A. PROJECT DESCRIPTION

PROJECTS DENTIFICATION AND BACKGROUND

The New York City Department of Environmental Protection (NYCDEP) is proposing to expand its Waterfowl Management Program beyond the current program at Kensico Reservoir to five additional City reservoirs: Rondout, Ashokan, West Branch, Croton Falls, and Cross River. The objective of the program is to minimize fecal coliform bacteria (FCB) loads to the reservoirs that result from waterbirds* roosting on the reservoirs during the migratory and winter seasons. The Expanded Program would include avian (bird) population monitoring, avian deterrence measures (e.g., meadow management and shoreline fencing), targeted avian dispersion activities (e.g., pyrotechnics, motorboats and airboats, and distress tapes), reproductive management methods (egg addling and nest destruction), and, on rare occasions, removal methods. The Expanded Program would be similar, but more limited in scope and duration, to the Kensico Reservoir Program. The program is a significant part of NYCDEP's watershed protection strategy, as set forth in its Long-Term Watershed Protection Plan and is required by the United States Environmental Protection Agency (USEPA) in the 2002 Filtration Avoidance Determination for the Catskill and Delaware watersheds (2002 FAD).

The five reservoirs under the Expanded Program are located in the following Towns and Counties. See Figure ES-1 for a map of the New York City watersheds that identifies the locations of these reservoirs.

Reservoir	Towns (County)
Rondout	Neversink (Sullivan), Wawarsing (Ulster)
Ashokan	Hurley, Marbletown, Olive (Ulster)
West Branch	Carmel, Kent (Putnam)
Croton Falls	Carmel, Southeast (Putnam), Somers (Westchester)
Cross River	Bedford, Lewisboro, Pound Ridge (Westchester)

There are several potential local, state, and federal permits and/or approvals that may be required to implement the program including the following:

- US Fish and Wildlife Service permits under Title 50, Wildlife and Fisheries, 50 CFR 21.

* Waterbirds targeted under this program include gulls, Canada geese, cormorants, ducks, and duck-like species.

- New York State Department of Environmental Conservation (NYSDEC) permits under the Fish and Wildlife Act, Article 11of the Environmental Conservation Law (ECL).
- NYSDEC freshwater wetlands permits under 6 NYCRR Parts 663, 664, and 665.

NYCDEP is required to examine the potential environmental impacts of the proposed project in its role as lead agency under the State Environmental Quality Review Act (SEQRA) and its implementing regulations (6 NYCRR Part 617) in accordance with Article 8 of the Environmental Conservation Law and City Environmental Quality Review (CEQR) Executive Order 91 of 1977 (as amended). NYCDEP, as lead agency in this process, determined that the Expanded Waterfowl Management Program may have significant adverse impacts on the environment and a Positive Declaration and Draft Scope of Work were issued on February 7, 2003. Public meetings to obtain oral testimony on the draft scope were held in Boiceville and Katonah, New York. The period for submitting written comments remained open until March 24, 2003. A Final Scope of Work and a Response to Comments document, issued on May 29, 2003, addressed comments received during the public review and finalized the scope of analysis for the Draft Environmental Impact Statement (DEIS). Based on the Final Scope of Work, the DEIS was prepared and circulated for public review. Public hearings were held in Stone Ridge and Katonah, New York to obtain oral testimony on the DEIS. The period for submitting written comments remained open until November 21, 2003.

This Final Environmental Impact Statement (FEIS) has been prepared incorporating responses to both oral and written comments received by NYCDEP. All pertinent comments and responses can be found in Chapter 15 of this document. The proposed mitigation to protect bald eagles, found in Chapter 11, was revised per comments received by NYS Department of Environmental Conservation (NYSDEC) and U.S. Fish and Wildlife Service. This revision includes eagle protection measures that the Endangered Species Unit of NYSDEC reviewed and approved in concept. In addition, NYCDEP commits to develop detailed eagle interaction guidelines in conjunction with NYSDEC prior to implementation of the proposed program. Changes made since the DEIS are indicated by double underlines.

NEW YORK CITY'S WATERSHED PROTECTION PROGRAM AND FILTRATION AVOIDANCE

For the last decade, NYCDEP and its partner agencies and organizations have developed and deployed a comprehensive watershed monitoring and protection program designed to maintain and enhance the high quality of Catskill/Delaware water. Key watershed protection initiatives include the Watershed Agricultural Program; acquisition of several key watershed lands; the enforcement of improved Watershed Regulations; initiation and expansion of environmental and economic partnership programs that target specific sources of pollution in the watershed; enhanced watershed protection efforts in the Kensico Reservoir basin; and upgrades of City-owned and non-City owned watershed wastewater treatment plants. The watershed protection program has provided the basis for a series of waivers from the filtration requirements of the Surface Water Treatment Rule (SWTR) by USEPA beginning in January 1993 and most recently in November 2002. The current Waterfowl Management Program at Kensico Reservoir and the proposed Expanded Waterfowl Management Program are identified as necessary components of the 2002 filtration avoidance determination by USEPA.

The filtration avoidance criteria are comprised of three main areas: Objective Water Quality Criteria, Operational Criteria, and Watershed Control Criteria. The criterion most relevant to the proposed Expanded Waterfowl Management Program are the FCB concentration requirements

of the Objective Water Quality Criteria. For source water entering the distribution system and prior to disinfection, raw water samples must contain less than 20 CFU/100 ml of FCB in at least 90 percent of all samples taken from the previous six months. A minimum of five samples per week must be collected. Under normal reservoir operating conditions, the standard applies to water entering the distribution system from Kensico Reservoir. However, when Kensico Reservoir is bypassed, water can be sent directly into the distribution system from West Branch Reservoir, and less often from Rondout and Ashokan Reservoirs. These reservoirs are referred to as terminal reservoirs because they are the most downstream reservoirs for the Delaware and Catskill systems, respectively.

NYCDEP'S WATERFOWL MANAGEMENT PROGRAM

The proposed Expanded Waterfowl Management Program is an outgrowth of measures undertaken by NYCDEP over the past ten years to monitor and manage waterbirds on the reservoirs to reduce FCB concentrations in the water supply. These efforts began in the early 1990s when NYCDEP initiated a program to identify, assess, and eliminate or reduce all known sources of FCB entering Kensico Reservoir. From these assessment efforts, waterfowl and gulls were determined to be a primary source of FCB loadings to the Kensico Reservoir. In response, NYCDEP implemented the Kensico Reservoir Waterfowl Management Program in late 1993. The success of the program and the identification of similar FCB loading problems from waterbirds at five key reservoirs—Rondout, Ashokan, West Branch, Croton Falls, and Cross River—has led to the development of the proposed Expanded Waterfowl Management Program.

THE PROGRAM AT KENSICO RESERVOIR

In past years, waterbird populations were a major source of FCB loadings in Kensico Reservoir in autumn and winter, resulting in FCB concentrations that were high enough to threaten compliance with the SWTR. Prior to the start of the Waterfowl Management Program in December 1993, compliance with the SWTR was achieved by bypassing Kensico Reservoir and sending water from the upstate reservoirs directly to the City. This action kept the City water system from entraining large numbers of FCB from the high concentrations that developed in Kensico Reservoir. However, bypassing reservoirs reduces the residence time and flexibility of the system and, therefore, is not a preferred operating scenario.

The Kensico Waterfowl Management Program, was first implemented in December 1993 and has been one of the most successful and cost-effective watershed management programs developed by NYCDEP. As discussed in "Water Quality" below, the program has lead to dramatic decreases in the levels of FCB in Kensico Reservoir. Since the inception of the Waterfowl Management Program, the primary water quality objectives have been met, namely the reduction of FCB at Kensico Reservoir's effluent chambers. FCB levels have remained in compliance with the SWTR at each of Kensico's effluent water sampling locations. As a result ,NYCDEP has been able to maintain flow through operations at Kensico Reservoir since 1993.

The Waterfowl Management Program currently implemented at Kensico Reservoir includes four primary components: population monitoring, avian deterrence, avian dispersion, and reproductive management methods. Other on-going programs include public education aimed at reducing food sources, and the evaluation of new techniques.

At Kensico Reservoir, NYCDEP implements several methods to monitor and assess waterbirds and their affect on water quality. Waterbird monitoring includes a year-round population and breeding census of all species that inhabit Kensico Reservoir. Population monitoring is

conducted daily, generally in the early morning and evening hours from August 1st through March 31st and weekly from April 1st through July 31st. In addition, a bird banding and collaring identification program is conducted in May and June for geese and gulls to aid in distinguishing resident from migratory birds. NYCDEP expects to begin a gull telemetry program in the near future. NYCDEP also performs microbiology analyses (described in "Water Quality" below) at Kensico Reservoir which have identified birds as a primary source of FCB.

Avian deterrence and dispersion measures have involved implementation of techniques for eliminating roosting waterfowl and gulls on the water's surface, with the goal being to lower FCB counts in the reservoir's untreated water. Avian deterrence techniques implemented by NYCDEP are intended to reduce nesting and foraging by resident Canada geese. Fencing is used to prevent easy access by geese to adjacent feeding areas, especially during molting periods or while raising a brood when waterbirds prefer to walk rather than fly. Meadow management has converted maintained lawn to tall grass and forbs rendering the vegetation less palatable and creating a less safe environment from predators. NYCDEP also uses mylar tape grids over docks and other shoreline structures to discourage birds from congregating in these areas.

Alewife management is a deterrence measure recently implemented. The entrainment of alewives from upstream reservoirs to Kensico Reservoir has generally been most problematic during the autumn and winter. Alewives are either collected at the aqueduct inflows to Kensico Reservoir or the intake elevation is changed at the upstream reservoirs to avoid entrainment, thus reducing bird congregations at the inflows to Kensico Reservoir.

Avian deterrence measures have shown to be effective in deterring waterbirds from limited areas of the reservoir. However, to remove waterbirds from large areas of the reservoir, avian dispersion activities are necessary.

Waterbird dispersion was initiated at Kensico Reservoir in December 1993. Avian dispersion activities are typically carried out from early morning (8:00 am daily) until approximately 1 to 2 hours past sunset, seven days per week between August 1st and March 31st. Dispersion activities are employed throughout the entire reservoir. Dispersion methods involve the use of motorboats or airboats combined with noisemakers (pyrotechnic devices such as bangers, screamers, and CAPAs) to locate and chase birds from the water surface. Airboats are used primarily during ice conditions, while motorboats are used at other times. Pyrotechnics are projected from boats or from the shoreline during times of inclement weather, when the use of boats is deemed unsafe. Dispersion is most successful during motorboat and airboat deployment in combination with the discharge of noisemakers (bangers, screamers, and CAPAs). Launching pyrotechnics from the shore, outside of small coves or confined reservoir areas, was not as effective. NYCDEP has also used distress tapes and red-beam lasers to disperse waterbirds; however, the effectiveness of these measures is still being tested.

Egg puncturing and nest destruction to control resident Canada goose populations are also implemented at Kensico Reservoir generally from March through May annually.

LIMITED PREVIOUS IMPLEMENTATION AT THE FIVE RESERVOIRS UNDER THE EXPANDED PROGRAM

Three limited trials of avian dispersion measures have been implemented at Rondout and Croton Falls Reservoirs in response to seasonal increases in FCB concentrations related to waterbirds. At Rondout Reservoir, motorboats and pyrotechnics were used to disperse birds from the areas around the intakes for three and a half weeks from December 22, 2000 to January 16, 2001 and

shoreline pyrotechnics and lasers were used for two weeks from December 30, 2002 to January 14, 2003. At Croton Falls Reservoir, in anticipation of start-up of the Croton Falls pump station during drought conditions in 2002, NYCDEP implemented a two week dispersion program using motorboats, pyrotechnics, and lasers from January 12, 2002 to January 28, 2002. As discussed under "Water Quality" below, these measures succeeded in reducing FCB levels in water leaving the reservoirs. Egg addling and nest destruction activities have also been carried out at Rondout and West Branch Reservoirs generally from March through May since 1999.

THE PROPOSED EXPANDED WATERFOWL MANAGEMENT PROGRAM

Introduction

Under the Expanded Waterfowl Management Program, NYCDEP would implement a waterbird management program at five additional City reservoirs: Rondout, Ashokan, West Branch, Croton Falls, and Cross River. The objective of the program is to minimize FCB loads to the reservoirs that result from waterbirds roosting on the reservoirs during the migratory and winter seasons. The programs at these five reservoirs would be implemented on an as-needed basis. They would be more limited in scope and hours than the program at Kensico Reservoir and would be targeted to meet specific criteria. As with the program at Kensico Reservoir, the Expanded Program would include avian population monitoring, avian deterrence measures (e.g., meadow management and shoreline fencing), avian dispersion activities (e.g., pyrotechnics, motorboats, and airboats), and reproductive management measures. Removal methods (capture with euthanasia or possibly processing) may be implemented on a very limited basis.

For purposes of impact assessment, the future analysis year is the overwintering period the program is expected to be first implemented: Fall 2003 to Spring 2004.

Project Purpose and Need

As described above, the Kensico Waterfowl Management Program has proven to be one of the most successful and cost effective programs for reducing FCB levels. Based on the success of this program, NYCDEP has determined that a waterbird management program is necessary at Rondout, Ashokan, West Branch, Croton Falls, and Cross River. Waterbird species similar to those found at Kensico Reservoir inhabit these five reservoirs and the reservoirs face similar seasonal elevations in FCB that correspond to seasonal congregations of waterbirds.

The five reservoirs in the Expanded Program were selected for several reasons. Rondout, Ashokan, and West Branch Reservoirs are included because they are: key reservoirs within the system; within 60-day travel time to the intake (60 days of waterborne traveling time to the distribution system allows natural processes such as sedimentation and die-off to reduce concentrations of pathogens in the source waters); and have the potential to function as source waters. Croton Falls and Cross River Reservoirs, although part of the Croton watershed, have the ability to pump water to the Delaware Aqueduct, primarily during drought conditions, and therefore also have the potential to be located within the 60-day travel time to an unfiltered source water and/or function as source waters. The Waterfowl Management Program at Croton Falls and Cross River would be limited to those time periods during which water is pumped into the Delaware Aqueduct, including one month prior to anticipated start-up. In addition to minimizing FCB levels, the primary goal of the Expanded Program, the program would also reduce the potential for waterbirds to serve as a source of human pathogens to the New York City water supply.

Program Implementation Overview

Bird monitoring is the first component of the program and would be conducted on at least a biweekly basis at Ashokan, Rondout, and West Branch Reservoirs and could be increased to a daily basis at Rondout and West Branch Reservoirs during certain times of the year. NYCDEP would also conduct bird monitoring at the Croton Falls and Cross River Reservoirs, on at least a biweekly basis, one month prior to anticipated start-up and during operation of the Reservoirs' pump stations. Other monitoring measures being proposed as part of the Expanded Program include bird banding and collaring and gull telemetry.

The second component of the management program is avian deterrence and could include a combination of meadow management, modification of human behavior, shoreline fencing, alewife management, and visual deterrents.

The third component of the program, avian dispersion, would be employed under conditions that meet certain implementation criteria (see "Implementation Criteria," below). Avian dispersion measures include the use of motorboats, airboats, pyrotechnics, avian distress tapes, and lasers to move and keep avian populations from congregating near the water intakes and other sensitive areas of the reservoirs. Airboats or motorboats would be employed in combination with pyrotechnics as the primary strategy for dispersing birds from critical areas of the reservoirs, except during inclement weather when pyrotechnics would be launched from the shoreline. NYCDEP expects to use these dispersion measures on a daily basis at the reservoirs when the implementation criteria are met and in the case of Cross River and Croton Falls Reservoirs, one month prior to anticipated start-up and during operation of the pump stations. Hours of operation would generally be between two hours before sunset and one to two hours after sunset, although they may be used earlier in the afternoon. Up to approximately 56 pyrotechnics may be used on any given day, although typically fewer would be used.

Based on experiences at Kensico Reservoir, distress tapes and lasers are not effective on their own in achieving the goals of the program without supplemental measures such as boats or pyrotechnics. However, NYCDEP will continue to test their use with the goal of improving their effectiveness.

Reproductive management methods including nest destruction and egg addling to reduce nesting by resident Canada goose, comorant, and mute swan populations would be employed at Rondout, Ashokan, and West Branch Reservoirs, and may be initiated at Cross River and Croton Falls Reservoirs. The final component of the program, removal methods (capture with euthanasia or possibly processing), may be implemented on a very limited basis.

Implementation Criteria

NYCDEP would implement the avian dispersion measures at Ashokan, Rondout, and West Branch on an "as needed" basis based on the following implementation criteria:

- Current bird populations, including roosting or staging locations relative to water intakes.
- FCB concentrations approaching or exceeding 20 CFU/100 ml at water intakes coincident with elevated bird populations;
- Recent precipitation events;
- Operational flow conditions within the reservoirs (e.g., elevations and flow patterns and amounts);
- Reservoir ice coverage and watershed snow cover; and

- An assessment that active bird management measures would be effective in reducing bird populations and FCB levels.

