

CHAPTER 4.D

NATURAL RESOURCES

A. INTRODUCTION

The Rockaway Peninsula in New York City is bordered by Jamaica Bay to the north and the Atlantic Ocean to the south. It comprises 8 square miles of land that support a variety of natural resources, including plant habitats and wildlife such as beach/dune areas, tidal wetlands, estuarine waters, woodlands and scrub/shrub habitat, migratory and shorebirds, as well as several species of special concern.

Chapter 4.B, “Land Use, Community Facilities, Public Policy, and Zoning,” describes five Representative Areas in the Rockaway Peninsula and provides examples of the different terrestrial and aquatic habitats and the wildlife associated with these areas. In four of those five Representative Areas, adulticiding actions could occur under the proposed *Mosquito Population Control Program in the Rockaways*. The natural resources in those areas are described in detail in Chapter 3.D, “Natural Resources,” in Section C, “Current Natural Resource Conditions Without the Proposed Action,” under the section *Beaches, Dunes and Bluffs*, and in the description of the Edgemere/Far Rockaway Representative Area. The purpose of this chapter is to assess the potential effects of the proposed *Mosquito Population Control Program in the Rockaways* on the resources of the Rockaway Peninsula, using the approach and methodology described in Chapter 3.D. The approach for this assessment follows the overall approach described in detail in Chapter 3.D for the *Mosquito-Borne Disease Control Program*. Because Chapter 3.D provides a detailed description of the approach, this chapter provides only a summary of the methodology, identifying areas where the approach was tailored to meet the special conditions on the Rockaway Peninsula.

This chapter is organized into the following sections:

- The methodology employed to assess the ecological risks from the application of the adulticides;
- The current natural resource conditions within the Rockaway Peninsula;
- The future conditions of the City’s natural resources within the Rockaway Peninsula without the proposed application schedule of up to six ground applications during the three summer months (twice a month); and
- An assessment of potential impacts to the resources of the Rockaway Peninsula.

B. METHODOLOGY

The methodology employed to assess the potential effects to the City’s natural resources on the Rockaway Peninsula was the same as that described in Chapter 3.D, “Natural Resources.” The results of the assessment conducted in Chapter 3.D for the *Mosquito-Borne Disease Control Program* were applied to the Rockaway Program. As described in Section B, “Methodology for the *Mosquito-Borne Disease Control Program*,” the impact assessment relied on the results of an ecological risk

assessment, combined with field studies of the active ingredients, to determine the potential effects to natural resources in this part of the City. No additional literature review was necessary for this evaluation because the same active ingredients evaluated for the *Mosquito-Borne Disease Control Program* are proposed for the *Mosquito Population Control Program in the Rockaways*. Because the screening level (Tier I) risk assessment presented in Chapter 3.D evaluated the exposure pathways that would apply to the resources of the Rockaway Peninsula, a separate Tier I was not conducted for the Rockaways. Instead, the results of the Tier I for the *Mosquito-Borne Disease Control Program* are discussed in relation to the resources found on the Rockaway Peninsula. The Detailed (Tier II) Risk Assessment was modified to address the different application schedule and conditions of the *Mosquito Population Control Program in the Rockaways*. The same empirical studies evaluated in Chapter 3.D were used to assess the potential effects to natural resources on the Rockaway Peninsula, and are not repeated in this chapter.

C. CURRENT NATURAL RESOURCE CONDITIONS WITHOUT THE PROPOSED ACTION

The plant and animal resources within the Rockaway Peninsula were described in Section 3.C of Chapter 3.D, “Natural Resources,” in the “Background” section, as well as in the description of the Edgemere/Far Rockaway Representative Area. This section provides a summary of this information, and identifies important resources of concern on the Rockaway Peninsula. As presented in Chapter 4.B, “Land Use, Community Facilities, Public Policy, and Zoning,” this assessment the Rockaway Peninsula was divided into five subareas: Western Rockaways, Neponsit/Belle Harbor, Seaside/Hammels, Somerville/Arverne/Edgemere, and Far Rockaway. Chapter 4.B provides a detailed description of the land cover and use within these five subareas and figures describing the locations of these subareas. The natural resources and resources of concern within each subarea are summarized below.

WESTERN ROCKAWAYS

This study area includes the area of the Rockaways from Beach 149th street west toward Rockaway Point. It is bounded to the north by the Rockaway Inlet area of Jamaica Bay, and to the south by the Atlantic Ocean. Most of the land use within this subarea is open space contained in Fort Tilden, Jacob Riis Park, and Breezy Point Park. The remainder of the land use is residential, concentrated in two communities: the larger Breezy Point community, located between Breezy Point Park and the western portion of Jacob Riis Park, and the smaller Roxbury community located to the north of Fort Tilden and just west of the Marine Parkway Bridge. With the exception of the Roxbury area, this subarea will not be subject to the proposed spraying program because it is either on Federal land that is part of the Gateway National Recreation Area administered by the National Park Service, or part of the Breezy Point community’s private mosquito control program.

