills has been monitored to evaluate whether the roadway provided an adequate level of service and to evaluate the degree of maintenance needed for roadways constructed over waste fills. A summary of highway projects constructed on top of landfills as reported in the literature is presented in this memorandum. Five different projects are discussed below.

1. Two New York highways on Refuse Fill. According to Burlingame (1985) the New York State Department of Transportation (NYSDOT) constructed at least two highways on refuse fills. The first highway was constructed on a relatively young refuse having a thickness ranging from 5 to 25-ft. The second highway was constructed on older refuse (20 years old) having a thickness of about 40-ft. Heavy rolling used to stabilize the refuse on two stages for both projects using a heavier compactor in the second stage. Densification was reported to extend to a depth of about 10-ft as indicated from electrical resistivity surveys. The first highway experienced large differential settlements and required resurfacing after 12 years in service. The second highway was successful and showed good serviceability after 14 years in service. The difference in performance was attributed to the age of the refuse (Burlingame, 1985).

2. Interchange of New Jersey Route 18 and Route 36, New Jersey. The alignment of the roadways and connector ramps for the interchange at the intersection of New Jersey Route 18 with the Garden State Parkway and New Jersey Route 36 transverse the Tinton Landfill (Lewis and Langer, 1994). The Tinton landfill received municipal waste and ceased operation in the early 1970s. The landfill was covered with soil and overgrown vegetation. The highway embankments for the interchange at the landfill reach 3 to 9 meters in height. The depth of waste and the interchange location reaches 7.6 meters and is underlain by medium dense to dense silty sand. The primary settlement of the landfill under the embankment loads was estimated to be on the order of 1.5 to 2.1 meters without the application of ground improvement. Three different approaches were considered to minimize the settlement and the possibility of bearing capacity failure: (1) removal of the waste and replacement with adequate fill, (2) preloading of the waste, and (3) deep dynamic compaction (DDC) of the landfill followed by a short period of preloading. It was decided that removal of the waste was too expensive and that preloading would not reduce post construction settlements to an acceptable range

unless a long preloading period was used (on the order of several years). The method selected for ground improvement was DDC of the waste material followed by a short period of preloading (six months). DDC was designed largely based on the Federal Highway Administration (FHWA) Report No. FHWA/RD-86/133, "Dynamic Compaction of Highway Construction – Volume I: Design and Construction Guidelines". Details of the DDC process used at the Tinton landfill are reported by Lewis and Langer (1994). The DDC processes resulted in up to 50 percent reduction in waste thickness. A test embankment was constructed on a landfill section with no DDC for comparison purposes. The test embankment was preloaded with a 1.5 meter surcharge for a period of 6 months. Settlements of both embankments were monitored for a period of 4 years. Lewis and Langer reported that the embankment on non-dynamically compacted waste experienced a larger total settlement than the embankment on dynamically compacted waste. However, primary settlement of the embankment on non-dynamically compacted waste occurred in a short period of time and may be considered "immediate". Long-term settlement of both embankments was reported to continue past the reported period and was similar in magnitude for both embankments.

3. State Highway 11, Tulsa, Oklahoma. Snethen and Homan (1991) reported on the construction and performance of a portion of The Gilcrease Expressway, Tulsa, Oklahoma, that crosses a strip mine/uncontrolled landfill area. The Gilcrease Expressway is an extension of State Highway 11 (SH-11) which connects the Tulsa International Airport with Highway U.S.-75. Near Yale Avenue, the highway crosses an area that was strip mined then subsequently used as an uncontrolled sanitary landfill. The project involved construction of an embankment having a maximum height of 9 m on layers of mine spoil covering layers of trash. The trash thickness ranged from 2 m to 7 m. Several options were considered for ground improvement, which included DDC, grouting, and constructing an elevated roadway on founded on drilled shafts reaching competent shale. DDC was selected on the basis of feasibility and economy. ODOT required three instrumented test sections to evaluate the effectiveness of ground improvement. Details of the DDC process used are reported by Snethen and Homan (1991). The results of the DDC were inconsistent and raised concern about its effectiveness. Therefore stone columns installed using deep dynamic compaction was used at critical locations within the site. Three test stone columns were installed to determine the most effective construction operation. Details of the construction process for the tree test stone columns are reported by Snethen and Homan (1991). The selected construction process was used to install 95 stone columns having 2 m in diameter and 5 m deep. After construction of the stone columns DDC was completed on the remaining portions of the site. ODOT monitored the settlement of the embankment constructed on the improved ground. Data collected after two years following the construction of the embankment

indicated 0.1 m settlement at areas improved using stone columns and 0.15 m settlement at areas improved using DDC. Snethen and Homan (1991) recommended using test sections to determine the effectiveness and construction sequence of DDC as well as to assess the need for additional foundation support.

These projects demonstrate the following:

- roadways requiring a high level of service can be successfully constructed over waste fills;

- roadways constructed over waste fills generally require additional design and site improvement, as well as a higher degree of maintenance, compared to roadways constructed over most non-waste materials; and

- parks are commonly and frequently constructed over landfills around the world, and such parks are operated in a manner that is protective of human health and the environment. Also, the operation of the parks at these sites has been successfully coordinated with the operation and maintenance of the landfill's post-closure operation and maintenance and monitoring systems.

III. LANDFILL LEACHATE CHARACTERIZATION AND TREATMENT

The 1990 CO agreement between the NYSDEC and the DSNY set forth a number of investigatory programs aimed at a comprehensive evaluation of environmental conditions within, under, and adjacent to the Landfill. Included within the 1990 CO is a program aimed at mitigation, with the objective controlling leachate discharge to the maximum extent practicable within the regulatory framework, including identification of leachate contamination, collection, and treatment technologies. A parallel objective is to define the impact of leachate discharge not amenable to control under either maximum practicable or alternative capture scenarios.

The information about leachate at the Landfill discussed in this section was originally presented in two reports prepared for the DSNY by IT Corp. and submitted to the NYSDEC. The two reports are the Final Hydrogeological Report, submitted July 25, 1993, and the Final Leachate Mitigation Report and Corrective Measures Assessment Report, submitted March 7, 1994. These two reports detail the activities and findings of the leachate mitigation investigation. The Final Hydrogeological Report was prepared in accordance with Subject 15 of Appendix A-6 of the 1990 CO. The Final Leachate Mitigation Report and Corrective Measures Assessment Report were prepared in accordance with Subject 13 of Appendix A-4 of the 1990 CO.

In performing this investigation, the site was characterized by describing its geologic, hydrogeologic, biological, and refuse characteristics, as well as the chemistry and quality

of surface water, groundwater, and leachate. From a broad perspective, geologic materials within the project site are represented by three distinct layers or units: refuse/fill, unconsolidated overburden, and consolidated bedrock. Refuse/fill consists of man-made deposits (i.e., the landfills) deposited on top of natural soil materials; these deposits currently range in thickness from several feet to over 150 ft. The unconsolidated overburden consists of natural soil materials lying between the refuse/fill and the bedrock. The overburden materials consist predominantly of fine-grained, silt and clay material. However, this low permeability matrix contains geologic heterogeneities, including sand lenses and layers, some of which exhibit lateral and vertical interconnection. These interconnected sand deposits represent potential conduits for the horizontal and vertical migration of leachate. The thickness of the overburden materials ranges from several tens of feet to over 200 ft. Fine-grained sediments underlying the landfills serve to restrict downward leachate migration and promote shallow, horizontal flow.

As part of the development of a conceptual model of site hydrogeology, analytical analysis of the rate of horizontal and vertical groundwater flux through the flow system was performed to estimate the magnitude of leachate and groundwater discharge and the rate of groundwater recharge (infiltration) to the refuse mounds. Two-dimensional (cross-sectional) numerical flow and solute transport models were also developed at each landfill section to evaluate the effects of changes to the physical flow system (e.g., unit thickness, hydraulic conductivity) on the distribution of leachate and groundwater flux. The results of the numerical modeling aided the development of a regional three-dimensional numerical model of the entire project area. The regional model was developed primarily to evaluate the significance of potential vertical leachate migration pathways, and allow for the assessment of the effectiveness of corrective measure alternatives.

During the leachate mitigation investigation it was found that leachate mounds existed within each landfill section and that regional flow in the overburden and bedrock trends from the upland areas of Staten Island to the coastal areas, with an overall regional gradient in the vicinity of the FKLF toward the south and southwest (i.e., toward the Arthur Kill). The results of analytical calculations of groundwater flow, numerical cross-sectional analyses of flow and solute transport, and three-dimensional (areal) analysis of flow indicate that the majority of leachate discharge from the refuse mounds (between 86 and 99 percent) is horizontal through the refuse and shallow sand units to adjacent surface waters. Recharge to the landfill sections was estimated through analytical flux analyses to be between approximately 13.2 and 18.3 inches per year. Under conditions which prevailed in 1993, the steady-state numerical analysis estimate of leachate generation from all of the landfill sections combined was approximately 1.2 million gallons per day. Actual leachate generation rates are reported in the records of discharges from the leachate treatment plan that have been and continue to be reported monthly in the Discharge Monitoring Reports required under the Fresh Kills Landfill SPDES Permit.

As part of the leachate mitigation investigation, two groundwater sampling programs were undertaken at the Landfill. These included a primary, compressive quarterly water

quality sampling program for 6 NYCRR Part 360 specified Expanded Parameters (indicator parameters, metals, and organic compounds), and a limited geochemical sampling program (filtered indicator parameters metals, and environmental isotopes).

Groundwater within the shallow/refuse water table monitoring zone at all landfill sections exhibited elevated concentrations of nitrogen and carbon series leachate indicator parameters (ammonia, total Kjeldahl nitrogen [TKN], biochemical oxygen demand [BOD], chemical oxygen demand [COD], and total organic carbon [TOC]). Regulated general water chemistry constituents are generally well in excess of water quality standards. Metals, typically boron, iron, and magnesium are present in elevated concentrations.

While detected, organic compounds exhibited a low concentration distribution and, with the exception of several constituents in the shallow/refuse and deep (bedrock) monitoring zones, their occurrence is sporadic. Virtually all of the detected organic compounds that occur over successive sampling quarters consist of volatile and semi-volatile organic compounds (VOCs and SVOCs). The concentration distribution of organic compounds observed in the leachate is low, with median vales ranging from 1 to 27 ug/L for VOCs and 5 to 20 ug/L for SVOCs. The concentration distribution of detected pesticides and herbicides is extremely low, and PCB compounds are virtually undetected. The highest strength leachate is observed at Section 1/9.

In general, the concentration of leachate indicator parameters in the confined sand and bedrock water-bearing units is one to several orders of magnitude below concentrations observed in the shallow/refuse monitoring zone. In the deeper sand units, exceedence of water quality standards is limited primarily to a number of metals constituents; in most cases, elevated concentrations of these analytes is believed to represent the mineral content of the soil and rock material, and the incidental, localized effects of turbidity and acid preservation on sample analysis and not the migration of leachate into these units. With very few exceptions, the presence of organic compounds is sporadic and not associated with leachate migration. The majority of exceedences of water quality standards within the intermediate zone are represented by three areas where vertical leachate migration is believed to have occurred, or potentially occurred. With one exception, the occurrence of organic compounds in the deep monitoring zone is extremely limited and sporadic in nature.