The avian management component of the program at Croton Falls and Cross River Reservoirs would be implemented, based on these criteria, one month prior to anticipated start-up of the Reservoirs' pump stations and during pump station operation. The reservoirs' pump stations are used to pump water from these reservoirs to the Delaware Aqueduct during drought conditions. It is expected that avian dispersion measures would be implemented infrequently at these reservoirs.

Based on the previous limited implementation of dispersion measures at Rondout and Croton Falls Reservoirs, NYCDEP believes that by focusing dispersion efforts on areas closer to the intake structures, FCB levels can be reduced to acceptable levels. With this in mind, NYCDEP has identified areas of potential high, medium, and low avian dispersion technique usage (see Figures ES-2 through ES-6 for maps of these areas). The areas of highest potential usage are nearest to the intake structures of the reservoirs and/or where waterbirds are known to congregate in large numbers based on avian monitoring surveys conducted to date.

In general, based on the implementation criteria above, the bird monitoring data that have been collected to date, and NYCDEP's limited implementation of bird dispersion measures at two of the five reservoirs, NYCDEP expects that the Expanded Program will be much more limited in scope than the program at Kensico Reservoir. The intent of the program at Kensico Reservoir is to displace birds from the entire reservoir, while the focus of the Expanded Program is to disperse birds from the areas nearest to the intake structures to other areas of the reservoir. Under the Kensico Program, dispersion activities are conducted daily from August 1st to March 31st for up to 13½ hours per day. At Rondout, Ashokan, and West Branch Reservoir, the peak period of dispersion activities would be expected to occur in December and January and activities may extend from November to March. Infrequently, the program may need to extend beyond these periods. During the implementation period, activities may need to be employed only on an intermittent basis. The program is expected to last for three to four hours on a given day, from two hours before sunset to one to two hours after sunset, although on rare occasions, activities may need to be conducted for up to six hours prior to sunset. As discussed above, implementation at Croton Falls and Cross River Reservoirs would be limited to one month prior to anticipated start-up of the Reservoirs' pump stations and during operation, for the same general time periods (November to March) and durations (generally 4 hours per day).

B. WATER QUALITY

EXISTING CONDITIONS WITH RESPECT TO FECAL COLIFORM BACTERIA AND WATERBIRDS

RONDOUT RESERVOIR

Review of FCB and waterbird count data for Rondout Reservoir suggests the following:

- The potential for high FCB concentrations, particularly those greater than 20 CFU/100 mL, is greatest from October through March.
- Periods of high FCB concentration from October through March coincide with high numbers of waterbirds near the intake. The "other waterbird" category (primarily ducks) and gulls dominate the waterbird counts during this period of the year.

- An annual phenomenon exists at Rondout Reservoir, where gulls switch their typical roosting location from mid-reservoir (Zones 2 and 2.5) to near the intake (Zone 1).
- At Rondout Reservoir, the highest numbers of waterbirds occur in the zones close to the intake, Zones 1 and 2, followed by medium dispersion zones farther up-reservoir, Zones 2.5 and 4.
- Due to the infrequency of waterbird counts and suspected higher frequency of waterbird population changes due to migrational stopovers, some high counts may be missed. Large numbers of migrants may stop over for a night to a few nights, which can be missed by the biweekly surveys, thereby impacting water quality for short periods of time. Geese may occur in large numbers in mid-to-late summer as their migrations begin (typically September for New York). Terrestrial and aquatic wildlife species other than waterbirds are also more prevalent during this time of year and may at times, depending on their activity, impact water quality.
- Increases in FCB concentration during the summer do not appear to be related to waterbirds, since waterbird counts were low. The occasional increases in FCB concentrations in the summer may be attributed to a number of factors, or combinations of factors, occurring within the reservoir and its watershed such as stormwater from precipitation events, changes in operations of existing land uses such as agricultural operations, events at sewage treatment plants, failure of septic systems, etc.
- Some limnological stations exhibited elevated FCB concentrations in November or December as waterbird counts were increasing. Limnological samples were often not taken in other months of the year when waterbird counts were high (January through March) due to ice or other adverse weather conditions at the reservoir.

The high waterbird count recorded in January 1998 corresponds to increased FCB concentrations at the keypoint sampling stations at the intake. The high waterbird counts observed in December 2000 correspond to the increases in FCB concentrations at the limnological stations and FCB concentrations greater than 20 CFU/100 mL at most of the keypoint stations including the aqueduct station between December 2000 and January 2001. Similarly, the elevated waterbird counts in December 2002 correspond to elevated FCB counts at the limnological stations and FCB concentrations greater than 20 CFU/100 mL at the keypoint stations located at the intake structure and the intake between December 2002 and January 2003. In general, most of the waterbirds are located in waterbird dispersion Zone 1 during the October through January period, the zone closest to the dam and the intake for the aqueduct. Therefore, the FCB data and waterbird count data demonstrate that during some periods of the year, typically during the early winter period from December through January, waterbird counts at the reservoir may be sufficiently high in the portion of the reservoir closest to the intake to raise FCB concentrations to unacceptable levels.

ASHOKAN RESERVOIR

Review of FCB and waterbird count data for Ashokan Reservoir suggests the following:

- The potential for high FCB concentrations, particularly those greater than 20 CFU/100 mL, is greatest from January through April and November through December.

- Periods of high FCB concentration from November through April coincide with high numbers of waterbirds. The "other waterbird" category and gulls dominate the waterbird counts during this period of the year.
- At Ashokan Reservoir, the highest numbers of waterbirds occur in Zones 4, 5, and 6 located in the East Basin, the basin from which water is typically released into the aqueduct.
- Due to the infrequency of waterbird counts and suspected higher frequency of waterbird population changes due to migrational stopovers, some high counts may be missed. Large numbers of migrants may stop over for a night to a few nights, which can be missed by the biweekly surveys, thereby impacting water quality for short periods of time. Geese may occur in large numbers in mid-to-late summer as their migrations begin (typically September for New York). Terrestrial and aquatic wildlife species other than waterbirds are also more prevalent during this time of year and may at times, depending on their activity, impact water quality.
- The generally low summertime average waterbird count per month does not appear to account for the occasional increase in FCB concentration during the summer (such as 1996 and 1998) at the limnological stations and keypoint stations described in the previous section. The occasional increases in FCB concentrations at the water quality stations in the summer may be attributed to a number of factors or combinations of factors occurring within the reservoir watershed such as stormwater from precipitation events, changes in operations of existing land uses such as agricultural operations, events at sewage treatment plants, failure of septic systems, etc.
- The increase in waterbird counts through the fall to early winter period does parallel the gradual increase in FCB concentration at the limnological stations, and the generally elevated FCB concentration at the keypoint stations next to the dam that occurs from October through December, and the elevated FCB concentrations at the keypoint stations in the January through April period. However, limnological samples were often not taken in early months of the year (January through March) when waterbird counts were high due to ice or other adverse weather conditions at the reservoir.

The high waterbird counts observed in January through April, and October through December generally correspond to occasional increases in FCB concentrations above 20 CFU/100 mL at the keypoint stations. Similarly, the high waterbird counts in the October through December period generally correspond to occasional elevated FCB concentrations at the limnological stations.

The waterbird counts and FCB concentrations suggest that there are circumstances where high numbers of waterbirds in Zones 4, 5, and 6 during the late winter to early spring, and fall through early winter periods, result in FCB concentrations that approach or are greater than 20 CFU/100 mL in and near the intake.

WEST BRANCH RESERVOIR

Review of FCB and waterbird count data for West Branch Reservoir suggests the following:

- The potential for high FCB concentrations, particularly those greater than 20 CFU/100 mL, is greatest from August through March During this period, operational changes at the reservoir may not be sufficient to bring the FBC concentration below 20 CFU/100 mL consistently at the intake to the aqueduct.

- Periods of high FCB concentration from August through March coincide with high numbers of waterbirds. The "other waterbird" category and gulls dominate the waterbird counts during this period of the year.
- At West Branch Reservoir, the highest numbers of waterbirds occur in Zones 1 and 3.
- Due to the infrequency of waterbird counts and suspected higher frequency of waterbird population changes due to migrational stopovers, some high counts may be missed. Large numbers of migrants may stop over for a night to a few nights, which can be missed by the weekly surveys, thereby impacting water quality for short periods of time. Geese may occur in large numbers in mid-to-late summer as their migrations begin (typically September for New York). Terrestrial and aquatic wildlife species other than waterbirds are also more prevalent during this time of year and may at times, depending on their activity, impact water quality.
- The generally low average waterbird count during the summer per month does not appear to account for the occasional increase in FCB concentration during these same months (such as 1996, 2000, 2001, and 2002) at the limnological stations and at the keypoint station DEL10 at the aqueduct (1995, 1996, 1998, 1999, and 2001). The occasional increases in FCB concentrations at the water quality stations in the summer may be attributed to a number of factors or combinations of factors occurring within the reservoir watershed such as stormwater from precipitation events, changes in operations of existing land uses such as agricultural operations, events at sewage treatment plants, failure of septic systems, tributary streams such as Horse Pound Brook, Long Pond, and Gypsy Trail.
- Limited coliphage analyses conducted on samples collected in 1996 from the Delaware influents and effluents and streams indicated that FCB in the aqueduct effluent are primarily from non-human sources, and FCB in the streams are primarily of human origin.
- The increase in waterbird counts from August through December parallels the gradual increase in FCB concentration observed consistently at the limnological stations, and the generally elevated FCB concentration at the keypoint station DEL10 during this same period. The correspondence of high waterbird count to elevated FCB concentration is less consistent from January through April, when waterbird numbers are high but not as high as the fall. However, limnological samples were often not taken in early months of the year (January through March) when waterbird counts were high due to ice or other adverse weather conditions at the reservoir.

The high waterbird counts observed from January through March, and August through December, generally correspond to occasional increases in FCB concentrations above 20 CFU/100 mL at the keypoint station, and at the limnological stations (August through December). In general, most of the high waterbird counts occurred in Zone 1 (closest to the dam).

The waterbird counts and FCB concentrations suggest that there are circumstances where high numbers of waterbirds in Zone 1 may result in FCB concentrations that may be greater than 20 CFU/100 mL near the intake, and may result in unacceptable FCB concentrations.

CROTON FALLS RESERVOIR

Review of FCB and waterbird count data for Croton Falls Reservoir suggests the following:

- The potential for high FCB concentrations, particularly those greater than 20 CFU/100 mL, is greatest from June through August and from October through March. During this period, operational changes at the reservoir may not be sufficient to bring the FCB concentration below 20 CFU/100 mL consistently at reservoir discharge.
- In 2002, periods of elevated FCB concentration (but below 20 CFU/100 mL) in December coincided with high numbers of waterbirds near the dam.
- At Croton Falls Reservoir, the highest numbers of waterbirds occur in Zone 2, the area closest to the reservoir discharge.
- Due to the infrequency of waterbird counts and suspected higher frequency of waterbird population changes due to migrational stopovers, some high counts may be missed. Large numbers of migrants may stop over for a night to a few nights, which can be missed by the biweekly surveys, thereby impacting water quality for short periods of time. Geese may occur in large numbers in mid-to-late summer as their migrations begin (typically September for New York). Terrestrial and aquatic wildlife species other than waterbirds are also more prevalent during this time of year and may at times, depending on their activity, impact water quality.
- The occasional increase in FCB concentrations at the limnological stations and the keypoint station CROFALLS (stream release) occurred during the summer of 2002 when waterbird numbers are reportedly low. This same trend of occasional increases in FCB concentrations in the water quality samples during the summer was also observed in 1995, 1996, 1997, 1998, 1999, and 2000 at the limnological stations, and at the keypoint station CROFALLS in 1995, 1997, 1998, 1999, 2000, 2001, and 2002), some of which were above 20 CFU/100 mL. As discussed previously for Rondout, Ashokan, and West Branch Reservoirs, the occasional increases in FCB concentrations at the water quality stations in the summer may be attributed to a number of factors or combinations of factors occurring within the reservoir watershed such as extreme precipitation events, changes in operations of existing land uses such as agricultural operations, events at sewage treatment plants, failure of septic systems, etc.

The increase in waterbird count in December coincides with a slight increase in FCB concentration observed at the limnological stations in 2002. This pattern of increasing FCB concentration in the fall to early winter period was also observed in 1997, 1999, and 2001. Additionally, the increased waterbird count observed in February and December of 2002 coincides with slight peaks in FCB concentration at the stream release station CROFALLS during these periods, although the peaks were less than 20 CFU/100 mL. This same pattern of elevated FCB concentrations at the reservoir discharge in January to March and December was seen in the other years of the 1995 to 2002 time period for the FCB data. However, limnological samples were often not taken in early months of the year (January through March) when waterbird counts were high due to ice or other adverse weather conditions at the reservoir.

Although only limited total waterbird data are available for Croton Falls Reservoir, the abundance pattern is similar to that seen at Rondout, Ashokan, and West Branch Reservoirs—high waterbird counts from December through March that are associated with elevated FCB concentrations at water quality stations. The high waterbird counts observed in December 2001, and January, February, March and December of 2002 generally correspond to peaks in FCB concentrations at the reservoir stream release station, although FCB concentrations remained below 20 CFU/100 mL. Similarly, the high waterbird counts in February and December

generally correspond to elevated FCB concentrations at the limnological station (1CCF) closest to the dam that were not above 20 CFU/100 mL. Most of the high waterbird counts occurred in Zone 2.

The waterbird counts and FCB concentrations suggest that there are circumstances, in the fall through early spring, where high numbers of waterbirds in Zone 2 may result in FCB concentrations that may be greater than 20 CFU/100 mL near the dam, and may result in FCB concentrations in the water being discharged from the reservoir that are greater than 20 CFU/100 mL.

CROSS RIVER RESERVOIR

Both FCB and waterbird count data for Cross River Reservoir are limited. Liminology data, which reflect FCB levels in the reservoir, are not available for December through March, and waterbird counts were taken in only five months of one year. However, several preliminary conclusions can be suggested from a review of the available FCB and waterbird count data as follows:

- In November 2002, periods of elevated FCB concentration at the limnological station from Cross River Reservoir coincided with high numbers of waterbirds near the dam. During this same period, FCB concentrations at the stream release station (CROSSRVR) showed an increase in mid-November, but remained below 20 CFU/100mL.
- The waterbird count in March and April of 2002 does not appear to correspond to distinct increases in FCB concentrations during the same time period.
- Although waterbird data for Cross River Reservoir are only available for 2002, the abundance pattern is similar to that seen at Rondout, Ashokan, West Branch, and Croton Falls Reservoirs—higher waterbird counts in the late-fall through early spring period.
- Due to the infrequency of waterbird counts and suspected higher frequency of waterbird population changes due to migrational stopovers, some high counts may be missed. Large numbers of migrants may stop over for a night to a few nights, which can be missed by the biweekly surveys, thereby impacting water quality for short periods of time. Geese may occur in large numbers in mid-to-late summer as their migrations begin (typically September for New York). Terrestrial and aquatic wildlife species other than waterbirds are also more prevalent during this time of year and may at times, depending on their activity, impact water quality.
- The generally low waterbird count during the summer of 2002 does not appear to account for the occasional increase in FCB concentration at the limnological station (none of which were above 20 CFU/100 mL) and at the station CROSSRVR (stream release) during these months. Some of the summer peaks at CROSSRVR were above 20 CFU/100 mL. This same trend of occasional increases in FCB concentrations in the water quality samples during the summer was also observed in 1998, 1999, 2000 and 2001 at the limnological station (none were above 20 CFU/100 mL), and at the station CROSSRVR in 1995, 1996, 1997, 1998, 1999, 2000, and 2001), some of which were above 20 CFU/100 mL. As discussed previously for Rondout, Ashokan, West Branch, and Croton Falls Reservoirs, the occasional increases in FCB concentrations at the water quality stations in the summer may be attributed to a number of factors or combinations of factors occurring within the reservoir watershed such as extreme precipitation events, changes in operations of existing land uses

such as agricultural operations, events at sewage treatment plants, failure of septic systems, etc.

Over time, as more waterbird count survey data are collected by NYCDEP at Cross River Reservoir, and more information becomes available on the seasonal patterns and locations of birds within the reservoir, NYCDEP may refine the waterbird management program. Adjustments may be made, for example, to redefine high dispersion usage areas. However, the current size of high dispersion usage zones will not be expanded beyond the current proposed areas, which were conservatively estimated.

PROBABLE IMPACTS OF THE EXPANDED PROGRAM ON FECAL COLIFORM BACTERIA AND PATHOGENS

CURRENT WATERFOWL MANAGEMENT PROGRAM AT KENSICO RESERVOIR

The proposed Expanded Waterfowl Management Program is an outgrowth of the measures undertaken by NYCDEP over the past 10 years to monitor and manage waterbirds on Kensico Reservoir to reduce seasonal increases in FCB concentrations. The history and success of the Waterfowl Management Program at Kensico Reservoir in reducing FCB concentrations and maintaining levels that are in compliance with the Surface Water Treatment Rule serves as the basis for evaluating probable impacts at the five additional reservoirs.

FCB Levels

Prior to implementation of the Kensico Waterfowl Management Program in late 1993, FCB concentrations peaked in the Kensico Reservoir every autumn and occasionally approached the maximum allowable limits of the Surface Water Treatment Rule (SWTR) in the diversion. NYCDEP initiated a comprehensive program in 1993 to identify, assess, and eliminate or reduce all known sources of FCB entering the Kensico Reservoir.