Jamaica Bay and portions of the Rockaway Inlet at Breezy Point serve as important breeding and nursery habitat for fish, and provide feeding and nesting areas for waterfowl, shorebirds, and colonial wading birds. The New York Natural Heritage Program has designated Breezy Point as a Priority Site for Biodiversity. The New York Department of State has designated Breezy Point as Significant Coastal Fish and Wildlife Habitat, along with the main portion of Jamaica Bay (USFWS 1997). Jacob Riis Park is approximately 225-acres and includes 1 mile of beach and boardwalk, active recreation facilities, and a pool. Fort Tilden consists of approximately 140 acres that include buildings, paved areas, and low-cut grassy areas with occasional shade trees, as well as some dune and woodland habitat. Breezy Point Park comprises approximately 200 acres of natural area with a wide ocean

beach, beachgrass dunes, grassland/shrub thicket, and saltmarsh fringe in the portion next to Jamaica Bay (USFWS 1997). The Breezy Point area supports some of the highest concentrations of beach-nesting birds in the State and in the New York Bight region. It has one of the largest piping plover nesting sites in the Bight, one of the largest concentrations of least terns in the Bight, one of the largest black skimmer colonies in the State and the Bight, and one of the largest common tern colonies. Other shorebirds found here include great black-backed gull, herring gull, willet, and American oystercatcher. Breezy Point is also used during the summer and fall migrations by other shorebirds, waterfowl, and raptors (American kestrel, sharp-shinned hawk, Cooper's hawk, northern harrier, osprey, peregrine falcon, and merlin). Peregrine falcons nest on the Marine Parkway bridge. Plant species of special concern found at Breezy Point include seabeach amaranth and seabeach knotweed in the ocean beach/dune area, and Schweinitz's flatsedge along Jamaica Bay (USFWS 1997).

Vegetation communities found in this subarea include beach/dune habitat, as described in Chapter 3.D, "Natural Resources," tidal *Spartina*-dominated wetlands, as well as upland areas with trees, shrub-scrub, meadow, and ruderal habitats. Beach/dune vegetation typically consists of beach grass, seaside goldenrod, sea rockets, bayberry, beach plum, coklebur and salt spray rose. The *Spartina*-dominated wetlands comprise species similar to those described for the Jamaica Bay and Edgemere/Far Rockaway Representative Areas presented in Chapter 3.D. Species of special concern that are known to occur within or in the vicinity of this subarea include many of those found at Breezy Point such as piping plover, seabeach amaranth, dune sandspur, least tern, and roseate tern. Other species expected to use the open space areas in this portion of the Rockaways include the shorebirds, wading birds, waterfowl and migratory birds, as well as numerous insect species described for the New York City area, discussed for the Jamaica Bay area in Chapter 3.D.

NEPONSIT/BELLE HARBOR

This subarea constitutes the land between 149th Street and 116th Street. While primarily residential, it does contain a portion of the beach/dune habitat of Rockaway Park along the Atlantic Ocean. Rockaway Beach runs along the entire length of the Rockaways next to the Atlantic Ocean from 3rd Street on the eastern portion of the peninsula to Jacob Riis Park. The beach/dune habitat on this portion of Rockaway Beach would be similar to that described for the Western Rockaways, and the beach and offshore fauna similar to that described for the Edgemere/Far Rockaway Representative Area in Chapter 3.D, "Natural Resources." Species expected to occur in this area include common shorebirds such as sandpipers, gulls, common tern, willet, and American oystercatcher, sand crabs, ghost crabs, and gem clams, as well as the species of special concern listed for the Western Rockaways. Bands of *Spartina*-dominated tidal wetlands with some *Phragmites*, similar to that described for the Edgemere/Far Rockaway Representative Area (see Chapter 3.D), border Jamaica Bay. Fish expected to occur along the shoreline area include silversides, mummichog, killifish, juvenile bluefish, sea trout, and spot. Invertebrates could include fiddler crab, mud crabs, blue crabs, and mud snails. Other wildlife expected to occur include the shorebirds and wading birds described for the Jamaica Bay region in Chapter 3.D such as gulls, cormorants, and egrets; songbirds such as red-winged blackbird; and numerous insects.

SEASIDE/HAMMELS

The Seaside/Hammels subarea extends from 116th Street to 74th Street and is primarily residential, with areas of industrial, commercial, and institutional use. Open space areas include a portion of Rockaway Park, as described for the Neponsit/Belle Harbor area; vacant lots with ruderal vegetation similar to that described for the vacant lots in the Edgemere/Far Rockaway Representative Area; and

bands of tidal wetlands similar to that described for the Edgemere/Far Rockaway Representative Area along the northern border next to Jamaica Bay (see Chapter 3.D, Natural Resources”). Animals found in this area would be similar to those described above for the Neponsit/Belle Harbor area.