Surface water sampling identified the presence of the following parameters that may potentially be derived from leachate: alkalinity, ammonia, BOD, COD, TKN, and turbidity. The following metals were identified as possibly landfill related: aluminum, arsenic, barium, copper, iron, lead, manganese, nickel, and zinc. Exceedences of the surface water standards were observed for the following parameters: copper, lead, nickel, and zinc.

The findings of the impact analyses indicate that leachate releases from the landfill primarily affect shallow groundwater and certain upstream surface water reaches; limited

or no effects are evidenced throughout much of the estuarine system and within deep groundwater bearing zones.

The results of water quality and geochemical analysis strongly support the geologic model, relative to the extensive distribution of fine-grained, hydraulically restrictive materials, as well as the findings of numerical flow and solute transport analysis. Within the shallow/refuse water bearing unit, leachate mixing with natural groundwater has been observed in shallow sand deposits within all landfill sections.

A leachate control system has been installed to capture leachate from each of the Landfill Sections for treatment. The components of the leachate control system vary among the Landfill sections. At Sections 1/9 and 6/7, the leachate control system consists of a cutoff wall and a leachate collection drain with associated leachate collection pump stations located along the perimeter of both landfill sections. At Sections 2/8 and 3/4, the leachate control system includes leachate recovery wells at the top, partial perimeter drains, and leachate collection pump stations located along the partial perimeter drains. Collected leachate from all landfill sections is conveyed through header pipes and force mains to the Fresh Kills Landfill Leachate Treatment Plant (FKLLTP). The FKLLTP, which is located in the southwestern end of Section 1/9, treats the collected leachate and discharges the effluent into the Arthur Kill through a subaqueous outfall in accordance with a SPDES permit. The performance of the leachate treatment system is monitored and data concerning the performance of the system is submitted to the NYSDEC on a regular basis.

In response to the 1993 hydrogeologic studies, leachate mitigation measures were implemented to: (i) reduce the rate of leachate formation and the deplete the source of leachate release; (ii) eliminate the pathways of leachate release; and (iii) mitigate the environmental impacts to the environmental resources beneath or adjacent to the landfill facility. The three main leachate mitigation components that were implemented were:

- *leachate treatment system:* treatments include flow equalization, biological treatment, chemical coagulation/precipitation, clarification, filtration, pH adjustment, and sludge conditioning/thickening/dewatering;
- *cut-off wall:* along the perimeter of Section 1/9 and 6/7, a slurry wall was built to minimize the amount of water from adjacent water bodies that enter the leachate collection system and to contain leachate during temporary leachate collection system shutdown for maintenance and/or malfunction; and
- *leachate collection system:* along most of the perimeter of Section 1/9 and 6/7 a trench drain was installed. In other areas (Section 2/8 and 3/4), leachate collection wells are also installed.

The components of the leachate mitigation system vary among the Landfill sections. At Sections 1/9 and 6/7, the leachate control system consists of a cutoff wall and a leachate collection drain with associated leachate collection pump stations located along the

perimeter of both landfill sections. At Sections 2/8 and 3/4, the leachate control system includes leachate recovery wells at the top, partial perimeter drains, and leachate collection pump stations located along the partial perimeter drains. The leachate recovery wells in these sections were installed to remove leachate directly from the landfill. Because closure cap construction in these landfill sections prevents recharge of liquid to the landfills, the leachate 'mounds' within these landfill sections drain after closure and over time the need to drain them using leachate recovery wells no longer exists. Collected leachate from all landfill sections is conveyed through header pipes and force mains to the Fresh Kills Landfill Leachate Treatment Plant (FKLLTP). The FKLLTP, which is located in the southwestern end of Section 1/9, treats the collected leachate and discharges the effluent into the Arthur Kill through a subaqueous outfall in accordance with a SPDES permit. The leachate mitigation program also included the development of a long-term monitoring plan. The system has been in operation for more than ten years and all monitoring data to date demonstrates that it is meeting or exceeding the original objectives and standards.

IV. GAS COLLECTION

The generation of landfill gas (LFG) is a natural process resulting from the decomposition of organic material in municipal solid waste. LFG is comprised mainly of methane, an explosive gas, and carbon dioxide, along with traces of other gases. Without controls, LFG will tend to migrate away from the Landfill within unsaturated soil layers, both vertically and horizontally. LFG also is a concern because of its odor and its effect on air quality—particularly the emission of methane, a "greenhouse gas" believed to contribute to global warming, and non-methane organic compounds (NMOC), which may be harmful to human health. Landfill gas at the Fresh Kills Landfill is managed both to control emissions of methane and NMOC and to prevent off-site migration of LFG.

During normal operating conditions, LFG is collected at the site through the active landfill gas collection system, which is composed of a network of LFG extraction wells and LFG transmission pipes. The collected gas is processed by either purification of the gas for use as fuel or flaring for thermal destruction of both methane and non-methane organic compounds. The flares serve as a backup to the processing plant in the event that field related problems occur or plant maintenance/repairs are needed. After active gas collection is no longer required, the active gas wells may be decommissioned and passive vents will be put into operation.

The LFG collection and control system is operated in compliance with the permit thresholds of the flare emission rates and with the Landfill MACT Rule (40 CFR 63, Subpart AAAA), under which a Startup, Shutdown, and Malfunction Plan (SSM) was established for the Fresh Kills Landfill Flares and Gas Processing Plant on 16 January 2004. This recent EPA regulation requires that emissions be minimized during SSM

events. In addition, data is collected routinely regarding the volume of landfill gas collected, the volume of leachate condensate managed, and the energy content and sulfur content of the landfill gas. Further, inspections of the landfill cover and LFG wellheads are conducted routinely to verify the performance of the system, and the cover system is monitored routinely for the presence of surface emissions of methane.

LFG migration is controlled through a system of perimeter LFG interceptor venting system (which is independent of LFG extraction system) and utility seals, which are used as a barrier to LFG migration through underground utility conduits. The LFG migration monitoring system at the site includes 62 LFG migration monitoring wells and 89 methane sensors to monitor for the occurrence of LFG migration.

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Memorandum

To:	Robert White and Sandy Collins, AKRF
From:	Dr. Andrew Bernick, AKRF
Date:	March 13, 2009
Re:	Fresh Kills Park: Wildlife Avoidance Response Analysis
cc:	Fresh Kill Park Team

INTRODUCTION AND PURPOSE

The approximately 2,200-acre Fresh Kills Park is a long-term project that will provide open space, recreational, and cultural facilities, and landscape enhancements at the former landfill sites. In addition, Fresh Kills Park will include park roads, footpaths, and bicycle and equestrian paths. The New York City Department of Parks and Recreation, as lead agency, issued the Draft Generic Environmental Impact Statement (DGEIS) for the Fresh Kills Park on May 16, 2008, and is in the process of preparing the Final Generic Environmental Impact Statement (FGEIS). As noted in Chapter 10 'Natural Resources' of the DGEIS, the Fresh Kills Landfill and surrounding area has substantial resource value in support of existing aquatic and terrestrial wildlife populations. The proposed Fresh Kills Park project would result in a substantial increase of human activity through use of multipurpose recreational trails (i.e., pedestrian activity, biking, equestrian activity) within Fresh Kills' habitat communities and vehicular activity (i.e., East Park roadways, internal access roads and bridges). Increased human activity within natural areas has the potential to result in impacts on wildlife populations through disturbance of life-sustaining activities such as breeding and foraging, direct mortality through road kill and other means. AKRF has prepared this memorandum in response to discussions with New York State Department of Environmental Conservation (NYSDEC) on January 30, 2009, and electronic communication with NYSDEC staff on February 3, 2009. These discussions concerned the expected human activities that would occur at the Fresh Kills Park (i.e., recreation, vehicular travel), and the likelihood that these activities would result in avoidance of existing or proposed habitats by wildlife that are currently using, or have the potential to use, existing habitats. The purpose of this memorandum is to provide a more detailed evaluation of the potential avoidance response of selected wildlife species that may be expected as a result of increased human presence at the proposed Fresh Kills Park. The results of this analysis will be incorporated within the Fresh Kills FGEIS.

METHODOLOGY

On the basis of input from NYSDEC's wildlife staff (Zahn 2009), and the existing habitats and wildlife known or with the potential to occur on and in the vicinity of the Fresh Kills Park project site, as described in the DGEIS (see Tables 10-7 [Birds], 10-8 [Mammals] and 10-9 [Reptiles and Amphibians]), AKRF developed a list of representative or 'model' species (see Table 1within this memorandum). The

species selected are representative of the large diversity of wildlife that occurs at the Fresh Kills Park project site. They include species that inhabit a range of habitat communities (woodlands, edge, freshwater ponds & swamps, estuarine creeks, etc.) and that exhibit a variety of foraging and behavioral patterns (nocturnal/diurnal activity, ground/aerial foragers, terrestrial/aquatic breeding, etc.). In example, the Eastern Wood-Pewee (*Contopus virens*) is a forest bird that prefers to nest in larger, contiguous woodland parcels. This species represents the general requirements of forest-breeding birds that are known to nest in woodland habitats within the proposed Fresh Kills Park area (i.e., wood thrush, red-eyed vireo, rose-breasted grosbeak).

Results of empirical studies conducted within or near the project area, or relevant studies performed in other geographic areas that relate to potential impacts of human activity (including recreation and vehicular transportation) and artificial lighting were summarized for the selected model species. Where empirical information was insufficient, a surrogate species with similar life history traits was used. On the basis of these empirical studies, and best professional judgment, AKRF developed definitions for key concepts (i.e. levels of human activity, human disturbance, and potential wildlife avoidance response) integral to the assessment of potential impacts to wildlife due to avoidance of habitats due to increased human activity, and developed a qualitative ranking system representing the level of potential avoidance response that might be expected from wildlife as a result of increased human activity within Fresh Kills Park (low, moderate and high response). The key concepts and ranked avoidance responses are defined in the following sections.

Finally, on the basis of life history information, empirical studies of species-specific impacts due to human activity and best professional judgment, the potential wildlife avoidance response was assessed for each model species. Resulting from this, recommendations were developed for management approaches to minimize wildlife impacts within the proposed Fresh Kills Park project.

HUMAN ACTIVITY, HUMAN DISTURBANCE AND POTENTIAL WILDLIFE AVOIDANCE RESPONSE

As noted in the DGEIS, based on the current low-levels of human presence that define existing conditions within the Fresh Kills Park project site, the increased human activity that would result from the proposed park project would be expected to have some effect on wildlife populations. The magnitude of potential adverse impacts due to human activity is dependent upon the extent of access afforded into contiguous areas of wildlife habitat by the construction of boat launches, trails, and roads. Any reduction in the ability for wildlife to move unimpaired from one habitat area to another, without mitigating measures, would result in some decline in suitability of habitat (Bissonette 2006). Noise, motion, and other aspects of pedestrian and non-motorized vehicle activity may directly elicit behavioral responses by wildlife. Other potential effects from increased human activity include indirect effects such as increased interspecific predation rates in proximity to trail edges (Miller et al. 2003), and direct effects such as mortality due to collision with non-motorized (i.e., kayaks, bicycles, horses) and motorized vehicles. As discussed previously, in order to assess the potential avoidance response and effect of human activity on wildlife, AKRF developed the following definitions for the level of human activity, human disturbance and potential wildlife avoidance response.,

Human Activity

Activities considered in this analysis include:

- Footpaths for passive recreation (walking, wildlife observation).
- Mulitpurpose trails, principally proposed around the base of the present landfill sections, for more active recreation (running, biking).
- Trails for mountain biking and horse riding (located in various habitats throughout the landfill).
- Roads and parking lots and associated lighting of location and from vehicles (East Park roads, parking lots in various locations of the proposed park).