The Kensico Waterfowl Management Program, first implemented in December 1993, has been one of the most successful and cost-effective watershed management programs developed by NYCDEP. As shown in Figure ES-7, the program has lead to dramatic decreases in the levels of FCB in Kensico Reservoir. Since the inception of the Waterfowl Management Program, the primary water quality objectives have been met, namely the reduction of FCB at Kensico Reservoir's effluent chambers. FCB levels have remained in compliance with the SWTR at each of Kensico's effluent water sampling locations. As a result NYCDEP has been able to maintain flow through operations at Kensico Reservoir since 1993.

Waterbird Counts

Kensico Reservoir hosts numerous waterbirds including a breeding population of Canada geese and a migratory overwintering population of three species of gulls, double-crested cormorants, and numerous ducks and duck-like species. At Kensico Reservoir, Canada goose, ring-billed gull (*Larus delawarensis*), and herring gull (*Larus argentatus)* are the dominant species and are the most significant populations that impact the reservoir. Seasonal population increases of waterbirds generally begin in August and persist through early April. During this period, waterbirds primarily use the reservoir for overnight roosting.

Total waterbird counts (see Figure ES-8) have dropped dramatically at Kensico Reservoir, particularly during the peak waterbird count period of August through March, since the Waterfowl Management Program was implemented in December 1993. In 1992 and 1993, the

highest average monthly waterbird count in any zone during the August to March peak waterbird period was about 1,400 waterbirds. For the post-Waterfowl Management Program period (1994 through 2002) the highest average monthly waterbird count in any zone during the August to March period was about 950 waterbirds in February 1995, during a period when NYCDEP was restricted to implementing the program with only limited in-house resources. Since 1996, the difference between pre- and post-Waterfowl Management Program implementation has been even more dramatic—from 1996 to 2002 the highest monthly average waterbird count in any one zone was approximately 250 waterbirds in January 2001. This dramatic decrease in waterbird counts during the peak waterbird abundance period generally coincides with the decreased FCB concentrations and decrease in the frequency of peak concentrations greater than 20 CFU/100 mL observed at the limnological stations and keypoint stations at the outflows.

In addition, controlling the productivity of resident Canada goose nests along the reservoir through egg addling and nest destruction significantly reduced productivity at the reservoir since these efforts began in 1994, helping to maintain the lower FCB concentrations observed in the summer. Although successful at essentially eliminating productivity, it has had little overall effect on the annual breeding populations except for a couple of years of fluctuations.

Microbiology Studies

Considerable progress has been made in developing and applying methods based on microbiology, molecular biology, and biochemistry for determining the sources of FCB to Kensico Reservoir. The goal of the coliform research has been to determine whether FCB in the reservoir water column, in the incoming streams, and in the waters leaving the reservoir via the aqueducts come from geese, gulls, humans, or other sources such as wild or domestic animals. NYCDEP microbiologists have attributed FCB in the reservoir to waterfowl and gulls.

Fecal samples from Canada geese, ring-billed gulls, and great black-backed gulls have been collected for various types of analysis including FCB counts, enumeration and serotyping of coliphages (viruses that infect *Escherichia coli* bacteria), serology and electrophoretic studies, and fatty acid analysis. The majority of FCB isolated from the reservoir was identified as *E. coli* and thus it has become a target organism for many of the bacteriological studies. Serology and electrophoretic results indicated a link between the *E. coli* collected from ring-billed gull and Canada goose feces and *E. coli* collected from Delaware effluent chamber.

NYCDEP conducted a study with F+ RNA coliphages and coliform bacteria on water samples collected from 1992-1994 including samples taken before, during, and after the cyclic peak of fecal contamination. The results of this study strongly suggested that nonhuman animals were the source of the annual cyclic elevation of FCB concentration in the reservoir.

Ratios of *Streptococcus* and *Enterococcus* bacteria were studied in 1993-1994 to provide supplemental data for determining sources of FCB contamination to Kensico Reservoir. The data collected showed that at the time of the coliform peak in 1993, the strep bacteria were elevated along with the FCB, suggesting that the fecal strep were most likely of non-human origin.

Further coliphage studies were performed in 1994-1996, after initiation of the Waterfowl Management Program. In 1994-1995, the first complete year of the Waterbird Management Program, coliphage and FCB concentrations dropped considerably. However, when coliphages were measured during the second full year of waterbird management in December 1995, several coliphages of non-human origin were detected. Although waterbird counts on the reservoir were low compared to earlier years, the number of waterbirds did increase during the month of December, which may have accounted for the elevated coliphages during this sampling event. A

survey was performed again in March 1996 and coliphages were detected when waterbird counts were not elevated. Run-off was ruled out as a source of the coliphages because there was no significant rainfall on or recently prior to the survey. Further coliphage sampling was conducted in April 1996 of water entering the reservoir from the Delaware and Catskill Aqueducts. The data strongly suggested that the upstate reservoirs were a source of coliphages to Kensico Reservoir and that waterbirds are a significant source of FCB in the upstate reservoirs.

Preliminary results from microbiological studies being conducted by the University of Washington and NYCDEP suggest that sources of *E. coli* levels observed at Kensico Reservoir are primarily avian (41 percent), followed by wildlife (29 percent) and other sources (30 percent, such as agricultural sources, humans, or domestic pets).

Rye Lake Case Study

Rye Lake is part of Kensico Reservoir, forming an extension of the reservoir to the east. Water quality sampling conducted at Rye Lake by the Westchester Joint Water Works (WJWW) documented increased FCB and total coliform bacteria concentrations in November and December 2002. FCB concentrations ranged from about 75 to 230 CFU/100 mL. The sources of the increased FCB and total coliform increases were identified by NYCDEP and WJWW as:

- High waterbird counts on Rye Lake from early to mid-December 2002.
- Increased number of gulls at Rondout Reservoir—which discharges to Kensico Reservoir, typically via West Branch Reservoir—in mid-December 2002 (monthly average of about 1,600 waterbirds) that contributed to FCB concentrations above 20 CFU/100 mL in the water discharged to the Delaware Aqueduct for much of December.
- Seasonal turnover of Rye Lake which likely occurred some time between November 25 and December 1, 2002. NYCDEP data suggests that the main basin of Kensico Reservoir, which is about the same depth as the Rye Lake at the WJWW intake, turned over some time during this time frame. Increases in FCB concentrations may occur as a result of redistribution of bottom waters that may have elevated levels of FCB.
- Discharges from the Delaware Aqueduct to Kensico Reservoir were eliminated for the period from November 29 until December 11, 2002. The cessation of flow from the aqueduct greatly reduced the movement of water in Rye Lake toward Kensico Reservoir.

The observed decrease in FCB concentration in late December 2002 and January 2003 at Rye Lake was likely due to a decrease in the number of waterbirds at the lake that resulted from continued and targeted waterbird management measures implemented by NYCDEP on Rye Lake, combined with routing the water from the Delaware Aqueduct through West Branch to settle out turbidity and bacteria, and the implementation of waterbird harassment measures at Rondout Reservoir at the end of December.

CASE STUDIES AT RESERVOIRS UNDER STUDY

In addition to the positive water quality impacts recorded at the Kensico Reservoir from waterbird management, three case studies of the effects of short-term implementation of waterbird management measures were examined, two at Rondout Reservoir (12/22/00 to 1/16/01 and 12/30/02 to 1/14/03), and one at Croton Falls Reservoir (1/12/02 through 1/28/02), to assess the potential effect of waterfowl management on FCB concentration at the five reservoirs.

Rondout Reservoir

NYCDEP implemented short-term waterbird management measures at Rondout Reservoir during two periods, described below, when waterbird counts were high and FCB concentrations at the keypoint sampling stations at the intake were elevated.

Case Study 12/22/00 to 1/16/01. In response to elevated FCB levels, NYCDEP employed waterbird dispersion measures from December 22, 2000 to January 16, 2001. This section describes the dispersal techniques used, and FCB levels and waterbird counts before, during and after the dispersal measures were implemented.

Figure ES-9 illustrates the following for the period of November 6, 2000 through April 5, 2002:

- The FCB concentration at the following locations:
  - Keypoint stations located at different depths at the intake—Stations RR1, RR2, RR3 and RR4.
  - Keypoint station within the effluent chamber, downstream of the intake—Station RDRR.
- The total waterbird count at Zones 1, 1.5, and 2 (proposed high waterbird dispersion zones).
- The start (December 22, 2000) and end (January 16, 2002) of short-term waterbird management measures.

As illustrated in Figure ES-9, average waterbird counts within the three high dispersion zones dropped considerably upon implementation of waterbird management measures. FCB concentrations at the intake (Stations RR1, RR2, RR3, and RR4), and most importantly, in the water entering the aqueduct (Station RDRR and RDRRECMT), dropped quickly to below 20 CFU/100 mL. The average waterbird counts in Zones 1, 1.5, and 2 dropped by more than half from the high of 1,400 in the period from December 22, 2000 to January 16, 2001. Although waterbird counts were still considerable during this period, fluctuating between about 100 and 600 waterbirds, they were not numerous enough to cause FCB concentrations to rise above 20 CFU/100 mL.

Case Study 12/30/02 to 1/14/03. In response to elevated FCB levels, NYCDEP employed waterbird dispersion measures from December 30, 2002 to January 14, 2003. This section describes the dispersal techniques used, and FCB levels and waterbird counts before, during and after the dispersal measures were implemented.

Figure ES-10 illustrates the following for the period of November 6, 2002 through April 5, 2003:

- The FCB concentration at the following locations:
  - Keypoint stations located at different depths at the intake—Stations RR1, RR2, RR3 and RR4.
  - Keypoint station within the effluent chamber, downstream of the intake—Station RDRRECMT.
- The total waterbird count at Zones 1, 1.5, and 2 (proposed high waterbird dispersion zones).

As illustrated in Figure ES-10, FCB concentrations at the intakes (Stations RR1, RR2, RR3, and RR4) and in the water entering the aqueduct (RDRRECMT) dropped to below 20 CFU/100 mL shortly after implementing waterbird management measures at the two zones closest to the

reservoir diversion. The average waterbird counts in Zones 1, 1.5, and 2 dropped by more than 75 percent from the high of 1,800 in the period from December 22, 2000 to January 16, 2001. Although waterbird counts in these three zones were considerable during this period, fluctuating between just a few waterbirds to about 450 waterbirds, they were not numerous enough to cause FCB concentrations to rise above 20 CFU/100 mL.

Croton Falls Reservoir

In response to elevated FCB levels, NYCDEP employed waterbird dispersion measures from January 12 through January 28, 2002. This section describes the dispersal techniques used, and FCB levels and waterbird counts before, during and after the dispersal measures were implemented.

Figure ES-11 illustrates the following for the period of November 11, 2001 through March 31, 2002:

- The FCB concentration at the following locations:
  - Limnological stations—Stations 1CCF and 2CCF.
  - Stream release/hydrology station downstream of the reservoir—Station CROFALLS.
- The total waterbird count at Zones 1 and 2 (proposed high waterbird dispersion zones) from mid-December 2001, when waterbird monitoring began in this reservoir, to March 31, 2002.
- The start (January 12, 2002) and end (January 28, 2002) of short-term waterbird management measures.

As illustrated in Figure ES-11, average waterbird counts within the two high dispersion zones dropped immediately upon implementation of waterbird management measures on January 12, 2002, concurrent with a sharp decrease in FCB concentration at all of the water quality sampling sites. FCB concentration in reservoir discharge below the dam was below 20 CFU/100 mL within two days of initiating waterbird management measures. As with the other two case studies, dispersing waterbirds from the two zones closest to the reservoir discharge, for about a two-week period, was quickly able to bring the FCB concentration below 20 CFU/100 mL. Waterbird counts began to rise within two weeks of ending the short-term management measures, with a concurrent increase in FCB concentration.

PATHOGENS

In addition to minimizing FCB levels, the primary goal of the Expanded Program, the program would also reduce the potential for waterbirds to serve as a source of human pathogens to the New York City water supply. Waterborne outbreaks of disease are caused by pathogenic organisms such as protozoan parasites (specifically *Giardia* and *Cryptosporidium* species).

While certain human pathogens have been isolated from goose, gull or duck feces, including *Giardia* spp., *Cryptosporidium parvum*, *Chlamydia psittaci*, *Campylobacter jejuni*, and *Listeria* spp., current studies suggest limited risk to human health based on low frequency of occurrence. Although the risk to human health from waterbird-derived pathogens is generally low, large concentrations of waterbirds in the immediate vicinity of a drinking water intake increases the potential for releasing these pathogens to the drinking water supply.

CONCLUSIONS

The results of the Kensico Program and the three case studies demonstrate the following:

- During certain periods of the year, primarily early to mid-winter, exceptionally high numbers of waterbirds within areas close to reservoir discharges may result in increased FCB concentrations in the reservoir and in the effluent from the reservoir.
- The coliphage analyses conducted by NYCDEP, further confirm that the increased FCB concentrations during these high waterbird count periods are likely associated with the presence of the waterbirds.
- Conducting short-term waterbird management measures (for two to three weeks) at Rondout and Croton Falls Reservoirs to disperse waterbirds from areas close to the reservoir outlets drastically and immediately reduced elevated FCB concentrations within the reservoirs and the reservoir discharge.
- Indications that FCB concentrations could be influenced by type of waterbird present—gulls versus others; variation in fecal matter composition among the waterbird species—pellet or loose; and roosting locations—ducks generally prefer the shallows and near the shoreline, whereas gulls prefer the open water where fecal matter and FCB are more likely to become entrained into the flow to the intake.

Therefore, during periods of sustained high FCB concentrations that coincide with large numbers of waterbirds (typically occurring from late fall through early spring), waterbird management measures that focus on dispersing waterbirds from the reservoir zones closest to reservoir outflows, can effectively and substantially reduce FCB concentrations in the water being released from the reservoir.

Certain human pathogens have been found in association with feces from geese and gulls. Dispersing waterbirds from the five reservoirs under the proposed Expanded Program would decrease the potential for waterbirds to serve as a source of these pathogens and for pathogens to enter the water supply system's tunnels and aqueducts.

POTENTIAL WATER QUALITY IMAPCTS FROM THE DISPLACEMENT OF WATERBIRDS TO OTHER LAKES, RESERVOIRS, AND WATER SUPPLY SYSTEMS AND FROM BOATS AND PYROTECHNICS

NYCDEP expects that under the Expanded Program, which is much more limited in scope than the program at Kensico Reservoir, waterbirds are likely to be dispersed to the areas of the five reservoirs that are not being actively managed with concentrated dispersion measures. However, a study was conducted to identify waterbodies within five miles of each reservoir to determine potential impacts if displacement to other waterbodies were to occur. The displacement of birds to other surface water supplies would not be expected to affect their ability to meet drinking water quality standards. Other than reservoirs that are part of New York City's Croton Water Supply System, all waterbodies that serve as drinking water supplies are filtered. The nearby reservoirs that are part of the Croton System are not terminal reservoirs. Due to the natural treatment that occurs as water flows from reservoir to reservoir prior to distribution, the additional birds would not be expected to affect the Croton System's ability to meet drinking water quality standards. However, the displacement of waterbirds to Class AA and A waters has the potential to significantly increase coliform levels in these waterbodies and could result in potential significant water quality impacts. (See "Mitigation" below, for measures proposed by

NYCDEP to mitigate these potential impacts.) For Class B and C waters, it is unlikely that displaced waterbirds would result in impairment of the best uses for these Classes and no potential significant impacts on water quality are expected to occur on these waters.

Due to the minimal input of pollutants associated with motorboats, airboats, and pyrotechnics and the large volume of water in the five reservoirs (approximately 9 to 103 billion gallons) the dispersion measures would not be expected to result in exceedances of water quality standards or any other significant water quality impacts.

C. LAND USE, ZONING, COMMUNITY CHARACTER, AND OPEN SPACE

INTRODUCTION

Community character, land use, zoning, community facilities, and open space can be affected by changes in noise, visual character, socioeconomic conditions, and traffic among other impacts. In the case of the proposed Expanded Program, no new structures would be constructed and traffic generated by the project would be negligible. As discussed in "Visual Resources" below, the avian deterrence and avian dispersion measures would not significantly alter views of or the visual character of the reservoirs. There would be no potential significant impacts on land use, community character, or open space from these affects of the proposed action and they are not discussed further in this section.

Therefore, the primary focus of this section is the affect of potential significant noise impacts on community character, land use, community facilities, and open space. As discussed in "Noise" below, noise levels generated by boats, pyrotechnics, and distress tapes would result in potential significant noise impacts to residents who live near the reservoirs, anglers who fish on the reservoirs, and other sensitive uses. At Rondout, Ashokan, and West Branch Reservoir, the peak period of dispersion activities would be expected to occur in December and January and activities may extend from November to March. Infrequently, the program may need to extend beyond these periods. During the implementation period, activities may need to be employed only on an intermittent basis. The program is expected to last for three to four hours on a given day, from two hours before sunset to one to two hours after sunset, although on rare occasions, activities may need to be conducted for up to 6 hours prior to sunset. Implementation at Croton Falls and Cross River Reservoirs would be limited to one month prior to anticipated start-up of the Reservoirs' pump stations and during operation, for the same general time periods (November to March) and durations (generally four hours per day).