SOMERVILLE/ARVERNE/EDGEMERE

The Somerville/Arverne/Edgemere subarea extends from 74th Street to 38th Street, including the area described in Chapter 3.D for the Edgemere/Far Rockaway Representative Area. It is primarily residential with open space areas comprising Rockaway Beach, the former Edgemere Landfill described in Chapter 3.D, Dubois Wildlife Sanctuary, bands of tidal *Spartina*- and *Phragmites*-dominated wetland, and vacant land with ruderal vegetation described in Chapter 3.D for the Edgemere/Far Rockaway Representative Area. The animal and plant communities found in the open space areas were described in Chapter 3.D and would be similar to those described above for the Neponsit/Belle Harbor area.

The Dubois Wildlife Sanctuary, located on the small peninsula immediately west of the Edgemere Landfill, contains approximately 34 acres of scrub/shrub vegetation, open fields, and a fringe of tidal wetlands adjacent to Jamaica Bay. Administered by the New York City Audubon Society, this natural area would not be sprayed as part of the *Mosquito Population Control Program in the Rockaways*.

FAR ROCKAWAY

The Far Rockaway subarea includes the remaining portion of the Rockaways within Queens, extending from 44th Street to the Nassau County border on the east, the Atlantic Ocean to the south, and Motts Basin in the north. While most of this area is developed for residential uses, with some commercial, industrial, and institutional uses, open space areas are found at Bayswater Point State Park administered by the New York City Audubon Society, Bayswater Park, and Rockaway Park. In addition to these park areas, there are vacant areas covering almost entire blocks near Seagirt Boulevard. Bayswater Point State Park is state-owned land and would not be sprayed with adulticides as part of the *Mosquito Population Control Program in the Rockaways*. This 12-acre park on the eastern shore of Jamaica Bay includes beach, wetland, and woodlands used by shorebirds, wading birds, waterfowl, and migratory birds similar to those described in Chapter 3.D for Jamaica Bay and the Edgemere/Far Rockaway Representative Area. The vacant parcels would be vegetated with ruderal species, similar to those described for the Edgemere/Far Rockaway Representative Area.

D. FUTURE WITHOUT THE PROPOSED ACTION

Without the *Mosquito Population Control Program in the Rockaways*, NYCDOH would continue its *Routine Program* to control mosquito breeding, mosquito and disease surveillance, and education programs. Because the area is mostly developed, with the exception of vacant lots that provide limited wildlife habitat and the land set aside as open space, there should be little change in natural resources. Over the years, development and filling of marshlands, along with other types of ecological degradation, have restricted the natural flushing of the saltmarshes, increasing habitat for the major nuisance mosquito in the Rockaways *Ochlerotatus sollicitans*, as well as other mosquito species. To correct this ecological degradation, the New York District of the U.S. Army Corps of Engineers (ACOE) has tentatively scheduled habitat restoration in Bayswater Point State Park, Dubois Point, and Brant Point beginning in 2003. These improvements will include construction of offshore breakwaters to accelerate the establishment of fringe saltmarshes, removal of a damaged seawall, extending and/or unclogging tidal creeks to promote the free flow of tides, removing unwanted vegetation, and fencing to prevent excessive drifting of sand. The restoration of tidal movement will

eliminate pockets of standing water and provide access to these areas for fish to help control mosquito larva.

As described in the section “Future Without the Proposed Action,” in Chapter 3.D, “Natural Resources,” the continued improvements to water quality in Jamaica Bay through the implementation of the CSO abatement program will result in improved habitat for aquatic organisms, possibly resulting in increased utilization by aquatic animals as well as shorebirds, waterfowl and wading birds that feed on them.

E. PROBABLE IMPACTS OF THE PROPOSED ACTION

ECOLOGICAL RISK ASSESSMENT

The ecological risk assessment for the *Mosquito-Borne Disease Control Program* presented in Chapter 3.D, “Natural Resources,” was organized in two tiers: a Tier I screening-level assessment and a Tier II detailed assessment. The purpose of the Tier I assessment was to eliminate from consideration those possibilities that did not have the potential for resulting in adverse effects to plants or animals from the Proposed Action. Where the Tier I assessment identified a potential adverse effect for a particular stressor or pathway, a detailed Tier II assessment was performed to evaluate the effects under conditions and assumptions representative of the City’s habitats and other natural resources.