- Boat traffic (principally non-motorized boat traffic, with motorized boat traffic assumed only present west of the West Shore Expressway Bridge).

Avoidance Response

Human disturbance has been defined by Frid and Dill (2002) as "deviation in an animal's behavior from patterns occurring without human influences" and by Liddle (1997) as activities that may alter a species behavior through awareness of human presence through passive contact (observation), habitat alteration that results in increased opportunity for human-wildlife interactions (creation of pathways) or direct or damaging contact with humans (fishing, and motorized and non-motorized vehicle collision). For the purposes of the assessment presented in this memorandum, human disturbance from the five human activities identified in the previous section were determined to have the potential to result in a wildlife avoidance response.

An avoidance response exhibited by wildlife is an escape behavior that occurs as the result of some type of negative stimuli (e.g., a bird fleeing a nest at the approach of a human on foot). The avoidance response elicited by a particular stimulus may vary depending upon how alert an organism is to human presence, the distance to adequate cover, and other factors. For the purposes of the assessment presented in this memorandum, avoidance response is used to describe the response of wildlife to specific types of increased human activity due to the Fresh Kills Park project.

Potential wildlife avoidance responses to human activity evaluated in this memorandum include the following:

- Individuals seek cover in habitat present immediately adjacent to the pathway, road or parking area;
- Individuals seek cover in habitat present within Fresh Kills park not in the immediate vicinity of pathway, road or parking area;
- Individuals seek cover in suitable habitats outside the Fresh Kills Park project site; and
- Individuals permanently move to suitable available habitat outside the Fresh Kills Park project site.

For the purposes of the analysis presented in this memorandum, avoidance responses are ranked as low, moderate and high. These levels are defined as:

- *Low* —A low potential for wildlife avoidance due to human activity; short-distance movements as a result of human disturbance or no reaction, high likelihood of habituation to human activity.
- *Moderate* —Moderate potential; longer-distance movements, or temporary relocation from the park area due to human activity, use of the site during periods of low human activity; a possibility for eventual habituation to human activity.
- *High* —High potential; human activity creates unsuitable conditions within the park, high likelihood of local extirpation from park boundaries; little to no possibility for habituation to human activity.

WILDLIFE AVOIDANCE RESPONSE ANALYSIS FOR MODEL SPECIES

For each model species listed in Table 1 to this memorandum, the analysis presents basic life history information, a synopsis of empirical studies of species-specific impacts due to human activity, and an assessment of the expected avoidance response within Fresh Kills as a result of the various levels of increased passive and active human activity that would occur within the proposed Fresh Kills Park.

BIRDS

Over 200 species of birds (see Table 10-7, Fresh Kills DGEIS for a comprehensive list) have been recorded at the Fresh Kills Park project site. They comprise species found in both aquatic and terrestrial systems throughout the year and are highly mobile. For the purpose of this analysis, nine model species were selected. Great Egrets and Great Blue Herons are wading birds that forage in freshwater, estuarine and occasionally terrestrial habitats. Great Egrets are most abundant from spring through late fall, and

have formerly used Isle of Meadows as a breeding site. Great Blue Herons are observed throughout the year, although they are not known to breed in the New York City area.

Several species of birds that require open grasslands for breeding and foraging are present, including raptors (Short-eared Owl, Northern Harrier) and passerines (Savannah Sparrow). Short-eared owls are not known to breed in the Fresh Kills Park project site, although they have been observed foraging between late fall and early spring. Northern Harrier has been confirmed as a breeder north of Fresh Kills and is present throughout the year. Savannah Sparrows have been confirmed as breeding birds on former landfill mounds and are also present during winter.

Two predators (Barn Owl and Peregrine Falcon) are also known to forage within open areas and forest edges at the Fresh Kills Park project site, although both are only known to nest on human structures; Peregrine Falcon on nearby bridges across the Arthur Kill and Barn Owl on interior bridges within the project site.

Lastly, two species of passerines represent birds that are common in edge habitats (Common Yellowthroat) and forest-interior habitats (Eastern Wood-Pewee).

For the purpose of the following analyses, it is important to note that few studies have confirmed whether the influence of recreational trails on bird communities is due to the physical presence of a trail, associated human activity on trails or both working in unison (Miller et al 1998). Life history information is from the Cornell Lab of Ornithology's Bird of North America series and Gough et al. (1998) unless otherwise noted.

Great Blue Heron (*Ardea herodias*)

The Great Blue Heron is an unlisted species in New York State. It is the largest heron in North America, and is largely piscivorous, but will also forage on amphibians, invertebrates, reptiles, mammals, and even other birds. Great Blue Herons are present in the New York City area throughout the year. They forage in freshwater, estuarine and terrestrial systems, and nest in tall trees that are near water, north and west of New York City. Islands and forested swamps are most often used as colony sites, but hillside tree canopies may also be used. Great Blue Herons are somewhat tolerant of human activity, and occasionally nest next to human dwellings. Reforestation and an increase in beaver-impounded streams has likely increased foraging and breeding habitat (McGowan and Corwin 2008).

Disturbance along footpaths, multipurpose trails and mountain biking and horse riding trails may occur along pathways adjacent to aquatic habitats. However, terrestrial trails and roadways would have a minimal impact on Great Blue Heron foraging activity.

The distance between human activity and wildlife is a major factor in determining if and when birds engage in an avoidance response as a result of disturbance (Fernández-Juricic and Tellería 2000). At foraging and loafing sites in Florida where waterbirds came into contact with motorized watercraft, buffer zones of 180 meters (591 feet) for wading birds, 140 meters (459 feet) for terns and gulls, 100 meters (328 feet) for plovers and sandpipers and 150 meters (492 feet) for ospreys were recommended to minimize disturbance (Rodgers and Schwikert 2002). In terms of aquatic recreation, only non-motorized watercraft would be permitted east of the West Shore Expressway Bridge. In these areas, where mudflats and soft shoreline areas are conducive to heron foraging, only short distance movements would be anticipated.

Avoidance response: Low (Foraging, "F"). Disturbance of foraging may occur as a result of boat traffic, but would likely be minimal if buffer zones are established. Short distance to long distance movements may occur as a result of human activity, but it would not be expected to result in lasting effects on Great Blue Heron foraging success.

Other species with similar habitat requirements or expected response: Black-crowned Night-Heron.

Great Egret (*Ardea alba*)

The Great Egret is an intermediate sized wading bird that is unlisted in New York State. In New York City, Great Egrets nest in maritime scrub-shrub thickets with shrubs, trees and vines on islands in estuarine habitats. Great Egrets formerly nested on island habitats in the Arthur Kill (through 2001 at Isle of Meadows within Fresh Kills). They forage primarily on estuarine and freshwater fish and some terrestrial vertebrates, and are routinely observed foraging in all areas of the project site and throughout the secondary study area from April to October, and rarely, as winter residents.

Wetland protection is critical to protection of populations of this species (Parnell et al. 1986).While many nesting areas are protected, coastal and inland foraging areas are not (McGowan and Corwin 2008).

As discussed for the Great Blue Heron, the distance between human activity and wildlife is a major factor in determining if and when birds engage in an avoidance response as a result of disturbance (Fernández-Juricic and Tellería 2000). Buffer zones of 180 meters (591 feet) for wading birds, 140 meters (459 feet) for terns and gulls, 100 meters (328 feet) for plovers and sandpipers and 150 meters (492 feet) for ospreys were recommended to minimize disturbance (Rodgers and Schwikert 2002).

Potential responses to human disturbance at breeding colonies of waterbirds include reproductive failure, population declines and displacement from activity areas (Skagen et al 2001). Disturbance along footpaths, multipurpose trails and mountain biking and horse trails may occur along pathways adjacent to aquatic habitats. However, terrestrial trails and roadways would have a minimal impact on Great Egret foraging activity.

Avoidance response: Moderate (Breeding, "B") / Low (F). If nesting commences on Isle of Meadows, the increase in motorized and non-motorized boat traffic that would occur within Fresh Kills Park could potentially influence nesting activity. For this reason, use of the island by boaters should be discouraged. Disturbance of foraging may occur as a result of boat traffic, but would likely be minimal if buffer zones are established. Short distance to long distance movements may occur as a result of human activity, but it would not be expected to result in lasting effects on Great Egret foraging success.

Other species with similar habitat requirements or expected response: Snowy Egret, Glossy Ibis, Green Heron, Clapper Rail

Short-eared Owl (*Asio flammeus*)

The Short-eared Owl is a New York State Endangered species that has been idenfied at Fresh Kills. This species is rapidly declining as a nesting species in New York (Andrle and Carroll 1988, Cooper 1998, Atlas 2000 data). Short-eared Owls were typically breeders in coastal Long Island and western and northern New York through 1985 (Bull 1974, Cooper 1998). Between 2000 and 2005, probable breeding evidence for this species was found at one site in Suffolk County, and no nesting was reported within New York City (Atlas 2000). They are a ground-nesting species that typically forage in relatively large open areas, such as grasslands, marshes, landfills, and airports. This species feeds primarily on small mammals throughout its range, particularly voles (*Microtus* spp.). Other mammals, such as rabbits, shrews, moles and several rodent species, are also known prey species. Norway rats (*Rattus norvegicus*), have been characterized as a rarely consumed prey species (Johnston 1956). Birds generally account for a small proportion of their diet; however, Short-eared Owls have been found to feed more often on birds in coastal than inland sites. The bird species consumed would be those occupying open grasslands and marshes where owls feed, such as shorebirds, tern and gull chicks, and passerines (Johnston 1956, Holt 1993).

The main conservation threat for Short-eared Owls is habitat loss and fragmentation. This species nests on the ground and requires fairly large open areas for foraging. Mammalian nest predators (i.e., Raccoon, Virginia opossum) prevalent in urban areas, may make nesting difficult in small, easily accessible grasslands. Mortality related to the bioaccumulation of pesticides in prey populations is likely to be low (Wiggins et al. 2006).

The minimum foraging area used by Short-eared Owls is sizeable (250 hectares (ha), 618 acres), and they tend to concentrate hunting activity in areas with little human disturbance (Martinez et al. 1998). Short-eared Owls will also forage in newly formed grassland habitats, such as reclaimed surface mines (Vukovich and Ritchison 2008). Within New York City, the habitats where Short-eared Owls are most often recorded include relatively undisturbed marshlands (Jamaica Bay) and closed landfills with low levels of human activity (e.g., Fountain and Pennsylvania Avenue landfills, and Edgemere Landfill). Any increase in human activity on footpaths, multipurpose trails, and mountain biking or horse riding trails would be expected to impact Short-eared Owl foraging within Fresh Kills Park if these activities occurred during peak foraging times at dawn and dusk. However, as their foraging style involves constant movement and hunting on the wing, it is unlikely that dispersal beyond short to moderate distances would occur if suitable habitat patches existed.