The assessment provided below also reflects a peak hour condition in which 22 pyrotechnics would be launched within a 1-hour period. This peak condition was developed to estimate reasonable worst-case noise impacts and is not expected to occur often; more typical conditions would involve fewer pyrotechnics. Noise impacts would be localized during any given time since boats would be moving throughout the reservoir (primarily in the high dispersion areas) and pyrotechnic devices would be launched from various locations from boats or along the shoreline. Therefore, no one location is expected to experience these impacts over an extended time period. This is particularly true of the medium and low dispersion usage zones where waterfowl management measures are not expected to be used on a frequent basis.

Noise generated by the proposed Expanded Program may be inconsistent with public policies of the Towns of Carmel and Kent as set forth in the noise ordinances within their Town Codes and the Towns of Bedford and Lewisboro as set forth in the noise provisions of their zoning codes.

GENERAL OPEN SPACE IMPACTS

This section addresses open space impacts common to the five reservoirs. Reservoir-specific open space impacts are discussed under each reservoir below.

Under the Expanded Program, boats and pyrotechnics would be highly audible and visible to anglers fishing on the reservoirs from rowboats or the shoreline and could affect the attractiveness of the reservoirs for fishing and discourage fishing activities during periods when they are being used. The primary fishing season at the reservoirs runs from April 1st through November 30th, although there is some panfishing that occurs all year round and ice fishing is permitted at the East of Hudson Reservoirs. Avian dispersion measures are expected to be employed in the late afternoon and evenings from November through March, although on rare occasions, they could begin earlier in the fall and end somewhat later in the spring. While anglers who fish on the reservoirs in the late afternoon and evening in both the early spring and late fall could be deterred from fishing, it is not expected that the avian dispersion activities would substantially overlap with the fishing season, nor would they affect the majority of anglers using the reservoirs. Anglers fishing in the high dispersion usage zones could move to the medium and low dispersion areas during use of the pyrotechnics and boats. If anglers were present during the proposed management activities, NYCDEP would be sensitive to their presence by maintaining the maximum practical distance while still achieving the goals of the management program, reducing boat speed to minimize wake, and alerting the anglers of pyrotechnics usage prior to their discharge. Therefore, no potential significant impacts on angler use of the reservoirs would be expected to occur under the proposed Expanded Program.

Shoreline fencing and other avian deterrence measures, if implemented at the reservoir, would not limit access to the reservoirs for fishing and would not result in any potential significant open space impacts.

In addition, open spaces could be affected by the displacement of birds from the reservoirs. Birds, particularly geese, may be attracted to, and deposit droppings on, open lawn areas or waterbodies that lie within these open spaces. As described in “Natural Resources” below, these areas are likely to already be experiencing these problems since the waterbirds are prevalent throughout the area. In addition, under the Expanded Program NYCDEP would endeavor to disperse waterbirds from the areas around the intake to other areas within the reservoir and minimize their displacement from the reservoir. However, if displacement were to occur, it has the potential to compound existing problems that may already exist in some of these areas. The mitigation measures described in “Mitigation” below to address potential significant water quality impacts from bird displacement to other waterbodies will also minimize impacts to open space areas. The mitigation measures will include contacting local government agencies and surface water suppliers prior to employing avian dispersion measures and potentially modifying the implementation of these measures in response to reported increases in gulls and Canada geese in nearby areas due to NYCDEP’s program.

RONDOUT RESERVOIR

INTRODUCTION

Avian dispersion measures are expected to be used primarily in the eastern half of the reservoir in the high dispersion usage areas—Zones 1, 1.5, and 2—and would be employed considerably less frequently in the rest of the reservoir. The reservoir is surrounded by NYCDEP property containing a forested buffer that is narrow and sparse in many locations. In the eastern half of the reservoir there are areas with no or limited forested buffer areas. Beyond NYCDEP property and Route 55A to the north and Route 55 to the south are low-density residential homes. In the southeastern corner of the study area is the hamlet of Grahamsville. There is an Eagle Observation area on the far western end of the reservoir.

As presented in "Noise" below, it is anticipated that due to the avian dispersion measures, there would be significant noise impacts within certain distances of the reservoirs, depending on ice and non-ice conditions (see Figures ES-12 and ES-13 under "Noise" below). Under ice conditions, the potential impacted area where significant noise impacts could occur extends 1,080 feet from the reservoir's northern shoreline and 1,280 feet from the reservoir's southern shoreline during weekdays. On weekends, these areas would be 950 feet from the reservoir's northern shoreline and 1,150 feet from the reservoir's southern shoreline. Under non-ice conditions, the potential impacted area where significant noise impacts could occur extends 690 feet from the reservoir's northern shoreline and 1,350 feet from the reservoir's southern shoreline during weekdays. On weekends, these areas would be 610 feet from the reservoir's northern shoreline and 1,270 feet from the reservoir's southern shoreline. As discussed above, dispersion activities rarely would be implemented outside the November to March period and would typically be implemented on an intermittent basis for three to four hours on a given day. Impacts would be more commonly experienced in the high dispersion areas than in the areas less actively managed under the program.

LAND USE AND COMMUNITY CHARACTER

Rondout Reservoir is located in a rural area and its quiet nature is a key defining element of its community character. Due to the significant noise impacts over large distances, there would be a potential significant impact on community character in the eastern half of the noise impact area that surrounds the high dispersion usage Zones 1, 1.5, and 2. In the western half of the study area, noise impacts are expected to occur considerably less frequently and, therefore, would not be expected to have a significant effect on community character. Potential noise impacts, particularly in the areas closest to the reservoirs, would be readily noticeable, intrusive, and significant. As discussed in "Noise" below, in many locations, the noise levels from pyrotechnic devices would be similar to other, more common impulsive noises experienced by the communities such as car door slamming, car horns, and gunshots from hunting. Throughout the noise impact area, the functional use of the residences and other land uses would not be significantly altered and the impacts are unlikely to result in changes to underlying land uses. The program would not have any significant visual character effects and, therefore, would not conflict with the Town of Neversink's Master Plan, which recommends maintaining views of Rondout Reservoir. There are no proposed developments or other land use and zoning changes within the impacted area under future No Action conditions.

COMMUNITY FACILITIES AND OPEN SPACE

There are several community facilities located within the noise impact area. These include the Tri-Valley School's playground and athletic field and a cemetery, both located in the southwestern section of the study area in the hamlet of Grahamsville. These facilities are not located near the high dispersion usage zones. Furthermore, no significant changes would occur to the functional use of the cemetery or the athletic field/playground, which is an active recreational use. Therefore, no potential significant impacts to community facilities are expected to occur under the proposed Expanded Program.

Potential significant noise impacts would also occur at open spaces within the study area including the Eagle Observation Area at the western end of the reservoir and on anglers who use the reservoir for fishing. Recreational users of the Eagle Observation Area could experience significant noise impacts when the pyrotechnics and boats are used in the medium dispersion zones on the western half of the reservoir. However, they are expected to be used less frequently in this half of the reservoir and would be used only during part of the year, for the most part outside of eagle nesting periods. Therefore, use of the avian dispersion measures is not expected to significantly alter the observation area or deter use of it by recreational users. (For impacts to eagles, see "Natural Resources" below.)

ASHOKAN RESERVOIR

INTRODUCTION

Avian dispersion measures are expected to be used primarily in the eastern half of the reservoir in the high dispersion usage areas - Zones 4, 5, and 6. These measures are expected to be employed considerably less frequently in the west basin of the reservoir. The reservoir is surrounded by NYCDEP property containing a thick, forested buffer in most locations and there are limited locations with views of the reservoir. Beyond NYCDEP property are low density residential homes and several community facilities. There is also a publicly accessible walkway along the dam on the southern edge of the reservoir.

As presented in "Noise" below, it is anticipated that due to the avian dispersion measures, there would be significant noise impacts within certain distances of the reservoirs, depending on ice and non-ice conditions (see Figures ES-14 and ES-15 under "Noise" below). Under ice conditions, the potential impacted area where significant noise impacts could occur extends 520 feet from the reservoir's northern shoreline and 1,360 feet from the reservoir's southern shoreline during weekdays. On weekends, these areas would be 560 feet from the reservoir's northern shoreline and 1,410 feet from the reservoir's southern shoreline. Under non-ice conditions, the potential impacted area where significant noise impacts could occur extends 400 feet from the reservoir's northern shoreline and 930 feet from the reservoir's southern shoreline during weekdays. On weekends, these areas would be 430 feet from the reservoir's northern shoreline and 960 feet from the reservoir's southern shoreline. As discussed above, dispersion activities rarely would be implemented outside the November to March period and would typically be implemented on an intermittent basis for three to four hours on a given day. Impacts would be more commonly experienced in the high dispersion areas than in the areas less actively managed under the program.

LAND USE AND COMMUNITY CHARACTER

The noise impact area is entirely comprised of NYCDEP-owned land to the north of the reservoir and largely comprised of NYCDEP-owned land to the south of the reservoir. Furthermore, community character in the northern half of the noise impact area would not be significantly affected by the changes to noise levels resulting from the proposed program due to the high traffic area along Route 28 that defines its character. There are small areas of primarily residential uses that border the land to the south of the reservoir (along Route 28A) that would be affected. In the southwestern half of the noise impact area that surrounds the medium (Zones 1 and 3) and low (Zone 2) dispersion usage zones of the west basin, noise impacts are expected to occur considerably less frequently and, therefore, would not have a significant effect on community character. Potential noise impacts, particularly in the areas closest to the reservoirs would be readily noticeable, intrusive, and significant. As discussed in "Noise" below in many locations, the noise levels from pyrotechnic devices would be similar to other more common impulsive noises experienced by the communities such as car door slamming, car horns, and gunshots from hunting. Throughout the noise impact area, the functional use of the residences and other land uses would not be significantly altered and the impacts are unlikely to result in changes to underlying land uses. There are no proposed developments or other land use and zoning changes within the impacted area under future No Action conditions, with the exception of a potential future use (residential or commercial) on a piece of property that fronts Route 28 in the Town of Hurley. Therefore, no significant impacts on land use, zoning, or community character are predicted to occur.

COMMUNITY FACILITIES AND OPEN SPACE

There are several community facilities located within the noise impact area. These include 2 churches (Living Word Chapel and Calvary Baptist Church) and Olive Free Library. The Calvary Baptist Church and Olive Free Library are in the study area adjacent to the low dispersion usage zone and noise impacts would be experienced infrequently. There is also a considerable forested buffer between the reservoir and these sites. Potential noise impacts at the Living Word Chapel would be highest (up to a 13.9 dBA change over existing noise levels under weekend ice conditions). However, these impacts would occur only during part of the year and typically in the late afternoon-to-dusk period. Potential noise impacts would be readily noticeable; however they would not significantly alter the church's ability to function. In addition, Maverick Concert Hall is located just outside the ½-mile study area. Concerts, particularly outdoor concerts at this facility, are considered to be a highly sensitive use. As discussed in "Noise" below no potential significant noise impacts are expected on this facility under the proposed action. Therefore, no potential significant impacts to community facilities are expected to occur under the proposed Expanded Program.

Potential significant noise impacts would also occur at open spaces within the study area including the publicly accessible walkway on top of the dam at the southern edge of the reservoir and on anglers who use the reservoir for fishing. The publicly accessible walkway runs along Zone 4, a potential high avian dispersion usage zone. Due to its proximity to the high dispersion usage areas, noise impacts from avian dispersion measures could discourage use of the walkway during the late afternoons and early evenings. However, the walkway is most heavily used in the late spring through early fall, while avian dispersion measures are expected to be employed in the late afternoon and evenings from November through March, although on rare occasions, they could begin earlier in the fall and end somewhat later in the spring. During these colder periods, the walkway is not heavily used in the late afternoon and early evening.

NYCDEP currently permits hunting of white-tailed deer on certain designated city-owned parcels and recently expanded the opportunities for deer hunting on city-owned land for the 2003 hunting season. Bow hunting of deer, introduced on a limited basis for the first time in thirty years last season, will be available this year at all NYCDEP hunting areas, in addition to regular gun and muzzleloader hunting. Of the city-owned lands adjacent to the five reservoirs under the Expanded Program, deer hunting will only be permitted in the area north of Ashokan Reservoir. These activities require a NYCDEP permit and are subject to restrictions to protect the water quality of New York City's reservoirs and for security reasons. As discussed in "Natural Resources" below, impulsive noises generated by the Expanded Program may result in startle response by deer. However, the impulsive noises generated by the Expanded Program would be similar to those of hunting. In addition, only part of the hunting area is located near the high dispersion usage areas under the Expanded Program. Furthermore, numerous other locations in the immediate vicinity are available for hunting including NYSDEC lands, other city-owned lands (Piney Point Road Unit, Wittenburg Unit, and South Mountain Unit), and other lands. Therefore, no potential significant impacts on open space would be expected to occur under the proposed Expanded Program.

WEST BRANCH

INTRODUCTION

Avian dispersion measures are expected to be used primarily in the southern half of the reservoir in the high dispersion usage areas—Zones 1 and 2. These measures are expected to be employed considerably less frequently in the rest of the reservoir. The reservoir is surrounded by NYCDEP property that contains a forested buffer in many locations and there are limited views of the reservoir. Beyond NYCDEP property are low density residential homes, some medium and high density residential area east of the reservoir, and several community facilities. Parks and open spaces include Nimham Mountain Multiple Use Area, located in the northern portion of the study area; Putnam County Veterans Memorial Park is part of this multiple use area.

As presented in "Noise" below, it is anticipated that due to the avian dispersion measures, there would be significant noise impacts within certain distances of the reservoirs, depending on ice and non-ice conditions (see Figures ES-16 and ES-17 under "Noise" below). Under ice conditions, the potential impacted area where significant noise impacts could occur extends 1,550 feet from the reservoir's shoreline during weekdays and 1,900 feet from the reservoir's shoreline during weekends. Under non-ice conditions, the potential impacted area where significant noise impacts could occur extends 830 feet from the reservoir's shoreline during weekdays and 1,020 feet from the reservoir's shoreline during weekends. As discussed above, dispersion activities rarely would be implemented outside the November to March period and would typically be implemented on an intermittent basis for three to four hours on a given day. Impacts would be more commonly experienced in the high dispersion areas than in the areas less actively managed under the program.

LAND USE AND COMMUNITY CHARACTER

In the northern portion of the noise impact area, in the areas surrounding avian dispersion usage Zones 3 (medium usage) and 4 (low usage), noise impacts are expected to occur fairly infrequently and therefore would not have a significant effect on community character. The noise impact area surrounding avian dispersion usage Zones 1 and 2 (high usage) is a fairly developed area, especially in the vicinity of Route 6, which traverses much of the area. Potential

noise impacts, particularly in the areas closest to the reservoirs would be readily noticeable, intrusive, and significant. As discussed in "Noise" below, in many locations, the noise levels from pyrotechnic devices would be similar to other more common impulsive noises experienced by the communities such as car door slamming and car horns. Throughout the noise impact area, the functional use of the residences and other land uses would not be significantly altered and the impacts are unlikely to result in changes to underlying land uses. There are no proposed developments or other land use and zoning changes within the impacted area under future no action conditions. Therefore, no significant impacts on land use, zoning, or community character are predicted to occur.

COMMUNITY FACILITIES AND OPEN SPACE

There is one community facility located within the noise impact area. The Raymond Hill Cemetery is in the noise impact area adjacent to the low dispersion usage zone and noise impacts would be experienced infrequently. In addition, it is at the edge of the noise impact area, so noise levels would not be expected to be at the level that would affect the functional uses of the cemetery. Therefore, no potential significant impacts on community facilities are expected to result from the proposed Expanded Program.

Potential significant noise impacts would also occur at open spaces within the study area including Nimham Mountain Multiple Use Area, Lake Gleneida, and on anglers who use the reservoir for fishing. In the impacted portions of the Nimham Mountain Multiple Use Area, there are hiking trails and roads (some of which may be used for bicycle riding and horseback riding) and hunting is allowed within the multiple use area. The impacted areas are adjacent to avian dispersion usage Zones 3 (medium usage) and 4 (low usage) and noise impacts are expected to occur fairly infrequently. In addition, dispersion measures would typically be used from late fall to early spring, whereas the multiple use area is most heavily used in the late spring through early fall. The noise impacts would occur in a small portion of the park and are unlikely to significantly affect the functional uses of the park, and the characteristics of the noise would not substantially differ from noises associated with hunting.

Potential significant noise impacts would be expected in the northwest and southwest corners of Lake Gleneida. The northwest corner is closest to a low dispersion area and would be impacted infrequently. The southwest corner is closest to a high dispersion usage zone; however, it is likely to be impacted only during ice conditions, when there would be few recreational users and it is at the edge of the noise impact area, so noise levels, while significant, would not be expected to be at the level that would affect the functional uses of the park.

Therefore, no potential significant impacts on open space would be expected to occur under the proposed Expanded Program.