Screening Level (Tier I) Risk Assessment

Chapter 3.D, “Natural Resources,” describes the methods and results of the Tier I assessment for the *Mosquito-Borne Disease Control Program* in detail. The Tier I analysis examined five exposure scenarios to assess potential risk to the City’s resources:

- ☞ **Terrestrial Receptors with Direct Exposure**—This scenario examined bees and other non-target insects, non-target mammals (inhalation and dogs drinking water from puddles), and birds (inhalation and preening).
- ☞ **Terrestrial Receptors Exposed Through the Terrestrial-based Food Chain**—This scenario examined the risks associated with the ingestion of grass, seed, and insects contaminated by the active ingredients applied at the full application rate by birds, mammals, and invertebrates.
- ☞ **Aquatic Receptors in Pond Exposed to Drift**—This scenario examined crustaceans, mollusks, insects, and fish exposed to contaminated water in hypothetical pond with a depth of 1 meter and a surface area of 10,000 square meters that is exposed to adulticides applied aerially at the maximum application rate.
- ☞ **Aquatic Receptors in Wetlands Exposed to Runoff**—This scenario examined fish and aquatic invertebrates exposed to water in shallow freshwater wetland and a shallow saltmarsh. It was assumed that a precipitation event (0.25 inches) following spraying washed the active ingredients from the ground surface or from the air and carried it to storm drains that discharge into the wetland. The stormwater discharge is assumed to enter the wetland as a slug, displacing the existing standing water at the discharge point. All of the active ingredient is assumed to be available in the water column, with no degradation or partitioning to sediment.
- ☞ **Terrestrial Receptors Exposed Through the Aquatic-based Food Chain**—This scenario examined fish-eating (piscivorous) birds (such as osprey and kingfishers) and mammals

(such as raccoons) that have the potential to be exposed to the active ingredients that enter aquatic habitats by eating fish that have bioconcentrated the active ingredients.

Because the Tier I screening analysis presented in Chapter 3.D, “Natural Resources,” uses conservative assumptions for the same active ingredients examined for the *Mosquito Population Control Program in the Rockaways*, using the same potential terrestrial and aquatic receptors that apply to the Rockaway Peninsula, the results of the Tier I screening analysis apply to the *Mosquito Population Control Program in the Rockaways*. Therefore, a separate screening assessment is not necessary for the *Mosquito Population Control Program in the Rockaways*. The pond scenario is the one exception, because there are no ponds on the Rockaway Peninsula. As was the case for the *Mosquito-Borne Disease Control Program*, the primary source of active ingredients for the four remaining scenarios is spraying for adult mosquitoes by the City.

The Tier I screening analysis presented in Chapter 3.D identified the following receptors or scenarios for further evaluation in the Tier II detailed risk assessment. The pond scenario is not summarized because it does not apply to the *Mosquito Population Control Program in the Rockaways*.

- ☞ Insects and other (terrestrial receptors) with direct exposure to the active ingredients.
- ☞ Aquatic arthropods in wetlands exposed to runoff—in freshwater wetlands, all groups of organisms suggested effects with the exception of mollusks exposed to permethrin, and crustaceans exposed to sumithrin. In saltmarshes, all groups exposed to all of the active ingredients suggested potential effects.
- ☞ Receptors exposed through the terrestrial-based food chain—a slight possibility of adverse effects to grass-eating mammals exposed to permethrin was identified.
- ☞ Receptors exposed through the aquatic-based food chain bioaccumulation—a slight possibility of adverse effects for mammals exposed to naled bioconcentrated by fish, and possible risk to birds and mammals exposed to permethrin and resmethrin bioconcentrated in fish.

Detailed (Tier II) Risk Assessment

As presented in Chapter 3.D, “Natural Resources,” the Tier I screening-level assessment used available toxicity data and conservative assumptions to eliminate certain receptors shown not to be at risk from the application of the active ingredients to control adult mosquitoes. The Tier I analysis also identified those stressors and pathways that would require additional investigation prior to making decisions regarding potential risk. The Tier II assessment examines these potential risks using a method tailored to meet the specific circumstances around each risk. The following sections present the Tier II risk assessment of the *Mosquito Population Control Program in the Rockaways*. Where the Tier II risk assessment for the Rockaways relies on the methods and results of the Tier II conducted for the *Mosquito-Borne Disease Control Program* presented in Chapter 3.D, the results of that evaluation are summarized. The Tier II assessment evaluates the risks identified in the Tier I for the *Mosquito-Borne Disease Control Program* for those scenarios that apply to the Rockaways, combining the two food chain scenarios into one:

- ☞ Terrestrial Receptors With Direct Exposure;
- ☞ Aquatic Receptors in Wetlands Exposed to Runoff (saltmarsh only); and
- ☞ Receptors Exposed Through the Food Chain.

Terrestrial Receptors with Direct Exposure

The Tier I assessment presented in Chapter 3.D, “Natural Resources,” identified a risk to non-target insects, represented by bees exposed to the active ingredients evaluated in this document. As discussed in Chapter 3.D, because toxicological data for other terrestrial insects are limited, bees act as the surrogate for other terrestrial non-target insects. Therefore, the results of the Tier I assessment suggest that other non-target insects such as butterflies, dragonflies, and damselflies, may also be affected by the direct impact and drift of adulticides. The active ingredients evaluated in this document have been developed to kill insects. They are nonspecific and have the potential to affect any insect that comes in contact with them.