In terms of roadway impacts, mortality associated with vehicle collisions would be elevated due to their low-flying foraging behavior; this would make Short-eared Owls most susceptible to vehicular collisions at roadways that traverse open foraging areas (Idaho Fish and Game 2005). Noise associated with vehicular traffic, as well as lighting of roadways and vehicular lighting (Longcore and Rich 2001), may also cause this species to interrupt foraging activities and make short-distance movements to less active areas within Fresh Kills or long distance movements to adjacent habitats.

*Avoidance response:*Moderate (Foraging only). On the basis of current activity patterns and population size in New York State, breeding activity would not be expected at the Fresh Kills Park project site. Foraging occurs in relatively large patches relatively free from human activity. In the event that trail systems allow sizeable expanses of open meadow, shrubland and marsh habitats, avoidance of human activity would likely cause short-distance movements. Roadways could represent a substantial source of mortality for this species.

Other species with similar habitat requirements or expected response: N/A

Northern Harrier (*Circus cyaneus*)

The Northern Harrier is a medium-sized, low-flying raptor of upland grasslands and marshlands that breeds throughout North America, and is a New York State Threatened species. This species has exhibited declines in New York State over the past 40 years. No surrounding states or provinces have listed this species as threatened or endangered (McGowan and Corwin 2008). Northern Harrier feeds primarily on small mammals and birds throughout its range, and suitable foraging habitat for this species is prevalent within the Fresh Kills Park project site.

Northern Harrier populations are particularly susceptible to habitat loss, fragmentation and degradation. Habitat succession that results in a reduction of open habitat and unfavorable mowing regimes also restrict breeding habitat for harriers. At least one breeding record has been confirmed in marshes along the West Shore of Staten Island to the north of the Fresh Kills Park project site. Frequent observation of foraging adults at Fresh Kills during the breeding season suggests that nesting activity could be occurring within existing Fresh Kills grasslands. Northern Harriers will also forage in newly formed grassland habitats, such as reclaimed surface mines (Vukovich and Ritchison 2008). As they nest on the ground, harriers are susceptible to mammalian nest predation, particularly in smaller urban grassland patches.

For footpaths, multipurpose trails and mountain biking and horse riding trails, human disturbance would have more of an impact if trail systems were more prevalent within open habitats. In general, foraging Northern Harriers cover large areas, and would not likely be substantially disturbed by additional human activity if trails are placed in an arrangement that does not significantly reduce grassland patch size. Where trails bisect the landscape and human activity is concentrated, increased alert distances and frequency of flushing may be observed for this species (Fernández-Juricic et al. 2001). However, due to its highly mobile foraging habits, the relative abundance of Northern Harriers (as compared to Short-eared Owls) and substantial marshland and grassland foraging areas in the vicinity of the Fresh Kills Park project site, avoidance response to human activity would likely be low.

Roadway impacts are similar to those for Short-eared Owls, which also engage in low-flying foraging behavior making them susceptible to vehicular collisions at roadways that traverse open areas (Forman 2005). Noise associated with vehicular traffic would also likely cause harriers to shift foraging activities, either through short-distance movements to less active areas within the Fresh Kills Park project, or long distance movements to adjacent habitats. Increased noise levels on busy roadways would also likely inhibit reproductive activity for Northern Harriers. Road impacts on ecosystems vary considerably with the volume, speed, width and design (Iuell et al. 2003). Foreman and et al. (2002) indicated that grassland birds tend to avoid breeding near roads in direct proportion to road volume, and shifted breeding activities up to 1 kilometer away from the most active roads.

Avoidance response: High (B) / Low (F). For breeding, increased segmentation of nesting habitats for recreation, noise and presence of higher levels of human activity would increase the opportunity for nest disturbance; New York City nesting for this species is limited. A low avoidance response would be expected based on the prevalence of foraging habitat and population size in the Fresh Kills area.

Other species with similar habitat requirements or expected response: N/A

Savannah Sparrow (*Passerculus sandwichensis*)

The Savannah Sparrow is an unlisted species in New York State that breeds and forages in grasslands and open shrublands at the Fresh Kills Park project site. It is one of few grassland passerines that have been confirmed as a breeder at the project site. Savannah Sparrows are found in various open habitats throughout much of North America and construct nests low to the ground in grassland habitats. Adults that have previously bred generally return to the same territory to pair with the previous year's mate if they have survived (Wheelright and Mauck 1998). Of the grassland sparrows, this species is declining the least due to large population sizes and ability to use a variety of grassland and early successional habitats. Although the Savannah Sparrow population in New York State has been stable over the past 20 years (McGowan and Corwin 2008), its dependence on grassland habitats makes it a suitable model species for the assessment of human activity on grassland birds within the proposed Fresh Kills Park.

The North American Breeding Bird Survey has indicated that grassland-nesting birds had a higher proportion of declining species than any other suite of birds in North America (Peterjohn and Sauer 1999). Grassland breeding birds in North America have been generally declining over the past 50 years; this effect is largely attributable to direct effects of habitat loss and degradation, and indirect effects of brood parasitism by Brown-headed Cowbirds, which influence nest success of a variety of passerines (Patten et al. 2006).

The distance between human activity and wildlife is a major factor in determining if and when birds engage in an avoidance response as a result of disturbance (Fernández-Juricic and Tellería 2000). In general, flushing distances for Savannah Sparrows are short, as grasslands provide cover when trails are not placed in an arrangement that significantly reduces grassland patch size. Where trails bisect the landscape and human activity is concentrated, increased alert distances and frequency of flushing is observed (Fernández-Juricic et al. 2001).

In terms of fragmentation, in recreational landscapes where an increased number of trails bisect grassland habitats, habitat edges that lead to higher rates of predation may be produced. In a study of recreational trails through grassland ecosystems in Colorado, abundance of grassland bird species (i.e., Grasshopper Sparrow, Western Meadowlark) was significantly higher in core habitat than along trails (Miller et al. 1998). Nests were less likely to occur along trails, and there was a positive relationship between the distance from trails and nest survival. Predation rates were also higher for nests along trails than in core grassland habitats.

Additionally, grassland habitats with edges that include trees or shrubs may attract cowbirds (for perching to search for nests to parasitize) and nest predators (Common Grackle, Northern Mockingbird), resulting in impacts to grassland-specialist species (Patten et al. 2006). In general, many grassland species,

including Savannah Sparrow, have been shown to respond negatively to the presence of trees adjacent to nesting areas (Cunningham and Johnson 2006).

For roadways, increased noise levels associated with vehicle traffic may inhibit reproductive activity. Road impacts on ecosystems vary considerably with the traffic volume, speed, width and design (Iuell et al. 2003). Foreman and et al. (2002) indicated that grassland birds tended to avoid breeding near roads in direct proportion to road volume, and shifted breeding activities up to 1 kilometer (0.6 miles) away from the most active roads. It is likely that Savannah Sparrows would not conduct breeding activity immediately adjacent to roadways, although foraging activity would potentially occur in the vicinity or roadways and parking lots during less active periods for vehicle traffic.

Artificial lighting along roadways may result in a disruption of reproductive behavior and a potential for increased vehicle collision during low light periods. As discussed in the Fresh Kills FGEIS Chapter 10 "Natural Resources", artificial light along roadways or produced by vehicles, has an influence on wildlife behavior. Longcore and Rich (2004) define ecological light pollution as "artificial light that alters the natural patterns of light and dark in ecosystems." There is substantial evidence that lighting in natural systems may have an effect on bird foraging, reproduction and other processes.

In birds, some evidence suggests that artificial night lighting affects the choice of nest site. De Molenaar et al. *(*2000) investigated the effects of roadway lighting on black-tailed godwits (*Limosa l.limosa*) in wet grassland habitats, and found a lower density of nests up to 300 m away from more highly lit sites, and earlier-nesting birds selected nest sites farther from lighted areas. For songbirds, Blackwell et al. (2009) examined responses of Brown-headed Cowbirds and Mourning Doves to object approach (i.e., a ground-based vehicle) and vehicle lighting, and the potential influence on antipredator behaviors such as alertness and flight response. A rapid flight response was elicited from cowbirds when approached with a lighted, moving vehicle; Morning Doves showed early alertness to moving vehicles, though their flight response was delayed in comparison to cowbirds. Therefore, variation in bird behavior in response to vehicular lights may influence patterns of bird collisions with vehicles.

Placement of trails and roadways affects the value of grassland passerine habitat. Trail consolidation in certain portions of grassland bird breeding habitat would reduce fragmentation of larger blocks of grasslands and maintains less-disturbed areas for fragmentation-sensitive grassland species (Miller et al 1998). It would also serve to limit disturbance due to noise and active recreation (mountain biking, horse riding). Clustering trails within localized areas, rather than developing a network of trails on grassland patches for the Fresh Kills Park project, would be advantageous to grassland bird species such as Savannah Sparrows.

Avoidance response: Moderate. Human activity on substantial trail networks across the Fresh Kills Park project has the potential to result in a reduction in available breeding habitat, and increased predation and brood parasitism of ground nesting grassland birds. Noise associated with roadways may cause a reduction in quality nesting habitat for grassland passerines.

Other species with similar habitat requirements or expected response: Bobolink, Grasshopper Sparrow, Dickcissel

Peregrine Falcon (*Falco peregrinus*)

Peregrine Falcons are a New York State Endangered Species. In natural environments, they nest on ledges and small shallow caves on high cliff walls. In urban areas, Peregrine Falcons nest on man-made platforms, bridges and tall buildings. In the New York City area, courtship occurs in February and March, with egg laying in April and May. Peregrine falcons typically return to the same nest every year. Within the vicinity of the project site, peregrine falcons have been reported as nesting on the Outerbridge Crossing and the Goethals Bridge in past years. They typically forage in open habitats on birds, and take prey on the wing.

It is unlikely that any ground based activity on any trails, roadways or waterways would disturb Peregrine Falcon activities, as they are adapted to urban habitats.

Avoidance response: Low. Peregrine Falcons in the New York City area tend to nest on human-made structures and forage in highly urban habitats. They feed on the wing and most often bring prey to perches elevated off the ground. Peregrines rarely come into contact with recreation or roadways, although a small opportunity exists for collision with motor vehicles.

Other species with similar habitat requirements or expected response: Red-tailed Hawk, American Kestrel

Barn owl (*Tyto alba*)

The Barn Owl is unlisted in New York State. It is a medium sized owl that feeds in open habitats and woodlands and nests in cavities or man made structures. Barn Owls feed on a variety of small mammals, primarily rodents such as voles, but also arthropods, amphibians and birds. This species has been confirmed as a nester in Fresh Kills underneath several bridges with substantial traffic, suggesting that they are somewhat tolerant to human disturbance at nest sites under current levels of activity within Fresh Kills Landfill roads. Barn Owls are at the northern extent of their range New York State, and substantial populations are only present in the Long Island and New York City areas due to nest box placement on coastal marshes and islands. They are primarily active during nocturnal and crepuscular periods.

As Barn Owls are principally night foragers, presumably when most park activities are at a minimum, it is unlikely that human activity on footpaths, and multipurpose trails, and horse riding and mountain biking trails would interfere with foraging activity.

As noted above, artificial lighting along roadways may result in a disruption of reproductive behavior and a potential for increased vehicle collision during low light periods. Roadside collisions during crepuscular foraging periods may be an important source of mortality for Barn Owls (Longcore and Rich 2001) and other owl species.