CROTON FALLS

INTRODUCTION

Avian dispersion measures are expected to be used primarily in the southern half of the reservoir in the high dispersion usage areas—Zones 1 and 2. These measures are expected to be employed less frequently in the rest of the reservoir. Furthermore, at Croton Falls Reservoir, avian dispersion measures would only be used during periods when the pump station is being used or one month prior to anticipated start-up. As discussed in "Project Description" above, this is not expected to occur on a frequent basis.

The reservoir is surrounded by NYCDEP property containing a forested buffer in many locations and there are limited locations with views of the reservoir. Beyond NYCDEP property are primarily low-density residential homes, some medium density residential areas, and several community facilities. Parks and open spaces include a park located in the eastern portion of the study area, between the reservoir and the Metro-North Railroad (Harlem Line), southeast of Lower Mine Road.

As presented in "Noise" below, it is anticipated that due to the avian dispersion measures, there would be significant noise impacts within certain distances of the reservoirs, depending on ice and non-ice conditions (see Figures ES-18 and ES-19 under "Noise" below). Under ice conditions, the potential impacted area where significant noise impacts could occur extends 1,960 feet from the reservoir's shoreline during weekdays and 2,110 feet from the reservoir's shoreline during weekends. Under non-ice conditions, the potential impacted area where significant noise impacts could occur extends 960 feet from the reservoir's shoreline during weekdays and 1,140 feet from the reservoir's shoreline during weekends. Implementation would be limited to one month prior to anticipated start-up of the Reservoir's pump station and during its operation, for the same general time periods (November to March) and durations (generally four hours per day) as specified for the other reservoirs. Impacts would be more commonly experienced in the high dispersion areas than in the areas less actively managed under the program.

LAND USE AND COMMUNITY CHARACTER

In general, because avian dispersion measures would only be used during periods when the pump station is in use or one month prior to anticipated start-up, noise impacts would not occur on a frequent basis. In the northeastern portion of the noise impact area, in the areas surrounding avian dispersion usage Zones 3, 4 (medium usage) and 5 (low usage), noise impacts are expected to occur more rarely. The noise impact area surrounding avian dispersion usage Zones 1 and 2 (high usage) is a fairly developed area. Potential noise impacts, particularly in the areas closest to the reservoirs would be readily noticeable, intrusive, and significant. As discussed in "Noise" below, in many locations, the noise levels from pyrotechnic devices would be similar to other more common impulsive noises experienced by the communities such as car door slamming and car horns. Throughout the noise impact area, the functional use of the residences and other land uses would not be significantly altered and the impacts are unlikely to result in changes to underlying land uses. There are no proposed developments or other land use and zoning changes within the impacted area under future no action conditions. Therefore, no significant impacts on land use, zoning, or community character are predicted to occur.

COMMUNITY FACILITIES AND OPEN SPACE

Potential significant noise impacts would occur at the Putnam County Hospital, Stoneleigh Medical Center, Kozy Cottage Pre-School, St. Joseph's Catholic School and Camp Kiwi (preschool). At Stoneleigh Medical Center and Camp Kiwi, which are in the study area adjacent to the low and/or medium dispersion usage zones, noise impacts would be experienced very infrequently. Potenital noise impacts at the Putnam County Hospital would be highest (up to a 13.3 dBA change over existing noise levels under weekend ice conditions) and would be readily noticeable. However, total noise levels with the proposed program would not be expected to exceed 49.1 dBA ($L_{eq(1)}$) at the facility. With the window-wall attenuation provided at the hospital, interior noise levels would be within acceptable criteria and would not be expected to significantly alter the hospital's ability to function. Potential noise impacts at Kozy Cottage pre-

school would also be readily noticeable, however they would not significantly alter the preschool's ability to function. Potential noise impacts at St. Joseph's Catholic School are expected to occur during ice conditions, but outside normal operating hours. All noise impacts would be expected to occur infrequently—only during operation and one month prior to anticipated start-up of the pump station. Therefore, no potential significant impacts to community facilities are expected to occur under the proposed Expanded Program.

Potential significant noise impacts would also occur to anglers who use the Croton Falls Reservoir and Middle Branch Reservoir for fishing. In addition, a small portion of Lake Gilead would be affected by noise impacts. Significant noise impacts would be expected to occur on a small portion of the Middle Branch Reservoir at its southern end. The reservoir is closest to a medium dispersion usage area and would be impacted infrequently and only during ice conditions when there would be few anglers. It is at the edge of the noise impact area, so noise levels, while significant, would not be expected to be at the level that would significantly affect angler use and anglers could relocate to other areas of the reservoir.

Significant noise impacts would be expected in a small portion of the southwestern end of Lake Gilead. The southwest corner is closest to a high dispersion usage zone; however, it is likely to be impacted only during ice conditions, when there would be few recreational users and it is at the edge of the noise impact area. So, noise levels, while significant, would not be expected to be at the level that would affect angler use or other uses of the lake, and anglers could relocate to other areas of the lake.

CROSS RIVER

INTRODUCTION

Avian dispersion measures are expected to be used primarily in the high dispersion usage areas—Zones 1, 2 and 3. These measures are expected to be employed less frequently in Zone 4. At Cross River Reservoir, avian dispersion measures would only be used during periods when the pump station is being used or one month prior to anticipated start-up. As discussed in "Project Description" above, this is not expected to occur on a frequent basis.

The reservoir is surrounded by NYCDEP property containing a forested buffer in many locations. Beyond NYCDEP property are low-density residential homes, some medium-density residential north of the reservoir, and several community facilities. Parks and open spaces in the study area include Ward Pound Ridge Reservation on the eastern edge of the study area, the Palmer Lewis Wildlife Sanctuary in the southeastern portion of the study area, and Hunt Sanctuary in the northwestern portion of the study area.

As presented in "Noise" below, it is anticipated that due to the avian dispersion measures, there would be significant noise impacts within certain distances of the reservoirs, depending on ice and non-ice conditions (see Figures ES-20 and ES-21 under "Noise" below). Under ice conditions, the potential impacted area where significant noise impacts could occur extends 910 feet from the reservoir's northern shoreline and 1,630 feet from the reservoir's southern shoreline during weekdays. On weekends, these areas would be 1,190 feet from the reservoir's northern shoreline and 1,910 feet from the reservoir's southern shoreline. Under non-ice conditions, the potential impacted area where significant noise impacts could occur extends 560 feet from the reservoir's northern shoreline and 1,020 feet from the reservoir's southern shoreline during weekdays. On weekends, these areas would be 740 feet from the reservoir's northern shoreline and 1,220 feet from the reservoir's southern shoreline. Implementation would

be limited to one month prior to anticipated start-up of the Reservoir's pump station and during its operation, for the same general time periods (November to March) and durations (generally four hours per day) as specified for the other reservoirs. Impacts would be more commonly experienced in the high dispersion areas than in the areas less actively managed under the program.

LAND USE AND COMMUNITY CHARACTER

In general, because avian dispersion measures would only be used during periods when the pump station is in use or one month prior to anticipated start-up, noise impacts would not occur on a frequent basis. In the easternmost portion of the noise impact area, in the areas surrounding avian dispersion usage Zones 4 (medium usage), noise impacts are expected to occur more rarely. The noise impact area to the north of the reservoir is a fairly developed area, particularly in the vicinity of Route 35. The southern and eastern portions of the noise impact area are quiet in nature; however, noise impacts would occur infrequently. There are no proposed developments or other land use and zoning changes within the impacted area under future no action conditions in the Towns of Bedford and Lewisboro. In the Town of Pound Ridge, there is currently a proposal for a 3-lot subdivision on a parcel located at the intersection of Route 121 and Honey Hollow Road. Potential noise impacts, particularly in the areas closest to the reservoirs would be readily noticeable, intrusive, and significant. As discussed in "Noise" below, in many locations, the noise levels from pyrotechnic devices would be similar to other more common impulsive noises experienced by the communities such as car door slamming, and car horns. Throughout the noise impact area, the functional use of the residences and other land uses would not be significantly altered and the impacts are unlikely to result in changes to underlying land uses. Therefore, no significant impacts on land use, zoning, or community character are predicted to occur.

COMMUNITY FACILITIES AND OPEN SPACE

Potential significant noise impacts would occur at the southeastern corner of Four Wind Hospital, southern end of John Jay High School, Harvey School, Cross River Baptist Community Church (Route 121 and Reservation Road), a nursery school (Route 35 near Salem Road), American Legion Hall, and a community center (Mark Mead and Old Post Roads).

Only very small portions of the properties of Four Wind Hospital and John Jay High School are expected to be significantly affected by changes in noise levels and only on weekends during ice conditions, when school would not be in session. These facilities and the American Legion Hall lie at the edge of the noise impact area and, therefore, noise level changes are not expected to be large enough to alter their use. Potential significant noise impacts at Harvey School, the church, nursery school, and community center would typically occur in the late afternoon to early evening hours, on an infrequent basis, and, therefore, would not be expected to significantly alter their use. In addition, Caramoor is located just outside the ½-mile study area. Concerts, particularly outdoor concerts at this facility, are considered to be a highly sensitive use. As assessed in "Noise" below, no potential significant noise impacts are expected on this facility under the proposed action. Therefore, no potential significant impacts to community facilities are expected to occur under the proposed Expanded Program.

Potential significant noise impacts would also occur at open spaces within the study area including the western end of Ward Pound Ridge Reservation and on anglers who use the Cross River Reservoir for fishing including ice fishing. In Ward Pound Ridge Reservation, within the

noise impact area, there are hiking trails, an overlook (665-foot elevation), and "Leatherman's Cave." There are also lean-to camping structures just outside of the noise contours.

Only a very small portion of the Ward Pound Ridge Reservation in Lewisboro would be expected to fall within the noise impact area and only on weekends under ice conditions. The portion of the Ward Pound Ridge Reservation within Pound Ridge lies in the portion of the noise impact area that is adjacent to the medium dispersion usage zone (Zone 4) and noise impacts would be expected to occur infrequently. Dispersion measures would typically be used from late fall to early spring, whereas the open spaces are most heavily used in the late spring through early fall. For these reasons and due to the infrequent occurrence, any impacts are unlikely to significantly affect the functional uses of these open spaces. Therefore, no potential significant impacts on open space would be expected to occur under the proposed Expanded Program.

D. NOISE

COMPARISON TO OTHER COMMON NOISE SOURCES

This section provides a comparison of sound levels generated by the pyrotechnic devices, an uncommon noise source, with other more typical impulsive noise sources experienced by the communities surrounding the reservoirs. Common noise sources include a car door slam, a car horn, and shotgun (common in West of Hudson from hunting or gun clubs). Table ES-1 provides a comparison of the L_{max} noise levels from the various pyrotechnic devices with other impulsive type sounds at distances they are typically heard. Car door slamming and car horns are typically heard at much closer distances, while shotguns are heard over longer distances. Pyrotechnics and shotguns are assessed at 500 feet to allow for a comparison over similar distances. As shown in the table, the noise from pyrotechnic devices would be similar to other more common impulsive noises experienced by the communities.

Table ES-1
Common Impulsive Noise Sources and Levels

Noise Source	L_{max}
Train Horn	89 dBA @ 50 feet
Car Horn	87 dBA @ 25 feet
Car Door Slamming	78 dBA @ 15 feet
Shotgun	84 dBA @ 500 feet 77 @ 1,000 feet
Banger	89 dBA @ 500 feet from shoreline
Screamer	80 dBA @ 500 feet from shoreline
CAPA	83 dBA @ 500 feet from shoreline

Sources: Car Horn and Car Door Slamming – Field measurements taken on June 18, 2003.
Train horn– FTA/USDOT, "Transit Noise and Vibration Impact Assessment," 1995.

PROBABLE IMPACTS ON RECEPTORS

The noise impact assessment was performed for four scenarios - under ice conditions (weekday and weekend) and non-ice conditions (weekday and weekend). Impacted areas (those areas that exceed the impact criteria) are provided for each reservoir, under each scenario. In general, the impacted area would be larger under ice conditions than under non-ice conditions; and on weekends than on weekdays. In addition, an assessment is provided of noise impacts at sensitive uses such as community facilities (e.g., schools, health facilities, religious institutions), open spaces (parks and anglers fishing on the reservoirs), and outdoor concert pavilions.

It is important to note that in reviewing the results of the noise impact assessment and contour maps, predicted noise impacts would occur only when certain implementation criteria are met and during limited time periods. As discussed in "Project Description" above, NYCDEP would implement the avian dispersion measures at Ashokan, Rondout, and West Branch on an "as needed" basis based on implementation criteria. In addition, at Croton Falls and Cross River Reservoirs, the program would be implemented, based on these criteria, one month prior to anticipated start-up of the Reservoirs' pump stations and during pump station operation. The reservoirs' pump stations are used to pump water from these reservoirs to the Delaware Aqueduct during drought conditions. Therefore, it is expected that avian dispersion measures would be implemented infrequently at these reservoirs.

Based on these criteria and the experience of NYCDEP staff, dispersion activities are expected to occur primarily during December and January and may extend from November to March. Infrequently, the program may need to extend beyond these periods. During the implementation period, it is expected that the activities would be employed on an intermittent basis and would last for three to four hours on a given day, from two hours before sunset to one to two hours after sunset, although on rare occasions, activities may need to be conducted for up to six hours prior to sunset. The assessment provided below, including the contour maps, also reflects a peak hour condition in which 22 pyrotechnics would be launched within a one-hour period. This peak condition was developed to estimate reasonable worst case impacts and is not expected to occur often; more typical conditions would involve fewer pyrotechnics.

Noise impacts within the contour would be localized during any given time. Avian dispersion measures would be used primarily in the high dispersion areas of each reservoir, and less often in the less actively managed areas of the reservoirs. To be conservative, it was assumed that pyrotechnic devices would be launched from the shoreline and the boats would be traveling within 100 feet of the shoreline. In reality, boats would be moving throughout the reservoir (primarily in the high dispersion areas) and pyrotechnic devices would be launched from various locations from boats or along the shoreline. Therefore, no one location is expected to experience these impacts over an extended time period. This is particularly true of the medium and low dispersion usage zones where waterfowl management measures are not expected to be used on a frequent basis. Within the contour, noise levels would drop as one moves farther from the shoreline. Noise levels predicted at the closest receptors to the shoreline would not be experienced by the vast majority of the sensitive receptors located within the contour, which are generally located more than 300 feet from the shoreline.

RONDOUT RESERVOIR

Ice Conditions

As shown in Table ES-2and Figure ES-12, under the prescribed criteria, the potential impacted area where significant impacts could occur at residences and other sensitive receptor locations extends 1,080 feet from the reservoir's northern shoreline and 1,280 feet from the reservoir's southern shoreline during weekdays under ice conditions. On weekends, these areas would be 950 feet from the reservoir's northern shoreline and 1,150 feet from the reservoir's southern shoreline. There would be no potential significant impacts under the impulsive noise criteria (62 L_{Cdn}); at the nearest sensitive receptor (approximately 160 feet from the reservoir shoreline) the noise level from the pyrotechnics would be 55.3 L_{Cdn}.

Within the noise impact contour, peak hour noise level increases would range from 5 dBA near the contour edge to 24.4 dBA at the closest residences (approximately 160 feet from the reservoir shoreline). At the closest receptors, the proposed project would increase noise levels by up to 24.4 dBA compared to the lowest ambient noise level (which was estimated at 43.4 dBA) and these impacts would be lower for the majority of sensitive receptors in the contour, particularly during non-peak conditions. Changes of this magnitude would be readily noticeable and intrusive. As discussed above, dispersion activities would rarely be implemented outside the November to March period and would typically be implemented on an intermittent basis for three to four hours on a given day. Impacts would be more commonly experienced in the high dispersion areas than in the areas less actively managed under the program.

Within the noise impact contour there are approximately 53 residences of which approximately 14, or 27 percent, are located near the high dispersion usage zones. For the remaining 39 residences (73 percent) located near the medium dispersion usage zones, noise impacts would be not be expected to occur on a frequent basis.

In addition, potential significant noise impacts would occur at the athletic fields and playground of the Tri-Valley Central School and the Grahamsville Cemetery, both located in the southwestern section of the study area in the hamlet of Grahamsville, and at the Eagle Observation Area at the western end of the reservoir. These uses are not located near the high dispersion usage zones and therefore noise impacts would not be expected to occur on a frequent basis. Few anglers would be using the reservoir during ice conditions.

Non-Ice Conditions

As shown in Table ES-2 and Figure ES-13, the potential impacted area where significant impacts could occur at residences and other sensitive receptor locations extends 690 feet from the reservoir's northern shoreline and 1,350 feet from the reservoir's southern shoreline during weekdays under non-ice conditions. On weekends, these areas would be 610 feet from the reservoir's northern shoreline and 1,270 feet from the reservoir's southern shoreline. There would be no potential significant impacts under the impulsive noise criteria (62 L_{Cdn}); at the nearest sensitive receptor (approximately 160 feet from the reservoir shoreline) the noise level from the pyrotechnics would be 55.1 L_{Cdn}.