However, other non-target terrestrial insects may not be as sensitive to the active ingredients as bees, nor is it likely that they would be exposed to as high a dose as in the laboratory toxicity tests done on bees where the active ingredient is applied directly to the bee. An insect walking on a surface that has been sprayed with adulticides may have a lower exposure dose because the surface area of the feet is small. This insect would receive a lower dose than those used to calculate the hazard quotient (HQ) in Tier I and, therefore, may have a lower potential for adverse effects. Additionally, certain activity patterns, behaviors, or habitat preferences will serve to protect some insects. For example, some insects live underground during some portion of the lifecycle and would have less exposure to adulticides on the ground. Insects such as some butterflies and dragonflies that rest under vegetation or structures at night would have less chance of being directly exposed to the adulticide sprayed at night than one resting on the surface. Any insect that actively avoids areas that have been sprayed would have a lower exposure and therefore less chance of being adversely affected.

Aquatic Receptors in Wetlands Exposed to Runoff

The Tier I assessment indicated the need to further assess the risks to aquatic resources exposed to adulticides through runoff. For the *Mosquito Population Control Program in the Rockaways*, only aquatic receptors in saltmarshes are a concern since there are no freshwater wetlands in the subareas described previously. The Tier I assessment used conservative assumptions of rainfall amount, and also assumed that the rainfall would carry all of the active ingredient to the wetland with no degradation or partitioning to other media. However, the adulticides containing these active ingredients would not be applied during a rainstorm or when rainfall is imminent, and rainfalls greater than .25 inches will also lower the concentration of the active ingredient that enters a saltmarsh typical of those that line Jamaica Bay on the northern border of the Rockaway Peninsula. The Tier I assessment presented in Chapter 3.D, “Natural Resources,” also did not consider any dilution that might occur in a receiving wetland or stream. All of these factors should result in lower risks to aquatic organisms than predicted by the Tier I risk assessment modeling.

Therefore, to better assess the risk from the active ingredients to aquatic organisms in the hypothetical wetland, the Tier II assessment for the *Mosquito Population Control Program in the Rockaways* modified the conceptual model for the Jamaica Bay Tier II assessment to reflect the wetlands and stormwater discharge conditions found on the Rockaway Peninsula. To assess the risks to the aquatic resources of Jamaica Bay, HQs were calculated for marine and estuarine species used in the Tier I assessment presented in Chapter 3.D for a discharge of stormwater runoff to Jamaica Bay from the Rockaway Peninsula. The assumptions used for this assessment are as follows:

- Adulticides are applied by truck at the maximum labeled rate over a 2660-acre area of the Rockaway Peninsula.

- ☞A 0.375 inch rainfall event was assumed to occur one day after spraying, and photolysis of the adulticide on exposed surfaces was assumed to occur during the 12 hours of daylight between the application and the rainfall. Rainfall was assumed to mobilize all of the adulticide reaching the ground that was not degraded by photolysis.
- ☞Adulticides are assumed to partition over an equal mix of concrete, asphalt, and soil over a distance of 300 feet. A mix of surfaces was felt to best describe land use in the Jamaica Bay watershed on the Rockaway Peninsula.
- ☞All applied adulticide was assumed to reach Jamaica Bay after taking into consideration degradation from photolysis, and that lost due to partitioning with organic carbon.
- ☞Adulticides that enter Jamaica Bay mix completely with the Bay's water. Volume of the Bay was calculated from the surface area (16,000 acres) and mean depth (12 ft).
- ☞No partitioning to organic carbon in the tidal basins or the main body of the Bay was assumed.
- ☞Reductions in toxicity associated with residence time in the basins of the Rockaway Peninsula were not considered.

Table 4.D-1 presents the toxicological endpoints, estimated exposure concentration in Jamaica Bay, and the HQs calculated for estuarine and marine species for the *Mosquito Population Control Program in the Rockaways*. These species include the most sensitive species identified in Tier I as well as other estuarine/marine species that occur, or are expected to occur, in Jamaica Bay. The HQs for sumithrin, resmethrin, naled, and PBO were below 1.0 for all biological groups evaluated, suggesting that aquatic organisms may not be affected by stormwater discharge containing these active ingredients from a single application. The HQs for permethrin were below 1 for mollusks, fish, and brown algae but above 1.0 for crustaceans. This suggests a possible risk to some aquatic organisms from the discharge of stormwater from the Rockaways following spraying with permethrin. The HQs for malathion were above 1.0 for crustaceans and mollusks but below 1.0 for fish. This suggests a possible risk to crustaceans and mollusks from the discharge of stormwater from the Rockaways following spraying with malathion. The *Mosquito Population Control Program in the Rockaways* includes the potential application of these active ingredients every two weeks. This repeat application schedule may result in an increase in the HQs to more than 1.0 for fish for malathion, and crustaceans and brown algae for naled since these are the next highest HQs in the table. Both of these compounds, however, degrade relatively rapidly in the environment which may decrease the actual effect on aquatic resources in the Bay.