Mortality resulting from vehicular collision and nest disturbance as a result of increased use of the proposed park roads and bridges, as well as artificial lighting, may create unsuitable conditions for this species. One mitigating measure that has been successful in Jamaica Bay is the placement of nest boxes in a variety of habitats.

Avoidance response: Moderate (B) / Low (F). Breeding underneath bridges that would be used as main park roads, forages during crepuscular and nocturnal periods outside of typical park activity.

Other species with similar habitat requirements or expected response: Cooper's Hawk, Great Horned Owl.

Eastern Wood-Pewee (*Contopus virens*)

The Eastern Wood-Pewee is unlisted in New York State. This species breeds in the mid- to high-canopy in woodland habitats, principally along woodland edges and open forests. This insectivorous species is prevalent in eastern deciduous woodlands, as well as coniferous woodlands in the southern part of its range. There is evidence that some forest interior birds breeding near forest edges experience poor nest success (Flaspohler et al. 2001). Eastern Wood-Pewees do not appear to be as susceptible to forest fragmentation as other forest interior species (Scarlet Tanager), and is more prevalent in Fresh Kills woodlands than forest interior species that require larger forest patches. Significant declines for this species have been recorded in New York State, possibly due to the maturation of open forest habitats, an increase in deer browsing in the mid-canopy where wood-pewees tend to forage or habitat alteration in their wintering range (McGowan and Corwin 2008).

In terms of direct impacts of human activity, use of footpaths, multipurpose trails or mountain biking and horse riding trails would not be expected to generate sufficient levels of noise in areas where wood-pewees would be present to cause more than a low level avoidance response. Additionally, few of these activities would result in mortality due to collision, as Eastern Wood-Pewees are arboreal nesters and foragers. However, the construction of trails through forest habitats may allow nest predators or brood parasites access into forest areas where Eastern Wood-Pewees nest.

The Eastern Wood-Pewee appears to be somewhat susceptible to brood parasitism by Brown-headed Cowbirds (*Molothrus ater*). In studies of deciduous forests, cowbirds are often attracted to nature trails and open corridors (Hickman 1990). Brood parasitism by Brown-headed Cowbirds and nest predation by other birds and mammals often increase in association with habitat edges and have the potential to change bird species diversity and composition within a forest patch (Ambuel and Temple 1983).

As noted for grassland birds, restricting trails to a limited area of a forest in certain portions of a forest benefits bird breeding habitat, as it reduces fragmentation of larger forest blocks and maintains less-disturbed areas for fragmentation-sensitive species (Miller et al 1998). Although this is not a specific requirement for Eastern-Wood Pewees, which nest in open forests and approaching edges, increased levels of fragmentation also may attract brood parasites and predators.

Miller et al. (1998) also discusses the effect that recreation may have on forest bird populations. In situations where increased nonconsumptive recreation leads to increased number of trails bisecting forest habitats, habitat edges that lead to higher rates of predation may be produced. In a study of recreational trails through forest ecosystems in Colorado, abundance of forest interior species (Western Wood-pewee, Solitary Vireo) was significantly higher in core habitat than along trails (Miller et al. 1998). Nests were less likely to occur along trails, and there was also a positive relationship between the distance from trails and nest survival. Predation of nests along trails was also higher than in core forest habitats.

In terms of roadway and parking lot impacts, Forman and Deblinger (2000) noted that within 650 meters (0.4 miles) of a busy four-lane highway, populations of forest-interior bird species are generally one-third lower than at greater distances. Decreases in breeding bird populations adjacent to roadways with high traffic volumes reported by Reijnen et al. (1995) and Reijnen and Thissen (1997) were attributed primarily to roadway noise, which may interfere with breeding activity (i.e., vocalization, etc.). For any roadways constructed through woodland areas where Eastern Wood-Pewees nest, it may be expected that individuals nesting in that area may move to adjacent forest patches where noise is reduced.

Avoidance response: Moderate. Declines throughout New York State have been observed for this species. Roadways in forested habitats may interfere with breeding activity through noise, and Brown-headed Cowbirds may be more likely to parasitize their nests when forest habitats are fragmented.

Other species with similar habitat requirements or expected response: Great Crested Flycatcher, *Empidonax* flycatchers, Red-eyed Vireo, Scarlet Tanager.

Common Yellowthroat (*Geothlypis trichas*)

The Common Yellowthroat is an unlisted species in New York State. It is a medium sized warbler that breeds and forages in marshes, thickets and shrublands. Common Yellowthroats are common in the Fresh Kills area during the breeding and migratory seasons. They may colonize areas following activities that alter habitat structure and create areas of thick growth, such as storm events that remove canopy trees.

In urban habitats, landscape-scale impacts (i.e., habitat loss, fragmentation) are an important determinant of bird species abundance, while local-scale impacts (i.e., disturbance through human and animal activity) has been shown to influence bird species richness (Schlesinger et al 2008). Additionally, human presence has been shown to reduce richness and abundance of birds (Fernandez-Juricic 2000).

In riparian areas, species richness declines with increasing land development, with settlement density being an important factor in determining habitat use by birds (Miller et al. 2003). Additionally, ground foragers and species that are generally tolerant of human activity were found to be most abundant along heavily used trail systems.

Disturbance along footpaths, multipurpose trails and mountain biking and horse riding trails would not be expected to cause serious disturbance for Common Yellowthroats, based on the dense cover available to them in breeding locations. It is likely that yellowthroats would flush short distances into edge habitats during disturbance.

Common Yellowthroats are susceptible to brood parasitism by Brown-headed Cowbirds. They will abandon or rebuild nests if they detect that eggs have been moved or replaced with cowbird eggs. The probability of both brood parasitism and nest predation has been shown to decrease as distance from a wooded edge increases, possibly due to a concentration of activity along habitat edges (Gates and Gysel 1978). Shrub-edge habitat is prevalent throughout Fresh Kills, and it is unlikely that additional edge resulting from increased trail creation in forested or open areas would compound this effect to the detriment of this species.

Burhans and Thompson (2006) found that abundances of seven bird species in urban landscapes, including Common Yellowthroat, were reduced according to landscape or housing density models, and brood parasitism was greater in the urban landscape compared to the rural landscape. Additionally, they found that nest success increased with nest height in urban shrublands.

As discussed for the Eastern Wood-Pewee, increased noise levels from roadways may inhibit reproductive activity due to its interference with bird communication during the breeding period (Reijnen et al. 1995, and Reijnen and Thissen 1997). There is also a possibility of mortality due to vehicular strikes during typical daytime activity, particularly if roadways were placed in areas of dense thickets. However, Common Yellowthroats have a substantial population within Fresh Kills in non-roadway areas, and any negative impacts associated with roadway activities would not likely result in adverse impacts to their occurrence within the project site.

Avoidance response: Low. In spite of brood parasitism by cowbirds, potential mortality due to vehicular traffic, Common Yellowthroats have substantial habitat within Fresh Kills in order to sustain life activities.

*Other species with similar habitat requirements or expected response:*Gray Catbird, Northern Cardinal, Yellow Warbler

MAMMALS:

Of the over 20 species of mammals observed or likely to be present at the Fresh Kills Park project site, three were selected as model species for this analysis. Meadow Voles are rodents common to open grassland areas, and population increases are generally observed for areas that undergo grassland restoration. Raccoons are common to terrestrial areas and forage along the terrestrial-aquatic interface in both freshwater and estuarine wetlands. White-tailed Deer, the largest wildlife species present at the Fresh Kills Park project site, occupy a variety of habitat types. This species has been confirmed as breeders on Isle of Meadows and is likely to reproduce within the project site.

Meadow Vole (*Microtus pennsylvanicus*)

The Meadow Vole is an unlisted species in New York State that breeds and forages primarily in grasslands and in woodland and marsh edge habitats. They are the most abundant vole in the state, and exhibit large population fluctuations (Braband 2000). Meadow Voles typically breed from March through November, constructing nests on the ground in dense areas of herbaceous or grassland cover, and may produce several broods per year. They tend to perform less well in habitats with low-cover than other vole species (Lin and Batzli 2001). They are a common rodent species at the Fresh Kills Park project site, and an important prey base for raptors foraging at the project site.

Foraging by meadow voles can place grasses and forbs that they find palatable under substantial foraging pressure—to levels observed for some ungulate populations. Meadow Vole foraging can also result in the growth of competing plants that are unpalatable to them, eventually creating non-ideal foraging environments for this species (Howe 2006). In general, vole populations may be more limited by a lack of winter food than by pressure from predators (Huitu et al. 2003). Vole populations may also forage heavily on on woody vegetation in early successional fields (Ostfeld et al. 1997).

The California Vole, a species with similar habitat requirements, does not appear to be heavily influenced by habitat fragmentation (Bolger et al. 1997). Some mammal species, including Meadow Voles, are able

to tolerate or increase in areas with increased development (Hansen et al. 2005). A similar trend is exhibited by Bank Voles in Italy (Ficetola et al. 2007). Use of footpaths and multipurpose trails would not likely result in significant disturbance to meadow voles, due to their relatively ground-based life history. Occasional vole mortality may be caused by road kills on mountain biking and horse riding trails, though this would likely represent rare events.

No clear evidence exists for the impacts of roads on Meadow Vole. Deer mice, another common and generalist species showed no clear disturbance effect in relationship to distance from a highway (Bissonnette 2006).

In general, rodents (an important prey item for raptors at Fresh Kills Park) may be influenced by artificial light. While it is possible that nocturnal-foraging birds may benefit from increased light to detect rodent prey, some rodents may also avoid lit areas. As noted in Bird et al. (2004), beach mice (*Peromyscus polionotus*) in Florida have been shown to alter foraging patterns within areas of beachfront exposed to certain types of long-wavelength lighting (specifically, low-pressure sodium vapor lights and incandescent yellow bug lights.) Compared with low-light areas, mice foraged within fewer patches near both types of artificial light and harvested fewer seeds within patches near bug lights. A similar pattern may be exhibited by voles, but further study would be needed to detect this pattern.

Avoidance response: Low. Meadow voles may experience some mortality when moving across roadways and mountain biking and horse riding trails, but they tend to remain undercover and likely have extremely large populations within grassland habitats in Fresh Kills.

Other species with similar habitat requirements or expected response: White-footed Mouse, Eastern Mole, Norway Rat.

Raccoon (*Procyon lotor*)

Raccoons are unlisted in New York State. They are an adaptable mammal that can live either in close proximity to humans or natural areas. While they prefer moist woodlands near a water source, they can colonize many kinds of habitats, including woodlands, grasslands, farms and suburban areas. Raccoons will use any type of cavity in which to breed and rest. They mate from February to June and have one litter per year. Raccoons are found throughout the Fresh Kills Park area.

The presence of humans and pets around homes and recreational areas can directly influence biodiversity, and human activity on trails near homes may displace some wildlife species (Hansen et al. 2005). Some wildlife species maintain populations or become more prevalent in urbanized areas with high levels of human activity (Markovchik-Nicholls et al. 2007). While suburban development negatively impacts some species, others (such as raccoons) are well suited to existence in human-dominated environments (DeStefano and DeGraaf 2003). This species is a common scavenger in human-dominated landscapes.

For footpaths, multipurpose trails, mountain biking and horse riding trails, it is unlikely that raccoons would be disturbed by recreational activity. Their activity pattern are generally nocturnal, any avoidance response would typically be low. For aquatic areas, raccoons forage along shorelines, and would not be expected to be impacted by human activities.