Table ES-2
Noise Levels within the Noise Impact Contour

Condition	Location	Distance	Lowest Existing Noise Level ($L_{eq(1)}$)	Total Noise Level with the Project ($L_{eq(1)}$)	Change ($L_{eq(1)}$)
Rondout Reservoir					
Ice Conditions/ Weekday	North Study Area	1,080 ft	46.0	50.9	4.9
	South Study Area	160 ft*	43.4	67.8	24.4
		1,280 ft	43.4	48.3	4.9
Ice Conditions/ Weekend	North Study Area	950 ft	47.6	52.6	5.0
	South Study Area	160 ft*	45.0	67.8	22.8
		1,150 ft	45.0	49.9	4.9
Non-Ice Conditions/ Weekday	North Study Area	690 ft	47.2	52.1	4.9
	South Study Area	160 ft*	35.7	64.7	29.0
		1,350 ft	35.7	40.7	4.9
Non-Ice Conditions/ Weekend	North Study Area	610 ft	48.9	53.8	4.9
	South Study Area	160 ft*	37.0	64.7	27.7
		1,270 ft	37.0	41.9	4.9
Ashokan Reservoir					
Ice Conditions/ Weekday	North Study Area	520 ft	54.8	59.8	5.0
	South Study Area	300 ft*	42.5	63.4	20.9
		1,360 ft	42.5	47.4	4.9
Ice Conditions/ Weekend	North Study Area	560 ft	54.0	59.0	5.0
	South Study Area	300 ft*	41.9	63.4	21.5
		1,410ft	41.9	46.8	4.9
Non-Ice Conditions/ Weekday	North Study Area	400 ft	53.9	58.8	4.9
	South Study Area	300 ft*	42.7	60.0	17.3
		930 ft	42.7	47.5	4.8
Non-Ice Conditions/ Weekend	North Study Area	430 ft	53.1	58.0	4.9
	South Study Area	300 ft*	42.0	60.0	18.0
		960 ft	42.0	47.0	5.0
West Branch Reservoir					
Ice Conditions/ Weekday		100 ft*	40.3	70.3	30.0
		1,550 ft	40.3	45.3	5.0
Ice Conditions/ Weekend		100 ft*	36.8	70.3	33.5
		1,900 ft	36.8	41.8	5.0
Non-Ice Conditions/ Weekday		100 ft*	44.5	67.3	22.8
		830 ft	44.5	49.4	4.9
Non-Ice Conditions/ Weekend		100 ft*	41.0	67.3	26.3
		1,020 ft	41.0	45.9	4.9
Croton Falls Reservoir					
Ice Conditions/ Weekday		100 ft*	36.3	70.3	34.0
		1960 ft	36.3	41.3	5.0

Table ES-2 (cont'd)
Noise Levels within the Noise Impact Contour

Condition	Location	Distance	Lowest Existing Noise Level ($L_{eq(1)}$)	Total Noise Level with the Project ($L_{eq(1)}$)	Change ($L_{eq(1)}$)
Ice Conditions/ Weekend		100 ft*	35.0	70.3	35.3
		2110 ft	35.0	39.9	4.9
Non-Ice Conditions/ Weekday	Typical	100 ft*	42.1	67.3	25.2
		960 ft	42.1	47.0	4.9
	Dead End	1200 ft	38.1	43.0	4.9
Non-Ice Conditions/ Weekend	Typical	100 ft*	39.0	67.3	28.3
		1140 ft	39.0	43.9	4.9
	Dead End	1390 ft	35.2	40.1	4.9
Cross River Reservoir					
Ice Conditions/ Weekday	North Study Area	910 ft	48.2	53.2	5.0
	South Study Area	100 ft*	39.6	70.3	30.7
		1630 ft	39.6	44.5	4.9
Ice Conditions/ Weekend	North Study Area	1190 ft	44.5	49.4	4.9
	South Study Area	100 ft*	36.7	70.3	33.6
		1910 ft	36.7	41.7	5.0
Non-Ice Conditions/ Weekday	North Study Area	560 ft	50.0	54.9	4.9
	South Study Area	100 ft*	41.0	67.3	26.3
		1020 ft	41.0	45.9	4.9
Non-Ice Conditions/ Weekend	North Study Area	740 ft	46.2	51.1	4.9
	South Study Area	100 ft*	37.9	67.3	29.4
		1,220 ft	37.9	42.7	4.9

* Closest receptor locations

Within the noise impact contour, peak hour noise level increases would range from 5 dBA near the contour edge to 29.0 dBA at the closest residences (approximately 160 feet from the reservoir shoreline). At the closest receptors the proposed project would increase noise levels by up to 29.0 dBA compared to the lowest ambient noise level (which was estimated at 35.7 dBA) and these impacts would be lower for the majority of sensitive receptors in the contour, particularly outside these peak conditions. Changes of this magnitude would be readily noticeable and intrusive. As discussed above, dispersion activities would rarely be implemented outside the November to March period and would typically be implemented on an intermittent basis for three to four hours on a given day. Impacts would be more commonly experienced in the high dispersion areas than in the areas less actively managed under the program.

Within the noise impact contour there are approximately 38 residences of which approximately 12, or 32 percent, are located near the high dispersion usage zones. For the remaining 26 residences (68 percent) located near the medium dispersion usage zones, noise impacts would not be expected to occur on a frequent basis.

In addition, potential significant noise impacts would occur at the athletic fields and playground of the Tri-Valley Central School and the Grahamsville Cemetery**,** both located in the southwestern section of the study area in the Hamlet of Grahamsville and at the Eagle

Observation Area at the western end of the reservoir. These uses are not located near the high dispersion usage zones and therefore noise impacts would not be expected to occur on a frequent basis. Potential significant noise impacts would also occur on anglers who use the reservoirs for fishing. The primary fishing season at Rondout Reservoir generally runs from April 1st through November 30th, while avian dispersion measures would be employed from late fall through early spring. Therefore, these measures are not expected to substantially overlap with the primary fishing season.

ASHOKAN RESERVOIR

Ice Conditions

As shown in Table ES-2 and Figure ES-14, the potential impacted area where significant impacts could occur at residences and other sensitive receptor locations extends 520 feet from the reservoir's northern shoreline and 1,360 feet from the reservoir's southern shoreline during weekdays under ice conditions. On weekends, these areas would be 560 feet from the reservoir's northern shoreline and 1,410 feet from the reservoir's southern shoreline. To the north of the reservoir, the impacted area falls completely within NYCDEP property and no potential significant impacts would result. There would be no potential significant impacts under the impulsive noise criteria (62 L_{Cdn}); at the nearest sensitive receptor (approximately 300 feet from the reservoir shoreline) the noise level from the pyrotechnics would be 51.5 L_{Cdn}.

Within the noise impact contour, peak hour noise level increases would range from 5 dBA near the contour edge to 21.5 dBA at the closest residences (approximately 300 feet from the reservoir shoreline). At the closest receptors, the proposed project would increase noise levels by up to 21.5 dBA compared to the lowest ambient noise level (which was estimated at 41.9 dBA) and these impacts would be lower for the majority of sensitive receptors in the contour, particularly outside these peak conditions. Changes of this magnitude would be readily noticeable and intrusive. As discussed above, dispersion activities would rarely be implemented outside the November to March period and would typically be implemented on an intermittent basis for three to four hours on a given day. Impacts would be more commonly experienced in the high dispersion areas than in the areas less actively managed under the program.

Within the noise impact contour there are approximately 158 residences of which approximately 94, or 59 percent, are located near the high dispersion usage zones. For the remaining 65 residences (41 percent) located near the medium and low dispersion usage zones, noise impacts would not be expected to occur on a frequent basis.

In addition, potential significant noise impacts would occur at two churches (Living Word Chapel and Calvary Baptist Church), the Olive Free Library, and the publicly-accessible walkway along the southern dam. Anglers would not be using the reservoir during ice conditions. The Calvary Baptist Church and Olive Free Library are in the study area adjacent to the low dispersion usage zone and noise impacts would be experienced infrequently. Noise impacts at the Living Word Chapel would be highest (an estimated 13.9 dBA change over existing noise levels under weekend ice conditions) and would be readily noticeable. However, these impacts would occur only during part of the year and typically in the late afternoon to dusk period.

Potential significant noise impacts would occur at the publicly accessible walkway on top of the dam that runs along Zone 4, a potential high avian dispersion usage zone. Dispersion measures would typically be used from late fall to early spring, whereas the walkway is most heavily used

in the late spring through early fall. Few anglers would be using the reservoir during ice conditions.

Non-Ice Conditions

As shown in Table ES-2 and Figure ES-15, the potential impacted area where significant impacts could occur at residences and other sensitive receptor locations extends 400 feet from the reservoir's northern shoreline and 930 feet from the reservoir's southern shoreline during weekdays under non-ice conditions. On weekends, these areas would be 430 feet from the reservoir's northern shoreline and 960 feet from the reservoir's southern shoreline. To the north of the reservoir, the impacted area falls completely within NYCDEP property and no potential significant impacts would result. There would be no potential significant impacts under the impulsive noise criteria (62 L_{Cdn}); at the nearest sensitive receptor (approximately 300 feet from the reservoir shoreline) the noise level from the pyrotechnics would be 50.8 L_{Cdn}.

Within the noise impact contour, peak hour noise level increases would range from 5 dBA near the contour edge to 18.0 dBA at the closest residences (approximately 300 feet from the reservoir shoreline). At the closest receptors, the proposed project would increase noise levels by up to 18.0 dBA compared to the lowest ambient noise level (which was estimated at 42.0 dBA) and these impacts would be lower for the majority of sensitive receptors in the contour, particularly outside these peak conditions. Changes of this magnitude would be readily noticeable and intrusive. As discussed above, dispersion activities would rarely be implemented outside the November to March period and would typically be implemented on an intermittent basis for three to four hours on a given day. Impacts would be more commonly experienced in the high dispersion areas than in the areas less actively managed under the program.

Within the noise impact contour there are approximately 75 residences of which approximately 45, or 59 percent, are located near the high dispersion usage zones. For the remaining 31 residences (41 percent) located near the medium and low dispersion usage zones, noise impacts would not be expected to occur on a frequent basis.

In addition, potential significant noise impacts would occur at Living Word Chapel (an estimated 9.6 dBA change over existing noise levels under weekend non-ice conditions) and would be readily noticeable. Potential significant noise impacts would also occur at open spaces within the study area including the publicly-accessible walkway along the southern dam and on anglers who use the reservoirs for fishing. The primary fishing season at Ashokan Reservoir generally runs from April 1st through November 30th, while avian dispersion measures would typically be employed from late fall through early spring. Therefore, these measures are not expected to substantially overlap with the fishing season.

Maverick Concert Hall, which hosts outdoor concerts, is a highly sensitive use located just outside the half-mile study area. Based on the noise assessment, no potential significant noise impacts are expected on this facility under the proposed action.

WEST BRANCH RESERVOIR

Ice Conditions

As shown in Table ES-2 and Figure ES-16, the potential impacted area where significant impacts could occur at residences and other sensitive receptor locations extends 1,550 feet from the reservoir's shoreline during weekdays and 1,900 feet from the reservoir's shoreline during weekends under ice conditions. There would be no potential significant impacts under the

impulsive noise criteria (62 L_{Cdn}); at the nearest sensitive receptor (approximately 100 feet from the reservoir shoreline) the noise level from the pyrotechnics would be 57.3 L_{Cdn}.

Within the noise impact contour, peak hour noise level increases would range from 5 dBA near the contour edge to 33.5 dBA at the closest residences (approximately 100 feet from the reservoir shoreline). At the closest receptors, the proposed project would increase noise levels by up to 33.5 dBA compared to the lowest ambient noise level (which was estimated at 36.8 dBA) and these impacts would be lower for the majority of sensitive receptors in the contour, particularly outside these peak conditions. Changes of this magnitude would be readily noticeable and intrusive. As discussed above, dispersion activities would rarely be implemented outside the November to March period and would typically be implemented on an intermittent basis for three to four hours on a given day. Impacts would be more commonly experienced in the high dispersion areas than in the areas less actively managed under the program.

Within the noise impact contour there are approximately 817 residences of which approximately 417, or 51 percent, are located near the high dispersion usage zones. For the remaining 400 residences (49 percent) located near the medium and low dispersion usage zones, noise impacts would not be expected to occur on a frequent basis.

In addition, potential significant noise impacts would be expected to occur at the Raymond Hill Cemetery on weekends. However, the cemetery is located near a low dispersion usage zone (Zone 4) and impacts would occur infrequently.

Potential significant noise impacts would also occur at open spaces within the study area including Nimham Mountain Multiple Use Area and on anglers who use the West Branch Reservoir and Lake Gleneida for ice fishing. In the impacted portions of the Nimham Mountain Multiple Use Area, there are hiking trails and roads (some of which may be used for bicycle riding and horseback riding) and hunting is allowed within the multiple use area. The impacted areas are adjacent to avian dispersion usage Zones 3 (medium usage) and 4 (low usage) and noise impacts are expected to occur fairly infrequently. In addition, dispersion measures would typically be used from late fall to early spring, whereas the multiple use area is most heavily used in the late spring through early fall. The noise impacts would occur in a small portion of the park and the characteristics of the noise would not substantially differ from noises associated with hunting.

Significant noise impacts would be expected in the northwest and southwest corners of Lake Gleneida. The northwest corner is closest to a low dispersion area and would be impacted infrequently. There would be few recreational users (e.g., anglers ice fishing) during this time of year.

Non-Ice Conditions

As shown in Table ES-2 and Figure ES-17, the potential impacted area where significant impacts could occur at residences and other sensitive receptor locations extends 830 feet from the reservoir's shoreline during weekdays and 1,020 feet from the reservoir's shoreline during weekends under ice conditions. There would be no potential significant impacts under the impulsive noise criteria (62 L_{Cdn}); at the nearest sensitive receptor (approximately 100 feet from the reservoir shoreline) the noise level from the pyrotechnics would be 57.4 L_{Cdn}.

Within the noise impact contour, peak hour noise level increases would range from 5 dBA near the contour edge to 26.3 dBA at the closest residences (approximately 100 feet from the reservoir shoreline). At the closest receptors, the proposed project would increase noise levels by

up to 26.3 dBA compared to the lowest ambient noise level (which was estimated at 41.0 dBA) and these impacts would be lower for the majority of sensitive receptors in the contour, particularly outside these peak conditions. Changes of this magnitude would be readily noticeable and intrusive. As discussed above, dispersion activities would rarely be implemented outside the November to March period and would typically be implemented on an intermittent basis for three to four hours on a given day. Impacts would be more commonly experienced in the high dispersion areas than in the areas less actively managed under the program.

Potential significant noise impacts would also occur at open spaces within the study area including Nimham Mountain Multiple Use Area and on Lake Gleneida (see "Ice Conditions" above) and on anglers who use the West Branch Reservoir and Lake Gleneida for fishing. Although there is year round fishing at West Branch Reservoir and Lake Gleneida, the primary fishing season generally runs from April 1st through November 30th. Avian dispersion measures would typically be employed from late fall through early spring, and are not expected to substantially overlap with the fishing season.

CROTON FALLS RESERVOIR

At Croton Falls Reservoir, avian dispersion measures would only be used during periods when the pump station is being used or one month prior to anticipated start-up. As discussed in "Project Description" above, this is not expected to occur on a frequent basis.

Ice Conditions

As shown in Table ES-2 and Figure ES-18, the potential impacted area where significant impacts could occur at residences and other sensitive receptor locations extends 1,960 feet from the reservoir's shoreline during weekdays and 2,110 feet from the reservoir's shoreline during weekends under ice conditions. There would be no potential significant impacts under the impulsive noise criteria (62 L_{Cdn}); at the nearest sensitive receptor (approximately 100 feet from the reservoir shoreline) the noise level from the pyrotechnics would be 57.3 L_{Cdn}.

Within the noise impact contour, peak hour noise level increases would range from 5 dBA near the contour edge to 35.3 dBA at the closest residences (approximately 100 feet from the reservoir shoreline). At the closest receptors, the proposed project would increase noise levels by up to 35.3 dBA compared to the lowest ambient noise level (which was estimated at 35.0 dBA) and these impacts would be lower for the majority of sensitive receptors in the contour, particularly outside these peak conditions. Changes of this magnitude would be readily noticeable and intrusive. Implementation would be limited to one month prior to anticipated start-up of the Reservoir's pump station and during its operation, for the same general time periods (November to March) and durations (generally 4 hours per day) as specified for the other reservoirs. Impacts would be more commonly experienced in the high dispersion areas than in the areas less actively managed under the program.

Within the noise impact contour there are approximately 951 residences of which approximately 515, or 54 percent, are located near the high dispersion usage zones. For the remaining 436 residences (46 percent) located near the medium and low dispersion usage zones, noise impacts would not be expected to occur on a frequent basis, particularly since the program would only be implemented during operation of the pump station or one month prior to anticipated pump station start-up.