Because the land area associated with the *Mosquito Population Control Program in the Rockaways* is small compared to the total number of acres of Brooklyn and Queens that drain to the Bay (36,700 acres), the effect of the stormwater discharge containing these active ingredients on the aquatic resources of the Bay should not be significant. Additionally, based on the half-lives and other physical/chemical characteristics of the active ingredients, the approximate two-week interval between spraying should not result in HQs that would suggest a risk to aquatic organisms other than for malathion and permethrin.

Table 4.D-1
Toxicological End Point Concentrations, Estimated Exposure Concentrations in Jamaica Bay,
And Hazard Quotients (HQ) for Marine And Estuarine Species Exposed to Active Ingredients
Used To Control Adult Mosquitoes as Part of The Mosquito Population Control Program in the
Rockaways

Species Exposed Through Food Chains

In the Tier I risk assessment presented in Chapter 3.D “Natural Resources,” and summarized above, the HQs for terrestrial organisms exposed through the terrestrial and the aquatic-based food chains were generally less than 1.0, with the exception of grass-eating mammals eating grass that had been exposed to naled sprayed by air or truck; piscivorous mammals exposed to naled, permethrin, and resmethrin; and piscivorous birds exposed to permethrin, resmethrin and Piperonyl butoxide (PBO). However, the Tier I analysis used several conservative assumptions presented below that are unlikely to be met under natural conditions.

- ☞ Predators would obtain all of their food from the sprayed area. This is unlikely for birds and mammals because they tend to roam over relatively large areas to feed.
- ☞ All of the prey and plant food in the sprayed area would have been exposed to the applied concentration of active ingredient.
- ☞ In the case of piscivorous birds and mammals, the fish being consumed has bio accumulated the active ingredient to concentrations achieved at equilibrium.
- ☞ The fish being consumed does not break down the active ingredient at all prior to its ingestion by the predator.

Because food chain effects have not been observed for the active ingredients in nature, the screening-level HQs were low, and the assumptions discussed above are overly conservative; significant adverse effects to terrestrial receptors through aquatic or terrestrial-based food chains are considered to be unlikely.

Summary of Ecological Risk Assessment Results

The Tier I ecological risk assessment eliminated the potential for adverse effects to a number of biological receptors, but also identified the potential for adverse effects for certain biological groups that needed to be addressed on a more detailed level in the Tier II assessment. The biological groups needing additional evaluation that apply to the Rockaway Peninsula included:

- ☞ Terrestrial Receptors (Insects) with Direct Exposure—Non-target insects, especially bees, exposed to any of the adult mosquito insecticides.
- ☞ Aquatic Receptors in Wetlands Exposed to Runoff—All groups of organisms in saltmarsh exposed to all adult mosquito adulticides.
- ☞ Receptors Exposed Through Terrestrial-Based and Aquatic-Based Food Chains—There is a slight possibility of adverse effects for grass-eating mammals exposed to permethrin. No other risks to grass-eating mammals or other wildlife from adulticides was suggested by the Tier I analysis. There is also a slight possibility of adverse effects for mammals exposed to naled, and possible risk to birds and mammals exposed to permethrin and resmethrin, from consuming fish that have bioconcentrated these adulticides.

The Tier II assessment analyzed these risks within the context of the resources found within the Rockaway Peninsula, further refining the assumptions to represent the existing conditions for the wetlands exposure scenario. The Tier II assessment concluded that several of the risks identified in Tier I would not result in adverse impacts to the natural resources on and within the vicinity of the Rockaways—these were birds and mammals consuming vegetation exposed to the active ingredients or consuming fish exposed to the adulticides, and certain aquatic resources in Jamaica Bay wetlands receiving stormwater discharge. The Tier II assessment of the *Mosquito Population Control Program*

in the Rockaways did conclude that there were potential adverse impacts on non-target insects and terrestrial arthropods on the Rockaway Peninsula and some aquatic resources from the discharge of malathion and permethrin. The following sections first discuss the natural resources with the potential to be adversely impacted by the application of the adulticides under this program.

Potential Impacts to Natural Resources

Potential adverse impacts to the natural resources of the Rockaway Peninsula may result from:

- ✎ The action of the adulticides on the aquatic and terrestrial animals and plants inhabiting the open spaces within the Rockaways, as evaluated in the Tier I and Tier II ecological risk assessments; and
- ✎ The activities associated with the adulticide application methods.

The following sections discuss these two groups of potential effects.