For roadways and parking lots, there is an opportunity for mortality due to vehicular collision, particularly during periods of seasonal activity. There is also a potential for vehicular lighting to disorient raccoons crossing roadways during night periods, which may result in increased vehicular collisions (Longcore and Rich 2004).

Avoidance response: Low – well adapted to human presence and typically resides. Some likelihood of mortality due to vehicular collisions

Other species with similar habitat requirements or expected response: Virginia Opossum

White-tailed Deer (*Odocoileus virginianus*)

White-tailed Deer are an unlisted species in New York State. They are year round residents of the Fresh Kills Park project site. They are typically crepuscular (most active at dawn and dusk) and feed on a variety of grasses, woody and herbaceous vegetation. The New York State breeding season is typically between October to January, with peak activity occurring in mid-November; fawns are usually produced in the late spring, are weaned by late summer/early fall, and may stay with female parents until after the first year (Stegemann 2002). They are generally more solitary during summer, and form larger groups during other seasons. White-tailed Deer use various habitats depending upon the season but often use the interface between forests and open areas. Hardwood and coniferous forests, grasslands and shrublands provide food resources and cover throughout they year. Although deer populations have been present on Staten Island for decades, an expanding breeding population appears to be present, leading to increased interactions between humans and deer (Newman 2008).

Stankowich (2008) presented a meta-analysis of artiodactyl (i.e., hoofed mammals with an even number of functional toes on each foot such as deer) escape responses due to human disturbance. Considerations for forming models of predicted ungulate escape behavior were presented, including variation in breeding status and body condition regulates wariness by season; whether human contact is typically lethal or non-lethal; species-specific life history traits; the availability of alternate resting and foraging sites; and the distance between feeding and resting sites. For White-tailed Deer, hunted populations were more wary than non-hunted populations, humans on foot created more disturbance than vehicles or noise; direct, rapid approaches resulted in longer-distance movement; hikers on predictable trails were less disturbing than off-trail hikers; and habituation in non-lethal situations was exhibited. George and Crooks (2006) observed no pattern of avoidance of human recreation by deer, although the probability of detecting deer during the day was lower as human recreation increased.

For footpaths and multipurpose trails, the directness with which one approaches would appear to influence a White-tailed Deer flight response, but it would not result in a long distance movement away from Fresh Kills Park. Taylor and Knight (2003) determined that there was no quantitative difference between wildlife response (in this case, for Mule Deer) between hiking activity and mountain biking; encounters between ungulates and horse riders was less clear and was identified as needing further investigation.

Because deer do not have the same level of avoidance response for vehicles as for people, roadways would be the principal disturbance factor for the Fresh Kills Park project. Therefore, mortality due to vehicle collision would be expected to increase for this species as a result of the Fresh Kills Park project. (Hansen et al. 2005). In the US, there are approximately 1.5 million deer–vehicle collisions, resulting in substantial financial losses and human injuries (Conover et al. 1995). Blackwell and Seamans (2009) suggest that habituation to vehicle traffic likely reduces the perception of threat to deer posed by vehicles.

Additionally, the crepuscular foraging habits of deer have lead to a higher incidence of deer-vehicle collisions during periods of low light. In terms of deer visual acuity and response when encountered with vehicle lighting at night, white-tailed deer have a varied response to different types of vehicular lighting (tungsten-halogen lights vs. high-intensity discharge lamps.) Tungsten-halogen lamps alone have been shown to elicit a later flight response (mean flight at 116 meters/380 feet) than a combination of both lighting types (mean flight at 132 meters/433 feet); flashing lights result in a delayed flight response (mean flight at 89 meters/292 feet). Thus, there are several factors that may regulate the incidence of vehicular collisions with deer during crepuscular or nighttime periods.

Avoidance response: Low. Deer are well adapted to suburban and park habitats similar to what is proposed as Fresh Kills Park. They have become habituated to suburban environments on Staten Island where hunting, if any, is limited. The main source of mortality is collision with vehicles, which may increase with the presence of roadways. While foot traffic elicits a greater response than vehicular traffic or noise, the avoidance response would not result in adverse impacts to this species within Fresh Kills Park.

Other species with similar habitat requirements or expected response: N/A

Indiana Bat (*Myotis sodalis*)

The Indiana bat is a New York State and Federally endangered species that, in the Fresh Kills Park project site and vicinity, would be expected to forage along forest edges and canopies (USFWS 2006). As they hibernate in caves and mines, this species would not be expected to occur at the Fresh Kills Park project site during the winter period. In New York, approximately 13,000 Indiana bats are known to exist in eight caves.

As noted in Stegemann and Hicks (2008), New York State is populated by nine bat species, including six species of cave bats (northern, Indiana, big brown, little brown and small footed bats and eastern pipistrelle) summer in various forest and open habitats, roost in man-made or natural structures and hibernate colonially in winter in caves or mines; and three species of tree bats (red, hoary and silver-haired) that live throughout the year in trees and migrate south in winter. The range of Indiana bats is not well understood in New York State.

For footpaths, multipurpose trails, and mountain biking and horse riding; it is unlikely that Indiana bats would come into contact with human activities. Females gather in nursery colonies that contain from 50-100 individuals and find shelter under the loose bark of dead trees. Wintering habitat is limited to Upstate New York caves.

Areas of Fresh Kills Park where artificial lighting will be present may result in enhanced foraging habitat for bats, as many bat species are attracted to insects that congregate around light sources (Frank 1988). However, increased insect abundance only benefits bat species that exploit light sources; faster-flying species of bats congregate around lights to feed on insects, whereas slower-flying species and those the prefer to forage in forest cover (such as Indiana Bats) tend to avoid lights (Blake et al. 1994). There can also be negative consequences resulting from artificial lighting. Boldogh et al (2007) found that bright artificial lighting at bat breeding locations delayed the onset bat emergence, occasionally caused entire colonies to relocate and appeared to negatively influence juvenile growth rate for bats that bred in human-constructed habitats.

Avoidance response: More study needed (B) */Low (F). Foraging occurs on the wing, making it unlikely that Indiana Bat would come into contact with human activities; foraging activity may be altered in areas where artificial lighting is apparent, such as along roadways. Their breeding habitat in Fresh Kills woodlands would require additional study.

Other species with similar habitat requirements or expected response: Big Brown and Little Brown Bat, Eastern Pipistrelle; for foraging/migrating species, Red, Hoary and Silver-haired Bats

REPTILES AND AMPHIBIANS:

Reptiles and amphibians (see Table 10-9, Fresh Kills DGEIS for a comprehensive list) present at the Fresh Kills Park project site are found in both estuarine and freshwater systems, and several species require movement beyond aquatic areas to terrestrial grounds for breeding or juvenile dispersal to adjacent sites. For the purpose of this analysis, four model species were selected. Diamondback Terrapins are unique in that they are one of the few turtles in New York State that use estuarine waters (with sea turtles potentially using Arthur Kill and Raritan Bay). Eastern Box Turtle represents predominantly terrestrial reptiles that disperse across trails and roadways to move between critical habitats during the course of the year. Painted Turtle represents reptiles that reside freshwater habitats for much of the year and emerge to deposit eggs in surrounding terrestrial areas. Southern Leopard Frogs, known to be present north of the Fresh Kills Park project site, represent amphibians that breed, forage and overwinter within freshwater ponds and emerge to disperse to adjacent freshwater areas.

Reptiles and amphibians are particularly susceptible to impacts associated with habitat fragmentation and alteration in terrestrial areas, as both terrestrial and aquatic species move to various microhabitats throughout the year for various life activities (breeding, dispersal). Roadways and high curb cuts, for

instance, can function as barriers to movement and either restrict reptiles and amphibians to small home ranges or serve as substantial sources of mortality when these relatively slow moving organisms attempt to cross moderately active (bike trails) to highly active (vehicular roads) areas.

Diamondback Terrapin (*Malaclemys terrapin*)

Diamondback Terrapins are a medium-sized turtle that resides in estuarine and salt marsh habitats and feeds on crabs, periwinkles and other marine invertebrates (Gibbs et al 2007). They are unprotected in New York State, and licensed takes are permitted for this species. In New York, terrapin populations are located mainly in Long Island, Staten Island, and the lower Hudson River north to Rockland, Putnam, and Orange Counties (Feinberg and Burke 2003). Terrapins hibernate in creek banks and typically nest from April through July. Nesting activity occurs during daylight hours or at night. Females prefer to nest in sandy soils with sparse vegetation, although they will nest in a variety of near-shore terrestrial habitats (Roosenburg 1994). Hatching generally peaks in September, though some eggs hatch in the following spring (Gibbs et al. 2007). In the non-breeding season, terrapins are largely diurnal. Population threats include development in wetland and shoreline habitats, harvesting and by-catch, and predation (i.e., raccoons) (Feinberg and Burke 2003, Burke et al. 2005). Diamondback Terrapins have been observed in Main Creek within the Fresh Kills Park project site (FGEIS 2008).

Disturbance to Diamondback Terrapin due to human activity along footpaths, multipurpose trails and mountain biking and horse riding trails would be restricted to pathways along estuarine and salt marsh shorelines, where terrapin movement is concentrated for egg laying. The Fresh Kills Park project has the potential to result in indirect impacts to Diamondback Terrapin due to increased raccoon predation.

Roadway and parking lot impacts would be possible for near-shore areas where Diamondback Terrapins would emerge for egg-laying. Roadways and parking lots that bisect suitable terrapin breeding habitat at Fresh Kills Park would be likely areas for road kills. However, any sections of roadway above grade (i.e., elevated roads supported on piers) would not be expected to result in terrapin road kills. Artificial street lighting has been shown to disorient sea turtle hatchlings near beaches (Salmon et al. 1995). It is unlikely that artificial lighting would have a substantial impact on diamondback terrapins, as they often lay eggs during the day. However, terrapins that nest during crepuscular or night periods may be at risk for disorientation due to artificial lighting along roadways and vehicular collisions.

In terms of aquatic recreation, only non-motorized watercraft would be permitted east of the West Shore Expressway Bridge. In these areas, where mudflats and soft shoreline areas are conducive to turtle nesting, it is unlikely that non-motorized watercraft would represent an important source of disturbance. Terrapins appear to be wary when approaching the shoreline for nesting activity, and any disturbance or mortality associated with motorized or non-motorized boat traffic is likely to be low.

Avoidance response: Low. Human interactions with terrapins for park activities are likely to be low, due and the absence of footpaths, trails or roads along the shoreline in the sensitive habitats and a minimum number of shore perpendicular trails (only for public access to the water for recreational purposes) that would allow for minimal human-turtle interactions.

Other species with similar habitat requirements or expected response: Sea turtles are rarely sighted within Raritan Bay and the Arthur Kill, though their presence within Fresh Kills is not known.

Eastern Box Turtle (*Terrapene carolina*)

The Eastern Box Turtle is a New York State Special Concern Species. It is found mostly in terrestrial areas on or near moist soils. This species will remain in a small home range if conditions are stable. Nesting occurs in June, with hatching in September and October. Hibernation within the soil lasts from October to May.

For impacts of recreation, the presence of footpaths, multipurpose trails and mountain biking trails in proximity to Eastern Box Turtle habitats, sources of impacts may include direct contact (collection or accidental trampling by pedestrians or pets), and barriers to movement across paths. During dispersal,

amphibians and reptiles may avoid crossing paths where human activity is high, which is likely for Eastern Box Turtle as they are strictly diurnal (Gibbs et al. 2007).