Potential significant noise impacts would occur at the Putnam County Hospital, Stoneleigh Medical Center, Kozy Cottage Pre-School, St. Joseph's Catholic School and Camp Kiwi

(preschool). At Stoneleigh Medical Center and Camp Kiwi, which are in the study area adjacent to the low and/or medium dispersion usage zones, noise impacts would be experienced more rarely. Noise impacts at the Putnam County Hospital would be highest (up to a 13.3 dBA change over existing noise levels under weekend ice conditions) and would be readily noticeable. However, total noise levels with the proposed program would not be expected to exceed 49.1 dBA ($L_{eq(1)}$) at the facility. With the window wall attenuation provided at the hospital, interior noise levels would be within acceptable criteria. Noise impacts at Kozy Cottage pre-school would also be readily noticeable. Potential significant noise impacts at St. Joseph's Catholic School are expected to occur during ice conditions, outside normal operating hours. All noise impacts would occur infrequently and only during operation and one month prior to anticipated start-up of the pump station.

Potential significant noise impacts would occur on anglers who use the Croton Falls Reservoir for ice fishing. Small portions of the Middle Branch Reservoir and Lake Gilead would also be affected during ice fishing season.

Non-Ice Conditions

As shown in Table ES-2 and Figure ES-19, the potential impacted area where significant impacts could occur at residences and other sensitive receptor locations extends 960 feet from the reservoir's shoreline during weekdays and 1,140 feet from the reservoir's shoreline during weekends under ice conditions. There would be no potential significant impacts under the impulsive noise criteria (62 L_{Cdn}); at the nearest sensitive receptor (approximately 100 feet from the reservoir shoreline) the noise level from the pyrotechnics would be 57.4 L_{Cdn}.

In addition, in dead end areas, with very low ambient noise conditions (such as those noise levels experienced in the vicinity of Sites 2, 4, and 5), significant noise impacts could be experienced in areas as far as 1,200 feet from the reservoir shoreline during weekdays and 1,390 feet on weekends.

Within the noise impact contour, peak hour noise level increases would range from 5 dBA near the contour edge to 28.3 dBA at the closest residences (approximately 100 feet from the reservoir shoreline). At the closest receptors, the proposed project would increase noise levels by up to 28.3 dBA compared to the lowest ambient noise level (which was estimated at 39.0 dBA in typical areas) and these impacts would be lower for the majority of sensitive receptors in the contour, particularly outside these peak conditions. Changes of this magnitude would be readily noticeable and intrusive. Implementation would be limited to one month prior to anticipated start-up of the Reservoir's pump station and during its operation, for the same general time periods (November to March) and durations (generally 4 hours per day) as specified for the other reservoirs. Impacts would be more commonly experienced in the high dispersion areas than in the areas less actively managed under the program.

Within the noise impact contour there are approximately 419 residences of which approximately 256, or 61 percent, are located near the high dispersion usage zones. For the remaining 163 residences (39 percent) located near the medium and low dispersion usage zones, noise impacts would not be expected to occur on a frequent basis particularly since the program would only be implemented during operation of the pump station or one month prior to anticipated pump station start-up.

Potential significant noise impacts would occur at the Putnam County Hospital, Stoneleigh Medical Center, and Kozy Cottage Pre-School (see "Ice Conditions" above). Potential significant noise impacts would also occur on anglers who use the Croton Falls Reservoir and

Middle Branch Reservoir for fishing. Although there is year round fishing at these reservoirs, the primary fishing season generally runs from April 1st through November 30th. Avian dispersion measures would typically be employed from late fall through early spring, and are not expected to substantially overlap with the fishing season. In addition, only a small portion of Middle Branch Reservoir lies within the noise impact area.

CROSS RIVER RESERVOIR

At Cross River Reservoir, avian dispersion measures would only be used during periods when the pump station is being used or one month prior to anticipated start-up. As discussed in "Project Description" above, this is not expected to occur on a frequent basis.

Ice Conditions

As shown in Table ES-2 and Figure ES-20, the potential impacted area where significant impacts could occur at residences and other sensitive receptor locations extends 1,190 feet from the reservoir's northern shoreline and 1,910 feet from the reservoir's southern shoreline during weekends under ice conditions. On weekdays, these areas would be 910 feet from the reservoir's northern shoreline and 1,630 feet from the reservoir's southern shoreline. There would be no potential significant impacts under the impulsive noise criteria (62 L_{Cdn}); at the nearest sensitive receptor (approximately 100 feet from the reservoir shoreline) the noise level from the pyrotechnics would be 57.3 L_{Cdn}.

In addition, in dead end areas, with very low ambient noise conditions (such as those noise levels experienced in the vicinity of Site 1), significant noise impacts could be experienced in areas as far as 1,630 feet from the reservoir shoreline during weekdays and 1,910 feet on weekends.

Within the noise impact contour, peak hour noise level increases would range from 5 dBA near the contour edge to 33.6 dBA at the closest residences (approximately 100 feet from the reservoir shoreline). At the closest receptors, the proposed project would increase noise levels by up to 33.6 dBA compared to the lowest ambient noise level (which was estimated at 36.7 dBA) and these impacts would be lower for the majority of sensitive receptors in the contour, particularly outside these peak conditions. Changes of this magnitude would be readily noticeable and intrusive. Implementation would be limited to one month prior to anticipated start-up of the Reservoir's pump station and during its operation, for the same general time periods (November to March) and durations (generally 4 hours per day) as specified for the other reservoirs. Impacts would be more commonly experienced in the high dispersion areas than in the areas less actively managed under the program.

Within the noise impact contour there are approximately 202 residences of which approximately 151, or 75 percent, are located near the high dispersion usage zones. For the remaining 51 residences (25 percent) located near the medium dispersion usage zone, noise impacts would not be expected to occur on a frequent basis particularly since the program would only be implemented during operation of the pump station or one month prior to anticipated pump station start-up.

Potential significant noise impacts would occur at the southeastern corner of Four Wind Hospital, southern end of John Jay High School, Harvey School, a church (Route 121 and Reservation Road), a nursery school (Route 35 near Salem Road), American Legion Hall, and a community center (Mark Mead and Old Post Roads). Only very small portions of the properties of Four Wind Hospital and John Jay High School are expected to be significantly affected by the proposed Expanded Program. At Harvey School and John Jay High School, significant noise

impacts would typically occur in the late afternoon to early evening hours, and not during normal school hours. Noise impacts at the church and nursery school would be readily noticeable and potentially intrusive.

Potential significant noise impacts would also occur at open spaces within the study area including the western end of Ward Pound Ridge Reservation and on anglers who use the Cross River Reservoir for ice fishing. Only a very small portion of the Ward Pound Ridge Reservation in Lewisboro would be expected to fall within the noise impact area and only on weekends under ice conditions. The impacted portion of the Ward Pound Ridge Reservation within Pound Ridge is adjacent to the low dispersion usage zone (Zone 4) and noise impacts would be expected to occur rarely. Dispersion measures would typically be used from late fall to early spring, whereas the open spaces are most heavily used in the late spring through early fall.

Non-Ice Conditions

As shown in Table ES-2 and Figure ES-21, the potential impacted area where significant impacts could occur at residences and other sensitive receptor locations extends 740 feet from the reservoir's northern shoreline and 1,220 feet from the reservoir's southern shoreline during weekends under ice conditions. On weekdays, these areas would be 560 feet from the reservoir's northern shoreline and 1020 feet from the reservoir's southern shoreline. There would be no potential significant impacts under the impulsive noise criteria (62 L_{Cdn}); at the nearest sensitive receptor (approximately 100 feet from the reservoir shoreline) the noise level from the pyrotechnics would be 57.4 L_{Cdn}.

In addition, in dead end areas, with very low ambient noise conditions (such as those noise levels experienced in the vicinity of Site 1), significant noise impacts could be experienced in areas as far as 1020 feet from the reservoir shoreline during weekdays and 1,220 feet on weekends.

Within the noise impact contour, peak hour noise level increases would range from 5 dBA near the contour edge to 29.4 dBA at the closest residences (approximately 100 feet from the reservoir shoreline). At the closest receptors, the proposed project would increase noise levels by up to 29.4 dBA compared to the lowest ambient noise level (which was estimated at 37.9 dBA) and these impacts would be lower for the majority of sensitive receptors in the contour, particularly outside these peak conditions. Changes of this magnitude would be readily noticeable and intrusive. Implementation would be limited to one month prior to anticipated start-up of the Reservoir's pump station and during its operation, for the same general time periods (November to March) and durations (generally 4 hours per day) as specified for the other reservoirs. Impacts would be more commonly experienced in the high dispersion areas than in the areas less actively managed under the program.

Within the noise impact contour there are approximately 137 residences of which approximately 103, or 75 percent, are located near the high dispersion usage zones. For the remaining 34 residences (25 percent) located near the medium dispersion usage zone, noise impacts would not be expected to occur on a frequent basis particularly since the program would only be implemented during operation of the pump station or one month prior to anticipated pump station start-up.

Potential significant noise impacts would occur at Harvey School, a church (Route 121 and Reservation Road), a nursery school (Route 35 near Salem Road), a community center (Mark Mead and Old Post Roads) and the western edge of Ward Pound Reservation (see "Ice Conditions" above). Potential significant noise impacts would also occur on anglers who use the Croton Falls Reservoir for fishing. Although there is year round fishing at these reservoirs, the

primary fishing season generally runs from April 1st through November 30th. Avian dispersion measures would typically be employed from late fall through early spring, and are not expected to substantially overlap with the fishing season.

Caramoor, which hosts outdoor concerts, is a highly sensitive use located just outside the half-mile study area. Based on the noise assessment, no potential significant noise impacts are expected on this facility under the proposed action.

TOPOGRAPHY EFFECTS

In the areas surrounding the reservoirs there is complex topography. Topography and the reflection of sound energy (echo effect) may affect the locations and magnitude of predicted noise level increases.

Therefore, under certain localized conditions, there could be significant noise levels outside the noise contour or within the noise contour, noise levels may be slightly higher than predicted. Local topographic features also have the potential to reduce noise levels within the contour due to additional shielding, beyond that accounted for in the analysis. These topographic effects are expected to occur in a limited number of areas, but could result in additional potential significant noise impacts where they occur.

E. NATURAL RESOURCES

POTENTIAL IMPACTS TO NATURAL RESOURCES FROM NOISE GENERATING WATERBIRD MANAGEMENT MEASURES OF THE EXPANDED PROGRAM

GENERAL ASSESSMENT

The results of empirical studies suggest that for birds and mammals, the noise levels from pyrotechnics have the potential to elicit an alert or startle response for individuals close to the shoreline, but should not significantly affect the survival of the wildlife individuals or reproductive success of terrestrial wildlife populations. Further away from the shoreline, the noise levels drop dramatically, illustrating the effect that attenuation factors have on the transmission of noise and noise levels. At ¼-mile, the noise levels are far below the general range of noise levels assessed in empirical studies. The noise levels are further reduced at ½-mile from the shoreline. Therefore, individuals farther from the shoreline are less likely to be affected by the noise from the pyrotechnics, the distress tapes, or the boat noises. Under worst case ice conditions, the noise levels would be higher but would still be below the noise levels assessed in empirical studies.

In addition to considering the results of empirical studies, the results of spectral analyses of the noises generated by avian dispersion measures suggest that the noise from the pyrotechnics would be heard by most terrestrial wildlife along the shoreline, but that the noise becomes less noticeable at ¼-mile from the shoreline. This further suggests that wildlife with the greatest potential to be affected by the waterbird management measures are those for which the reservoir or shoreline area is important for breeding, foraging or resting habitat. Wildlife using the shoreline area include waterbirds (ducks, gulls and geese); wading birds (herons and egrets); raptors that nest or feed along the shoreline such as eagles, owls, and osprey; belted kingfisher, insectivorous birds that would feed over the water surface such as swallows, flycatchers, and

nighthawks; mammals closely associated with water such as beaver, muskrat, mink, otter, and raccoon; frogs and salamanders, and aquatic snakes.

For wildlife known to use the shoreline area or the reservoir itself, much of the assessment of potential impact is dependent on whether the period for implementation of avian dispersion measures (November through March) coincides with periods that would affect the stability of local or regional populations of these species. Use of pyrotechnics would overlap with the early portion of the breeding season for raptors that use the shoreline areas (bald eagles, osprey and great horned owl), and may occur during the egg laying and incubation period. Bald eagles can begin nesting as early as February and great horned owls can be incubating eggs as early as late January. Osprey are not known to breed at any of the reservoirs but either occur or have the potential to occur at all five reservoirs during the spring and fall migration, and during the summer at Cross River Reservoir. Potential impacts to eagles breeding and/or overwintering at the reservoirs, and to osprey, are addressed in the proceeding section assessing impacts to threatened or endangered species.

While NYCDEP has observed great horned owls nesting along the reservoir shorelines where the noise level from waterbird dispersion measures would be highest, they have also been observed in woodland habitats farther from the shoreline. The preferred nesting habitat for great horned owls is usually bottomland, mature forest next to good feeding area (mammals comprise the majority of the diet, including cottontail rabbit, skunk, muskrat, mice, squirrels, opossums, but individuals will eat birds up to the size of geese, ducks, hawks and small owls, Andrle and Carroll 1988 and Kaufman 1996). Because owls have a lower hearing threshold in the 1 to 4 kHz range than most other birds (sensitive to lower noise levels than other birds in this frequency range), noise from avian dispersion measures could be heard farther from the shoreline and would have the potential to affect selection of nesting locations in those individuals not tolerant of the noise. Great horned owls commonly nest in an old tree nest used by a large hawk, osprey, bald eagle, heron or crow (Andrle and Carroll 1988). Because great horned owls have been found to be somewhat tolerant of human activity, nesting in parks and cities and towns (Andrle and Carroll 1988) and its breeding status in New York appears to be stable (Levine 1998), the loss of nesting habitat along and within the vicinity of the shoreline of the reservoirs would not be expected to result in significant adverse impacts to the regional great horned owl population.

For owls that have active nests prior to the implementation of waterbird dispersion measures, the results of empirical studies on spotted owl (Delaney et al. 1999) suggest that while owls nesting close to the shoreline have the potential to flush during implementation of waterbird dispersion measures, nesting success would not be expected to be affected. Nesting success for individuals nesting along the shoreline may be affected should avian dispersion measures result in frequent flushing and lower prey delivery rates. However, because the breeding status of great horned owls is stable in New York, lower nesting success for some nesting locations near the shoreline would not be expected to result in significant adverse impacts to the regional population of this species. Additionally, waterbird dispersion measures are expected to be implemented typically just one hour past sunset, with an additional hour past sunset as necessary, and would not be implemented in the early morning hours prior to sunrise (night). This daily timing would reduce potential impacts to the primary feeding periods for many owls, although some individuals may begin feeding at dusk. Therefore, significant adverse impacts to the regional great horned owl population would not be expected to occur should waterbird dispersion measures be implemented after egg laying has begun.

The nesting period for other owls known to breed at the reservoirs, eastern screech-owl, and barred owl generally begins in late March in New York (Andrle and Carroll 1988). Although the implementation of waterbird dispersion measures have the potential to overlap with the start of the breeding period for these two species, significant adverse impacts would not be expected to occur. The eastern screech owl prefers woodlands, farm groves and shade trees with some open ground where it feeds on large insects and small rodents (Kaufman 1996), and is therefore not likely to use the area in the vicinity of the shoreline extensively. Similarly, the barred owl favors dense and thick woods with only scattered clearings, especially wooded swamps where it eats mostly small mammals (Kaufman 1996) and would not be likely to use the shoreline area to any great extent.

All five reservoirs are used extensively by migratory waterfowl such as Canada goose, bufflehead, common goldeneye, mallard, American black duck, and common and hooded merganser, during the spring (March through June) and fall (September through early December) migrations, and as overwintering habitat by a smaller number of waterfowl species attracted to open water areas. Because waterfowl and other waterbirds are the target of the waterbird dispersion measures, they have the greatest potential to be adversely affected by the Expanded Program. The primary adverse impact would be the loss of habitat used as resting and feeding areas by migratory waterfowl (primarily during November and March), and waterfowl overwintering habitat, and the subsequent potential for this loss to affect the status of some waterfowl populations.

The overwintering period for waterfowl coincides with the potential period for implementation of waterbird management measures, November through March. The dominant waterfowl species observed at the reservoirs in the fall and winter include American black duck, mallard, and common and hooded merganser. Potential impacts to these dominant overwintering waterfowl due to loss of habitat would be minimized by focusing dispersion measures in high dispersion zones of the reservoirs, and maintaining some suitable migratory and overwintering habitat for waterfowl in areas of the reservoirs with less intensive bird management measures. NYCDEP observed that waterbirds rarely left Rondout Reservoir during the two instances when waterbird management measures were required at the reservoir, described in the case studies presented in "Water Quality" above. Instead, waterbirds moved from the high dispersion zones near the dam to other portions of the reservoir.

While waterbirds have a greater potential to be affected by the waterbird management measures proposed as part of the Expanded Program, the results of empirical studies suggest that although migratory waterbirds may exhibit a startle response to some sound stimuli (flight from the stimuli) the energetic cost to migratory waterbirds from the response appears to be low (Conomy et al. 1998) disturbances from boat traffic may not result in departure from a foraging area, particularly in the spring (Knapton et al. 2000). This suggests that the energetic cost to migratory birds from being dispersed from the high dispersion areas should be low provided there are suitable roosting areas nearby within the reservoir (i.e. the medium and low dispersion areas that would be affected less frequently). Waterbirds not within the immediate vicinity of the boats or pyrotechnics, and where visual stimuli from boats and pyrotechnics are limited, would have a lower potential for being affected by waterbird management measures.