Potential Adulticide-Related Impacts

Terrestrial Receptors With Direct Exposure or Exposure Through the Food Chain

The same discussion and conclusions presented in Chapter 3.D, “Natural Resources,” with respect to potential direct impacts to non-target insects and indirect impacts to mammals, birds, reptiles, and amphibians for the *Mosquito-Borne Disease Control Program* would apply to the *Mosquito Population Control Program in the Rockaways*. There is a low potential for risk to birds and mammals. There would be no predicted significant adverse impact from inhalation of the active ingredients, or from ingestion through food, preening in the case of birds, or drinking water from puddles in the case of dogs. There would be potential adverse impacts to certain individual non-target insects. However, the overall impact to the insect community on the Rockaway Peninsula, and any secondary impacts to other groups of organisms that depend on them for food, would not result in significant adverse impacts. The proposed spraying schedule for the Rockaways would provide sufficient time for the insect community to rebound through migration from unaffected areas or through reproduction by unaffected individuals.

Aquatic Receptors in Wetlands Exposed to Runoff

The Tier II assessment conducted for Jamaica Bay for the *Mosquito Population Control Program in the Rockaways* suggests there would be no predicted significant adverse impacts on aquatic organisms from the active ingredients with the exception of crustaceans and mollusks from the discharge of stormwater containing malathion and to crustaceans from the discharge of stormwater containing permethrin. The Tier II assessment, while it took into account partitioning of some of the active ingredients with the land surface, did not take into account partitioning in the storm sewers or CSOs before discharged to the Bay, nor did it take into account partitioning within the water column of the receiving water. When these factors are taken into consideration, the estimated exposure concentration may be lower than that estimated in the analysis. This, combined with the small volume of the discharge from the Rockaways compared to the volume of Jamaica Bay, and the fact that the discharge will not be stagnant within the Bay but will mix with the receiving water, suggests that the potential adverse impacts to aquatic resources of the Bay would not be significant. Fish, because they are mobile, will not be constantly exposed to the active ingredients, unlike the laboratory environment used for the toxicity tests. While some benthic invertebrate individuals have the potential to be adversely impacted by the discharge of stormwater or CSO containing the active ingredients because they are less mobile, benthic invertebrate communities tend to recover quickly and, therefore, should not be significantly adversely impacted.

Endangered Species

Sections B and C of Chapter 3.D, “Natural Resources,” describe the existing conditions within the Rockaway Peninsula and the endangered animal and plant species known to occur here. The Federally listed species include the piping plover and seabeach amaranth. The piping plover is a shorebird that nests and forages on beaches and dunes of Breezy Point and the Atlantic Coast beaches associated with Rockaway Park. Seabeach amaranth is found in areas similar to that used for nesting by the piping plover. The City will not be implementing the *Mosquito Population Control Program in the Rockaways* at Breezy Point or on any other Federal- or State-owned properties, which minimizes the potential impacts to endangered species in these areas. With respect to the Rockaway beach area, the City would minimize impacts by maintaining at least a 100 foot setback from the landward edge of the dune habitat where such breeding habitats have been identified. Impacts to other plant species of special concern found within the Rockaway peninsula—seabeach knotweed in the ocean beach/dune area and Schweinitz’s flatsedge in the tidal wetlands of Jamaica Bay—should be minimized by maintaining the proposed setback from the beach habitats and the 100-foot setback from waterbodies.

The remaining species of special concern are shorebirds such as the terns; wading birds such as the egrets, ibis, herons, and bitterns associated with wetlands and shallow water areas; waterfowl such as the pied-billed grebe; and raptors such as northern harrier and peregrine falcon. As presented in the ecological risk assessment contained in the previous sections of this chapter as well as in Chapter 3.D, direct adverse effects to birds through inhalation, preening or consumption of contaminated fish are expected to be minimal. In addition, the City’s buffer zones from waters should reduce the amount of adulticides entering the preferred habitat areas for the shorebirds, wading birds, and waterfowl. Indirect effects caused by a loss of prey species should also be small because of the ability of most of these birds to switch to different prey items should one particular prey item become less abundant. The northern harrier consumes small rodents and other small animals that are not expected to be affected by the application of the proposed adulticides and should not be affected by a loss of prey. Peregrine falcons feed on other birds, which are not expected to be affected by the proposed adulticides and, therefore, should not experience a loss of prey items. In addition, the high elevation selected by the peregrine falcon for nesting should minimize potential contact with the adulticides applied by truck. Individual falcons nesting on the Marine Parkway Bridge should likewise have little contact with adulticides applied by truck because of the City’s no-spray setback from waterbodies.