Trails that would exhibit high use by mountain biking and horse riding have the potential to result in loss of individuals due to collisions. Road kills of Eastern Box Turtle during dispersal between habitats is an important source of mortality (Bissonette 2006). For road arrangements that are situated between breeding ponds and required upland habitats, the lack of safe passage between the two may result in mortality during seasonal movements. Efforts to create passageways under or around roadways in such areas are one way to minimize the potential for such mortality, as is the closure of roadways during peak activity. Avoidance of road arrangements that bisect turtle breeding habitats, or using advantageous roadway structures (roadways without curbs adjacent to wetland areas) may be more desirable techniques.

Avoidance response: Moderate. Vehicular collisions for dispersing Eastern Box Turtles are a potential significant source of mortality. Impact avoidance techniques are discussed below and are also presented in Chapter 23 of the FGEIS "Impact Avoidance and Mitigation Measures."

Other species with similar habitat requirements or expected response: N/A

Painted Turtle (*Chrysemys picta*)

Painted turtles are unlisted in New York State. They are a common turtle species present in most freshwater ponds and swamps within the state, although they prefer shallow open water habitats. Painted Turtles are active between March and November and spend winter in hibernacula, such as muskrat lodges (Gibbs et al 2007). Most land movements are conducted by females searching for nesting habitat, although males may travel from dried up wetlands to nearby open water areas. Mating occurs between March and June, and nesting in June and July. Young generally hatch in August and September but may overwinter in the nest.

Although habitat alteration is a major factor in turtle population declines, human recreation can also be detrimental (Bowen and Janzen 2008). Female Painted Turtles may alter nest-site selection due to human activity and perceived risk of mortality. Poor site selection resulting from human activity in an area can affect the probability of nest depredation through nest density and edge effects, and may also affect offspring survival through temperature-related incubation or overwintering success, as well as offspring sex ratio in turtles with temperature-dependent sex determination (Bowen and Janzen 2008).

For impacts of recreation, the presence of footpaths, multipurpose trails and mountain biking trails in proximity to Painted Turtle habitats, sources of impacts may include direct contact (collection or accidental trampling by pedestrians or pets), barriers to movement across paths and altered nest site selection due to encounters. During dispersal, amphibians and reptiles may avoid crossing paths where human activity is high, which is likely for Painted Turtle females which disperse during the day to nest (Gibbs et al. 2007).

Trails that exhibit high use for mountain biking and horse riding have the potential to result in loss of individuals due to collisions. As discussed for the Eastern Box Turtles, road kills of Painted Turtles dispersing between habitats is an important source of mortality (Bissonette 2006). Where roads are situated between breeding ponds and required upland habitats, the lack of safe passage between the two may result in mortality during seasonal movements. Efforts to create passageways under or around roadways in such areas are one way to minimize the potential for such mortality, as is the closure of roadways during peak activity. Avoidance of road arrangements that bisect turtle breeding habitats, or using advantageous roadway structures (low curb heights adjacent to wetland areas) may be more desirable techniques.

Avoidance response: Moderate. Although tolerant to polluted pond habitats, human disturbance may cause females to alter nest site selection to suboptimal sites. Additionally, vehicular collisions for dispersing turtles may also be a potential source of mortality. Impact avoidance techniques are discussed below and are also presented in Chapter 23 of the FGEIS "Impact Avoidance and Mitigation Measures."

Other species with similar habitat requirements or expected response: Snapping Turtle, Red-eared Slider (introduced), Eastern Mud Turtle

Southern Leopard Frog (*Rana sphenocephala*)

The Southern Leopard Frog is a New York State Special Concern species that breeds and forages in freshwater ponds and swamps and associated upland areas. New York represents the northern terminus of the species' range and distribution of this species is restricted to sites in Long Island, Putnam County and Staten Island (NYNHP 2008).In general, amphibians require sufficient terrestrial habitat for feeding, overwintering, and connectivity among ponds to sustain viable populations (Boone et al. 2008). In terms of life history, leopard frogs require three habitats for survival: a breeding pond used in the spring by the adults and through summer by the tadpoles, meadows or fields for feeding in summer, and a stream or lake or pond for overwintering (Pope et al. 2000). In New York State, local declines of Southern Leopard Frog may be due to high pH conditions in ponds as a result of acid deposition (Gibbs et al. 2005). Local declines of Northern Leopard Frogs, a species with habitat requirement similar to the Southern Leopard Frog, have been recorded across North America, the assumption being that availability and quality of breeding ponds is the dominant factor in regulating population size. Amphibian declines have been correlated with breeding habitat destruction or unsuitability due to disturbance (poor water quality, presence of introduced species, etc.). Also, patterns of mortality linked to outbreaks of some ranaviruses have been shown to occur in areas disturbed by human activities, including habitat destruction and alteration (Carey 2000).

The potential for recolonization of suitable habitats requires a review of the constraints on a landscape scale, beyond examining available breeding ponds alone (Pope et al. 2000). Population viability is dependent upon management of breeding (i.e, ponds) and nonbreeding (i.e., terrestrial) habitats. For example, when forest habitat surrounding ponds with low densities of Northern Leopard Frog was converted back to grasslands, densities for this species increased (Pope et al. 2000).

Conditions within some retention ponds within Fresh Kills Park project site are likely to be poor for amphibian populations, although several amphibian species have been noted at such ponds within the project site (e.g., Spring Peeper, Green Frog and American Bullfrog). Southern Leopard Frogs have been observed in freshwater ponds in the vicinity of Fresh Kills Park (i.e., ponds surrounding a Con Edison plant and the former GATX facility to the north of the site), suggesting that areas with former industrial uses may be suitable for this species. Additionally, Fresh Kills has several forested wetlands that may be suitable for Southern Leopard Frog breeding.

Aquatic environments may be made suitable for use by local native amphibian species (such as leopard frogs) if they are managed in a way that promotes diversity (i.e., creating conditions unfavorable for predatory species). In highly managed habitats amphibian breeding ponds, such as those at golf courses and other disturbed areas, the presence of chemical contaminants and pesticides (even at sublethal levels, see Relyea and Diecks 2008) in permanent ponds that support bullfrog populations, fish and predatory insect populations may result in the reduction or elimination of other amphibian species. When bullfrogs were experimentally removed from such habitats, there appeared to be increases in native amphibian populations (Boone et al. 2008). This suggests that careful management of some pond habitats in proximity to grasslands may result in suitable Southern Leopard Frog habitat.

For impacts of recreation, the presence of footpaths, multipurpose trails and mountain biking trails in proximity to Southern Leopard Frog habitats, sources of impacts may include direct contact (collection or accidental trampling by pedestrians or pets), barriers to movement across paths and flight response due to encounters. During dispersal, amphibians may avoid crossing paths where human activity is high, although this may not be a routine event as amphibian dispersal events often occur during crepuscular or nocturnal periods when park activity would be low (Gibbs et al. 2007).

In terms of trails that would exhibit high use by horse riding and domesticated animals, the effects of nitrogen input may create difficult conditions for survival of native amphibian populations. In Knutson et al. (2004), input of high levels of nitrogen (from livestock waste) and turbidity caused by livestock

disturbance lead to poor water quality, low oxygen concentrations, and an overall poor environment for amphibian eggs and tadpoles of northern leopard frogs, pickerel frogs and other species. Similar trends may occur for breeding ponds in proximity to horse riding trails where runoff from trails is directed into breeding ponds.

In terms of vehicular roadways, it has been well established that road kills of amphibians dispersing between habitats are an important source of mortality (Bissonette 2006). Additionally, artificial lighting in freshwater wetland areas may have an influence on frog reproduction, movement and foraging. Baker and Richardson (2006) found that Green Frogs exposed to artificial light gave fewer advertisement calls and moved more frequently than under ambient light conditions; this result indicates that population dynamics can be affected by exposure to artificial light. While insectivorous frogs may also benefit from insects gathering under artificial light (Longcore and Rich 2006), this may also result in an increased opportunity for vehicle collision.

For road arrangements that are situated between breeding ponds and required upland habitats, the lack of safe passage between the two may result in mortality during seasonal movements. Efforts to create passageways under or around roadways in such areas are one way to minimize the potential for such mortality, as is the closure of roadways during peak activity. Avoidance of road arrangements that bisect amphibian breeding habitats, or using advantageous roadway structures (low curb heights adjacent to wetland areas) may be more desirable techniques.

Avoidance response: Moderate. Limited habitat exists for Southern Leopard Frog within Fresh Kills, in the southerly ponds of East Park. Therefore, any segmentation of critical habitat by project roads is a consideration in this analysis with respect to mortality, unless mitigating measures are taken. Impact avoidance techniques are discussed below and are also presented in Chapter 23 of the FGEIS "Impact Avoidance and Mitigation Measures."

Other species with similar habitat requirements or expected response: Spring Peeper, Green Frog, American Bullfrog, various salamander species.

DISCUSSION AND RECOMMENDATIONS

As noted above, wildlife avoidance response to human activity within the proposed Fresh Kills Park is expected to be complex and varied, as the species occupy a wide range of ecological niches and would be exposed to various levels of human activity.

However, some basic themes emerged from the analysis, and can be applied to the development of recreational and transportation elements proposed for the Fresh Kills Park project:

- Some species, such as Common Yellowthroat and Raccoon, would likely benefit by segmentation created by trail systems in forest and open habitats; based on proximity to cover and behavioral adaptations, they are also least likely to be negatively affected by human activities.
- Species that require forested habitats, such as Eastern Wood-Pewee, would be impacted by habitat fragmentation and the increased potential for brood parasitism and predation resulting from placement of trails within forested areas. While forest resources within the Fresh Kills Park project site are modest in terms of statewide forested habitat and may not support large populations of forest interior species, within New York City they represent important breeding habitat for these species.
- Grassland species, including Northern Harrier and Savannah Sparrow, could also be impacted by habitat fragmentation caused by extensive trail systems and subsequent human use.
- Roadways for vehicular traffic have the potential to be most damaging to reptile and amphibian populations either currently inhabiting Fresh Kills, or that would be likely to colonize the site under future conditions. They also may cause an increase in mortality to bird and mammal species through road kill.