Cumulative Effects from the Application of Adulticides and Larvicides

USEPA not evaluated the potential cumulative effects to natural resources from the concurrent application of larvicides and adulticides to aquatic habitats. Because of differences in the mode of action between the adulticides evaluated in this EIS and the larvicides that are part of the City’s *Routine Surveillance and Control Program* and the *Mosquito Control Program in the Rockaways*, the cumulative effects should be limited. The larvicide *Bacillus thuringiensis* (BTI) targets primarily mosquitoes and, therefore, its application with the adulticides will not results in greater effects to natural resources than the adulticides alone. BTI can affect other dipterans along with mosquitoes, which could result in greater impacts to some groups of dipterans when combined with some adulticides. Methoprene has the potential to affect non-target invertebrates. However, because the City is not proposing to use methoprene in ponds, lakes, or wetlands, the cumulative effect of this larvicide with the adulticides should not pose significant additional risk to natural resources.

Cumulative Effects of Active Ingredients Applied by City With Background

The primary waterbody with the potential to have background levels of any of the active ingredients within the Rockaway peninsula is Jamaica Bay. The results of the USGS study referenced in Chapter 3.D, “Natural Resources,” combined with the results of the City’s post-spray water sampling from the 2000 spray events discussed in Chapter 3.F, “Water Quality,” that indicated few instances of sumithrin or PBO in the waterbodies sampled, suggest that detectable background levels of the adulticides should not be present in the Bay. Therefore, cumulative impacts on natural resources from background levels of pesticides and the proposed *Mosquito Population Control Program in the Rockaways* should be no greater than those discussed above.

Potential Related Impacts

The following aspects of the adulticide application process for the *Mosquito Population Control Program in the Rockaways* may cause the same potential effects to natural resource as the *Mosquito-Borne Disease Control Program* discussed in Chapter 3.D, “Natural Resources”:

- Movement of trucks applying the adulticide;
- Lights from the truck application; and
- Other human disturbance associated with the application.

Movement of Trucks Applying the Adulticide

Effects to natural resources associated with the movement of trucks during spraying may include loss of some individual wildlife and birds due to impact with the truck. However, because the trucks move slowly at 5 to 10 mph, are noisy, and have headlights, no significant impacts are expected from those trucks. Other impacts associated with the movement of trucks may be associated with ground disturbance and creation of ruts should the truck leave paved roadways. Because the trucks must maintain a setback from water, effects to aquatic resources would be minimal and will not be significant.

Noise from the Truck During Application

Some wildlife and bird individuals would be affected by the noise associated with the truck. These effects may include a change in activity pattern such as cessation of feeding activities or resting, or change in the resting location. However, these effects would be temporary and non-significant, and normal activity patterns should return once the vehicle has passed.

Lights From the Truck Application

As with the noise effects, the lights from the truck may cause a temporary change in activity pattern such as feeding or resting. However these changes would be temporary and normal activities should return once the vehicle has passed.

Other Human Disturbance Associated With the Application

Any other human disturbance associated with the application of adulticides, such as increased human contact during the spraying would be temporary and short-lived, and will have minimal effect on wildlife or birds.

Inerts

Chapter 3.C, “Public Health,” discusses the inert ingredients contained in the adulticides evaluated in this EIS. In most cases the inerts consist of petroleum distillates or white mineral oil. Mineral oil is

included in USEPA's list of minimal-risk inert ingredients, which include substances that are ubiquitous in nature and not expected to present a hazard to human health or the environment. The amount that would make its way into Jamaica Bay should not affect water quality or aquatic organisms. With respect to petroleum distillates, the volume applied in these ULV formulations will be small. Some of the volume applied will volatilize in the atmosphere or on the ground surface before it reaches Jamaica Bay through stormwater runoff. The amount of these inerts that would eventually enter the Jamaica Bay will be small and inconsequential compared to other sources of these compounds in Jamaica Bay, and should not result in significant impacts to aquatic organisms.

F. CONCLUSIONS

This chapter has provided a detailed description of the existing conditions of the natural resources on or near the Rockaways Peninsula. The habitats and characteristics of the Rockaways Peninsula were utilized to assist in the evaluation of the potential impacts on natural resources from the Proposed Action. Screening level (Tier 1) and focused (Tier II) ecological risk assessment methods were used to assess the potential risks to biological receptors from the Proposed Action. In addition, assessments were performed to determine the potential impacts from the operations of the mechanical equipment (such as trucks, all-terrain vehicles, and aircraft) on natural resources. The risk assessment calculations were weighted with results from empirical studies and best professional judgment to assess the effects and significance of potential impacts of the various active ingredients to resources found in the Representative Areas (and therefore, the City), in accordance with guidelines in the *CEQR Technical Manual* for determining significance.

No significant adverse impacts are expected from the application equipment, including trucks or aircraft applying adulticides, and no significant adverse impacts are expected on endangered species. No significant adverse impacts are expected from the inerts in the adulticides. No predicted significant adverse impacts are expected on birds, pets, or mammals. There would be potential adverse effects on aquatic life near the outfalls of storm water runoff in Jamaica Bay if it rains after an application. In addition, adverse effects would occur to other insects and terrestrial arthropods from direct contact to the adulticides. While there would be losses of individuals in these species, these potential adverse effects are not considered to be significant adverse impacts.

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