The DGEIS provided several mitigation measures to reduce wildlife avoidance responses, local extirpation or mortality. These include the following:

- A protection plan would be prepared for each portion of the park under development that identifies trees, sensitive plant communities such as wetlands, and any other plant communities that have been identified for retention throughout the development of the proposed project, and establish a protection zone around these resources to minimize the potential for adverse impacts.
- In areas where habitat is to be created as part of the overall park design, trails would be designed to avoid hydrological systems, avoid existing natural habitats or include a vegetated buffer when they are placed within an existing natural area.
- Incorporating measures to mitigate potential impairments to wildlife movement through road construction by incorporating wildlife underpass features into culverts constructed under the park roads to maintain stormwater drainage and flow patterns, or separate wildlife underpass features where feasible.
- Using viaducts where feasible to minimize impairment of wildlife movement under roadways.
- Incorporating wildlife crossing warnings into roadway signage.
- Monitoring wildlife/vehicle collisions to identify the need for additional measures (e.g., speed reduction) to minimize wildlife losses and adverse effects to motorist safety due to collisions.
- Using vegetation that does not attract wildlife in roadside landscaping and keeping vegetation adjacent to the road low to provide wildlife with unobstructed view of oncoming traffic.
- Establishing vegetation screens along roadway to reduce traffic noise in certain landscape enhancement areas.
- Reduce the number of trails, trail density, or intersections within certain portions of the park while still maintaining access for adequate levels of recreation.
- Modify habitat structure along trails to allow for wildlife access to nearby cover, effectively increasing tolerance of wildlife to human presence (Fernandez-Juricic et al. 2001).
- Most proposed construction activities occurring above mean high water would not be expected to adversely affect Diamondback Terrapins or their use of the tidal wetlands and adjacent upland areas along Main Creek within the project site. In order to avoid the potential for adverse impacts to Diamondback Terrapins, a barrier should be established around any areas of disturbance in the vicinity of estuarine creeks prior to the start of breeding period, which can start as early as mid-May in the New York City area. This barrier could consist of a firmly established silt fence with hay bales placed against the inner edge of the fence. The location of the barrier will be established in consultation with NYSDEC.

Additional mitigation that could be applied in Fresh Kills Park to reduce the extent of human-wildlife interaction includes the following:

- In terms of vehicular roadways, it has been well established that road kills of reptiles and amphibians dispersing between habitats are a significant source of mortality (Bissonette 2006). For road arrangements that are situated between breeding ponds and required upland habitats (e.g., the two stormwater management ponds, Basins C1 and C2, near the confluence of Main Creek and Richmond Creek that may be separated from portions of the East Park by a park drive), the lack of safe passage between the two may result in mortality during seasonal movements. Reptile and amphibian mortality may be reduced by (1) creating passageways under or around roadways to allow for safe movement; (2) closure of roadways during peak activity periods; and (3) avoidance of road arrangements that bisect breeding habitats for reptiles and amphibians.
- Incorporating additional measures into roadways to reduce mortality of wildlife that have the potential to move across roadways during seasonal dispersal. For example, with seasonal pool breeding reptile

and amphibian species, storm drains along roadways with high curbs may serve as traps for dispersing reptiles, amphibians and other wildlife. Roadways and high curb cuts, for instance, can function as barriers to movement and either restrict reptiles and amphibians to small home ranges or serve as substantial sources of mortality when these relatively slow moving organisms attempt to cross moderately active (bike trails) to highly active (vehicular roads) areas. The use of low sloping curbs allow for easier movement across road surfaces and reduced mortality, as discussed in Calhoun and Klemens (2002) and Calhoun and deMaynadier (2004).

- In order to minimize human disturbance of wildlife that uses grassland habitat, trails should be placed in an arrangement that does not significantly reduce grassland patch size. Trail consolidation in certain portions of grassland habitat would reduce fragmentation of larger blocks of grasslands and maintain less-disturbed areas for fragmentation-sensitive grassland species (Miller et al 1998). Clustering trails within localized areas, rather than developing a network of trails on grassland patches for the Fresh Kills Park project, would be advantageous to grassland bird species such as Short-eared Owl, Northern Harrier and Savannah Sparrow.
- Similar trail clustering should also occur in forested habitats, to reduce fragmentation and potential for increased brood parasitism on forest-dwelling species.
- At foraging and loafing sites where waterbirds come into contact with motorized watercraft, buffer zones of 180 meters (591 feet) for wading birds, 140 meters (459 feet) for terns and gulls, 100 meters (328 feet) for plovers and sandpipers and 150 meters (492 feet) for ospreys have been recommended to minimize disturbance (Rodgers and Schwikert 2002).
- As nesting may commence on Isle of Meadows, use of the island by park visitors or boaters should be prohibited. Disturbance of foraging may occur as a result of boat traffic, but would likely be minimal if buffer zones are established.
- To further minimize waterbird impacts, only non-motorized watercraft should be permitted east of the West Shore Expressway Bridge and motorized watercraft should be restricted by at least 75 meters (246 feet) from the shoreline of Isle of Meadows, a former colonial waterbird nesting colony that still has suitable nesting habitat present.
- Human activity along any proposed shoreline footpaths, multipurpose trails and mountain biking and horse riding trails may disturb wildlife that uses the terrestrial-estuarine interface (i.e., Diamondback Terrapin nesting, waterbird foraging etc.). A setback distance of 100 feet for pathways that run parallel to shoreline areas would be recommended along estuarine and salt marsh shorelines.
- Barn Owls are known to nest under the bridges that cross Fresh Kills within the proposed Fresh Kills Park. In order to minimize pedestrian disturbance of Barn Owl nesting, trails should be set back at least 50 feet from the known nest locations and screening vegetation or structure should be in place.
- Barn Owls are known to successfully colonize nest boxes in the Jamaica Bay area, which appears to have the largest density of nesting Barn Owls in New York State. The expansive grassland and saltmarsh habitats of Fresh Kills Park make this an ideal location for Barn Owl nest boxes. Nest boxes should be placed prior to any interior bridge construction (to offer a nesting cavity in the event that presently nesting Barn Owls are displaced by construction activity), and should be placed in areas away from human activity and with a reduced likelihood of nest predation. If successful, other nest box programs (for swallows, American Kestrel, Eastern Bluebird) would greatly increase the habitat value of the park both prior to and following park development.
- Implement management measures to reduce wildlife behavioral reactions to human recreation and disturbance. These may include restricting off trail movements of humans, prohibit dogs from critical areas, partition the landscape into recreation zones to allow certain human activities in some areas but ban them in others, and educate visitors about how their actions influence wildlife (Stankowich 2008).

- Multilingual signage should be placed throughout the proposed Fresh Kills Park on the subject of harassment or collection of plants or animals.
- If recreational footpaths, multipurpose trails and mountain biking and horse trails and vehicular activity at Fresh Kills Park results in a broad reduction in the park's ecological and resource value, then the potential natural resources value and one of the purposes of establishing the park designed on ecological principles and dedicated to restoration may not be attainable. Currently, park elements are being planned for perimeter areas of Fresh Kills (North Park, South Park). One strategy to mitigate wildlife disturbance would be to limit access to core areas of the park (Klein et al. 1995). Rather than developing trail systems that fragments the entire landscape, trails would be restricted to previous roadways (internal landfill roads, etc) or to limited areas of the park. Access to interior park areas, such as former mounds, could be restricted to special programs that would allow for controlled access to natural areas. This would minimize human impacts and maximize resource value.

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Table 1

Potential For Wildlife Avoidance Due To Human Activity Within The Proposed Fresh Kills Park

SPECIES OF INTEREST	NY STATE/FEDERAL STATUS	HABITAT	POTENTIAL AVOIDANCE RESPONSE AS A RESULT OF HUMAN PRESENCE	SOURCES
Reptiles and amphibians				
Diamondback Terrapin	NY Unlisted, Licensed Take Permitted	Feed in estuarine waterbodies, breed in near-shore terrestrial areas.	Low	2, 14, 18, 19, 22, 35, 55, 66
Eastern Box Turtle	NY Special Concern	Breed/feed in woodlands, grasslands and swamps.	Moderate*	2, 14, 15, 19, 22, 23, 35, 55, 66
Southern Leopard Frog	NY Special Concern	Breed/feed in freshwater ponds and swamps.	Moderate	1, 2,5, 6,7,9, 12,13, 14,17,19, 22, 25, 33, 34, 35, 46,47, 54, 55, 66
Painted Turtle	NY Unlisted	Feed in freshwater ponds and swamps, breed in near-shore terrestrial areas.	Moderate	2, 14, 19, 22, 23, 35, 55, 66
Birds				
Peregrine Falcon	NY Endangered	Breed on human-created structures, feeds in open grasslands/shrublands.	Low*	3, 10, 14, 19, 22, 35, 40, 41, 56, 66
Short-eared Owl	NY Endangered	Feed in open grasslands/shrublands. Do not breed in NYC.	Moderate (F)	3, 10, 14, 19, 21, 22, 27, 35, 38, 39, 40, 41, 42, 56, 62, 66, 67
Barn Owl	NY Unlisted	Breed in/on human structures, feed in open habitats.	Moderate (B) / Low (F)	3, 10, 14, 19, 21, 22, 35, 39, 40, 41, 42, 56, 66
Northern Harrier	NY Threatened	Breed/feed in grasslands/open shrublands.	High (B) / Low (F)	3, 10, 14, 19, 21, 22, 30, 35, 39, 40, 41, 42, 56, 62, 66, 67
Great Egret	Unlisted	Island breeder, forages in freshwater, estuarine and terrestrial habitats.	Moderate (B) / Low (F)	14, 19, 22, 32, 35, 41, 51, 58, 61, 66
Great Blue Heron	Unlisted	Feed in freshwater, estuarine and terrestrial habitats. Do not breed in NYC.	Low (F)	14, 19, 22, 32, 35, 41, 51, 58, 61, 66
Savannah Sparrow	Unlisted	Breed/feed in grasslands/open shrublands.	Moderate	8, 10, 14, 19, 22, 30, 35, 39, 40, 41, 42, 44, 45, 56, 63, 64, 66, 67
Eastern Wood-pewee	Unlisted	Breed/feed in woodland interior areas.	Moderate*	11, 14, 16, 19, 20, 22, 27, 31, 35, 39, 40, 41, 48, 49, 50, 52, 56, 65, 66
Common Yellowthroat	Unlisted	Breed/feed in woodland edges, shrubland and marsh habitats.	Low*	8, 11, 14, 19, 22, 35, 39, 40, 41, 42, 45, 50, 56, 66

Table 1 (cont'd)

Potential For Wildlife Avoidance Due To Human Activity Within The Proposed Fresh Kills Park

SPECIES OF INTEREST	NEW YORK STATE/ FEDERAL STATUS	HABITAT	POTENTIAL AVOIDANCE RESPONSE TO HUMAN PRESENCE	SOURCES
Mammals				
Meadow Vole	Unlisted	Breed/feed in grasslands, also woodlands and marshes.	Low	4, 14, 19, 22, 26, 28,29, 35, 36, 42, 43, 66
Raccoon	Unlisted	Breed/feed in various human-created and natural habitats.	Low	14, 19, 22, 35, 37, 42, 57, 66
White-tailed Deer	Unlisted	Breed in woodlands/shrublands, feed in various terrestrial habitats.	Low	14, 19, 22, 24, 27, 35, 37, 42, 59, 60, 66
Indiana Bat	NY and Fed Endangered	Feed in open habitats and woodlands, breed in riparian or lakeside woodlands, and hibernate in caves/mines.	More Study Needed (B) /Low (F)	14, 19, 22, 35, 66

Notes:
* = similar species used for assessment due to lack of published literature on species-specific avoidance of human activity
B= breed
F = feed
Ranking of potential for wildlife avoidance due to human activity within the proposed Fresh Kills Park:
Low – Low potential for wildlife avoidance due to human activity; short-distance movements as a result of human disturbance or no reaction, high likelihood of habituation to human activity.
Moderate – Moderate potential; longer-distance movements, or temporary relocation from the park area due to human activity, use of the site during periods of low human activity; a possibility for eventual habituation to human activity .
High – High potential; human activity creates unsuitable conditions within the park, high likelihood of local extirpation from park boundaries; little to no possibility for habituation to human activity
Sources: See **Literature Cited – Wildlife Avoidance Response Analysis**