Should migratory or overwintering waterfowl be dispersed from the reservoirs, despite the focused application of waterbird dispersion measures only in certain areas of the reservoirs, waterfowl using the West of Hudson reservoirs (Rondout and Ashokan Reservoirs) have a greater potential to be affected by loss of migratory or overwintering habitat than those using the

East of Hudson Reservoirs (West Branch, Croton Falls and Cross River Reservoirs). There are fewer waterbodies within 5 miles of Rondout (5) and Ashokan (10) Reservoirs to provide habitat for dispersed waterfowl, than for West Branch (60), Croton Falls (30) and Cross River (27) Reservoirs. Because the breeding population status of the four most common overwintering waterbirds at the reservoirs, mallard, American black duck, and common, and hooded merganser, in the Atlantic Flyway are currently stable (USFWS 2003), potential impacts to these four species from the loss of some overwintering habitat or migratory habitat, due to the Expanded Program would not be expected to result in significant adverse impacts to their status.

The American black duck, one of the four common overwintering waterfowl at the five reservoirs, has no state or federal status, but the continued interbreeding with mallards poses a threat to the genetic integrity of the species within the Atlantic Flyway. The Partners in Flight Bird Conservation Plan for The Southern New England Physiographic Area identifies American black duck as in need of immediate management or policy in this region (Dettmers and Rosenberg 2000). Although significant adverse impacts to black ducks would not be expected as a result of the Expanded Program, measures would be implemented to reduce potential impacts to this species because of concerns over the status of the American Black Duck within the Atlantic Flyway, and its abundance at the reservoirs during the period when waterbird management measures may be implemented.

Waterbird dispersion measures would be expected to be less intensive in March. Should dispersion measures continue to the end of March, dispersion measures have the potential to affect breeding for Canada goose, wood duck, and mallard which are known to nest at the reservoirs. Because the eastern population of mallard, wood duck and Canada goose are considered stable (USFWS 2003, North American Waterfowl Management Plan 2002), significant adverse impacts to the breeding population of these species would not be expected should the period for implementation of dispersion measures overlap slightly with their breeding period. American black duck, and common and hooded merganser, three other waterfowl known to breed at the reservoirs begin breeding activity in April and would not be expected to be affected by waterbird dispersion measures. Because the period for avian dispersion measures would not occur during the period when waterfowl nestlings would be present, adverse impacts to nestlings associated with avoidance of motorboats or airboats would not be expected.

Wading birds and shorebirds using the reservoirs as migratory stopovers and for breeding have the potential to be impacted by the implementation of waterbird dispersion measures. Examples of wading birds observed at the reservoirs include great blue heron (breeding, wintering and year round), green heron (breeding), great egret (migratory), little blue heron (migratory), black-crowned night herons (migratory and summer at West of Hudson reservoirs), and snowy egret (migratory). The period for waterbird dispersion measures would likely end before migratory great blue heron occur at the reservoirs (late March to early April) and breeding would occur at the reservoirs (April to July). The period for waterbird dispersion would also avoid the breeding period for green heron (April to August), and the likely periods for little blue heron, great egret, snowy egret and black-crowned night heron (April to October) to occur at the reservoirs (Andrle and Carroll 1988, Levine 1998, eNature.com 2003). Therefore, significant adverse impacts to regional populations of wading birds would not be expected as a result of waterbird dispersion measures.

Examples of shorebirds observed at the reservoirs include spotted sandpiper (breeding and migratory), least sandpiper (migratory), solitary sandpiper (migratory), greater and lesser yellowlegs (migratory), killdeer (breeding and migratory), and woodcock (breeding, migratory

and wintering). Similar to the wading birds, the migratory period for these shore birds is generally from April to October (Levine 1998, eNature.com), outside the period for implementation of waterbird dispersion measures. Therefore, significant adverse impacts to regional populations of these shorebirds would not be expected to occur as a result of waterbird dispersion measures. The breeding period for spotted sandpiper and killdeer (April through July, Andrle and Carroll 1988) is also outside the period for implementation of waterbird dispersion measures, therefore adverse impacts to breeding activity for these two species would not be expected from the implementation of dispersion measures. The breeding period for woodcock (late-March through July) with mating activity occurring occasionally in February at West Branch Reservoir has the potential to coincide with waterbird dispersion measures if they should be necessary through March, and they also may occur in the East of Hudson reservoirs during the winter. Because of the habitat preference of this species (successional woodlands adjacent to open fields, Kaufman 1996), they are less likely to be found in the vicinity of the shoreline where noise levels would be the highest. However, mating display has been observed close to the shoreline at West Branch Reservoir. Although some mating and nesting habitat close to the reservoir shorelines may be affected by waterbird dispersion measures occurring in late February through March, significant adverse impacts to regional populations of woodcock would not be expected to occur as a result of waterbird dispersion measures.

Ring-billed gulls, herring gulls, and to a lesser extent great black-backed gulls, are the most frequently observed gulls at the reservoirs during the late fall and winter and are the target species for waterbird dispersion measures from November through March. Loss of migratory and wintering habitat for these species would be minimized by focusing dispersion measures in high dispersion zones of the reservoirs, which would maintain some suitable migratory and overwintering habitat for gulls in areas of the reservoirs with less intensive bird management measures. NYCDEP has observed gulls moving from the area where waterbird dispersion measures were implemented at Rondout Reservoir to other areas of the reservoir. However, should gulls be dispersed from the reservoirs as a result of waterbird dispersion measures, significant adverse impacts to the regional populations of these gulls would not be expected. Herring gull populations are considered stable, their breeding and non-breeding distributions are wide-spread, and there are no known threats to breeding populations. Ring-billed gulls and great black-backed gull populations are also not considered to be at risk. Since 1970, ring-billed gull populations have experienced a biologically significant increase and great black-backed gull populations are also apparently increasing. Breeding and non-breeding populations of ring-billed gulls are secure and threats to breeding and non-breeding populations of great black-backed gulls are assumed to be low (Kushlan et al. 2002).

All five reservoirs are used extensively by migratory songbirds and raptors. Loss of habitats used as resting and feeding areas by migratory birds would have the potential to affect populations of these species. Pyrotechnic usage would be discontinued prior to the nesting season for most songbirds (generally April through August), including those species such as flycatchers and swallows, and belted kingfisher that have the potential to use the shoreline area and the reservoir for feeding (Andrle and Carroll 1988). Therefore, no potential significant impacts on the breeding bird habitat for songbirds and belted kingfisher, and regional populations of the belted kingfisher and songbirds breeding in the vicinity of the reservoirs would be expected to occur as a result of waterbird management measures. Additionally, birds located within the woods beyond the shoreline would experience lower noise levels from the pyrotechnics due to attenuation, and would have less or no visual contact with the pyrotechnics. Breeding bird surveys conducted at Kensico Reservoir by NYCDEP since 1992 have not documented a change

in species of songbirds breeding at the reservoir since waterbird management measures were implemented in December 1993. Belted kingfisher also occur or have the potential to occur along the reservoir shorelines in the winter, during the period of implementation of waterbird dispersion measures. Because this species feeds primarily during the day, when fish and invertebrates can easily be seen, it is less likely to be active during the period of day when waterbird dispersion measures would be implemented. Therefore, significant adverse impacts to this species would not be expected to occur as a result of waterbird dispersion measures.

In addition to the bald eagle and osprey, raptors known or expected to occur in the vicinity of the reservoirs during migration or during the breeding period include northern harrier (migration and wintering), sharp-shinned hawk (migration, breeding in West of Hudson, and wintering), cooper's hawk (breeding, migration and wintering), northern goshawk (breeding, migration, and wintering), red-shouldered hawk (breeding, migration, and wintering), broad-winged hawk (breeding, and migration West of Hudson), red-tailed hawk (breeding, migration and wintering), rough-legged hawk (wintering, and migration East of Hudson), American kestrel (breeding, year-round West of Hudson and wintering East of Hudson), merlin (migration and wintering East of Hudson), and peregrine falcon (migration and wintering East of Hudson). Northern harrier is a state-listed threatened species, peregrine falcon is a state-listed endangered species, and Cooper's hawk, northern goshawk, sharp-shinned hawk, and red-shouldered hawk are Species of Special Concern. Potential impacts to these species are addressed in the proceeding section assessing impacts to threatened or endangered species.

Of the remaining raptors, the spring migratory period (mid-February to April), and fall migratory period (October through December) of the rough-legged hawk (Levine 1998) has the potential to coincide with a portion of the period for implementation of waterbird dispersion measures. Rough-legged hawks prefer open grasslands, marshes and farmlands where it feeds primarily on small rodents (Kaufman 1996). Because habitat for this species is limited within the vicinity of the reservoirs, significant adverse impacts to migratory populations would not be expected to occur as a result of waterbird dispersion measures. The spring migratory period (mid-February to June), and fall migratory period (late July to November) for red-tailed hawk has the potential to overlap with a portion of the period for implementation of waterbird dispersion measures. The red-tailed hawk breeding period (March through July) also has a potential to occur during the period for implementing waterbird management measures if it should continue into March in a given year. Red-tailed hawk is the most widespread large hawk in North America and is found in any kind of terrain that provides open ground for hunting and high perches, such as woodlands with scattered clearings to open grassland with trees or poles for perching. Nesting habitat is also variable (Kaufman 1996). Because this species is widespread and tolerates a variety of habitats significant adverse impacts would not be expected to occur to individuals breeding, overwintering, or migrating through the areas surrounding the reservoirs. The migration period (late March to mid-April) and breeding period (April through June) for the American kestrel (Andrle and Carroll 1988, Levine 1998) is generally outside the expected period for waterbird dispersion measures. This species is also not likely to occur along the shoreline. Therefore, adverse impacts would not be expected to occur as a result of waterbird dispersion measures. Spring migration for merlin generally peaks in April, and the fall migration from mid-September to late October (Levine 1998). Because the migratory period for this species is generally outside the period for implementation of waterbird dispersion measures, significant adverse impacts to the regional population of this species would not be expected to occur.

Mammals that hibernate during the winter, such as groundhogs, and bats (little brown, Keen's, silver-haired, eastern pipistrelle, big brown, red, hoary), would not be expected to be affected by

noise generated by the avian dispersion measures. For mammals that hibernate underground, noise levels should be further attenuated by the ground. Mammals that breed during the fall or winter period such as white-tailed deer, fox, raccoon, weasel and skunk are generally woodland species and would occupy areas where sound levels from management measures would be reduced. In addition, with the exception of deer, many of these mammals are nocturnal and therefore have less potential to be active when waterbird dispersion measures are being implemented during the day. Beaver and muskrat do occur along the shorelines of the reservoirs (Rondout, Ashokan and West Branch Reservoirs plus Croton Falls for muskrat) and therefore have the potential to be exposed to noise resulting from avian dispersion techniques. However, because beaver and muskrat are nocturnal, and generally less active during the winter (the most likely period for implementation of waterbird management measures (November through March), with fewer forays out of the den or lodge, individuals would have less opportunity to be exposed to the noise levels projected at the shoreline. Therefore, significant adverse impacts to beaver and muskrat would not be expected. While mink and otter have the potential to be active during the period for implementation of avian dispersal techniques (November through March), not all portions of the reservoirs would receive dispersal measures at the same time or level of intensity, and habitat would be available in the areas not actively managed. Additionally, the period of pyrotechnic use would occur only during a four-hour period of the day which minimizes adverse impacts to hunting activities. Mink may be nocturnal or hunt during the day, depending on availability of prey. Therefore, adverse impacts to these wildlife species would not be expected. Results of empirical studies suggest that while mammals may exhibit some reaction to the noise generated by the pyrotechnics (startle response observed in reaction to sonic booms), these reactions have not been found to adversely impact wildlife or livestock, or reproductive success of the species evaluated. Therefore, significant adverse impacts to mammals would not be expected as a result of avian dispersion measures used for waterbird management.

The results of the noise analysis also suggest that noise levels generated by pyrotechnics, boats and distress calls may elicit some response for individuals at the shoreline, but would be less likely to affect birds or mammals within woodlands and other habitats at a ¼-mile from the shoreline. Birds and other wildlife located within the woods beyond the shoreline would also have less or no visual contact with the pyrotechnics, which may reduce the potential for noise to affect breeding, and feeding activities. Additionally, the Expanded Program does not anticipate using pyrotechnics, boats or distress calls more than 2 hours past dusk, which should minimize effects to nocturnal species.

The results of empirical studies also indicate that wildlife have the potential to habituate to recurring noises. Though the noise from the boats and distress calls would not be constant, they would likely have a more gradual on-set than the pyrotechnics. Because motorboats are already used at the reservoirs by NYCDEP for water quality sampling, from about April through mid-December, birds and other wildlife using the reservoirs during this period may have already acclimated to the noise and sight of motorboats. However, under the program the boats would be used much more frequently and the period of use would extend through the winter. Because distress calls are generally species specific, the distress calls themselves would not be expected to result in significant adverse impacts non-target bird populations.

The anticipated typical schedule (November through March) for use of avian dispersion measures is outside the breeding season for reptiles and amphibians, minimizing potential impacts to reproductive success of the populations currently found at the reservoirs. Most reptiles and amphibians known or expected to occur within the vicinity of the reservoirs are inactive (in hibernation or torpor underground) from late fall-early winter to early spring, the

period of peak waterbird abundance and the likely period when waterbird management measures would be implemented. None of the snakes or turtles found in the study areas would be expected to breed before the end of March and breeding would be completed before November (eNature.com 2003). While most of the salamanders do not become active for breeding until March or April, the red-spotted newt begins breeding in late winter to early spring, during the period when waterbird dispersion measures would occur. Because of the preferred habitat for the adult, dense submerged vegetation, swamps and low velocity streams, noise impacts would be expected to be minimal. Other species, such as the eastern red-backed salamander, though breeding from October to April, is a ground-dwelling terrestrial species that hides beneath woodland debris or stones during the day, and forages within leaf litter at night. On the basis of the noise assessment, ground-level noise levels within woodland areas would be expected to be low, and would not be expected to result in adverse impacts to this widespread species. For frogs and toads known to occur in the vicinity of the reservoirs, the American toad, Fowler's toad, spring peeper, pickerel frog, and green frog begin breeding in March. Wood frog breeds in the early spring, before ice has completely melted (eNature.com 2003). Although waterbird dispersion measures have the potential to occur during breeding of this species, minimizing the implementation of waterbird dispersion measures after dark should minimize potential impacts to breeding caused by the noise from pyrotechnics. Other species such as the gray treefrog, and American bullfrog breed from April to August (eNature.com 2003) and would not be expected to be impacted by waterbird dispersion measures.

Therefore, use of avian dispersion measures during the period of reptile and amphibian inactivity would not result in significant adverse impacts to individuals or reptile and amphibian populations. Should implementation of waterbird management measures occur earlier in the fall when reptile and amphibian species are still active, the results of spectral analysis of the pyrotechnics suggest that noise levels of the pyrotechnics have a lower potential to affect reptiles and amphibians about a ¼-mile from the shoreline than at the shoreline. Reptiles are generally most sensitive to noises in the lower frequency range—infrasound—in the air and as ground vibrations. Because the pyrotechnics explode in the air, ground vibrations generated from pyrotechnics are minimal. Near the ground surface, noise generated by the pyrotechnics would be attenuated by vegetation and by the ground and would be lower than further off the ground. The lower noise levels on or near the ground, combined with the minimal or negligible generation of ground vibrations which many reptiles and amphibians are sensitive to, and the decrease in sound level with distance from the shoreline, suggests that there is little potential for significant adverse impacts to reptiles and amphibians from the use of pyrotechnics during their active period.

Significant adverse impacts to fish would not be expected to occur from the use of avian dispersion measures. Potential adverse impacts to fish from the movement of boats would not be expected to be significant because of the small number of boats and the time of year (outside spawning period for fish species).

THREATENED OR ENDANGERED SPECIES AND OTHER SPECIES OF SPECIAL CONCERN

The proposed Expanded Program could result in potential significant impacts to the osprey and bald eagle. Measures to mitigate these potential impacts are discussed in "Mitigation" below. In addition, while impacts to the common nighthawk are not expected to be significant, measures would be implemented to minimize the potential for impacts to these species.

Osprey

This species has been observed at Cross River Reservoir during the spring (March through May) and fall (September to mid-October) migration, and during the summer, and at Rondout, Ashokan, and West Branch Reservoirs during fall migration. It has the potential to use Croton Falls during spring and fall migrations. Individuals using the reservoirs during summer are not expected to be adversely impacted by waterbird management measures. Individuals using the reservoirs during migration have the potential to be adversely affected by waterbird management measures. Most individuals would be expected to have left the area by mid-October. Although the results of empirical studies suggest that raptors may be fairly tolerant of the noise levels generated by pyrotechnics, NYCDEP will coordinate with NYSDEC and the USFWS to develop measures to be implemented when waterbird management measures are used to minimize adverse impacts to migrating and wintering osprey. Osprey mitigation measures would only be implemented when individuals are observed at the five reservoirs. "Mitigation" below, discusses mitigation to minimize potential significant adverse impacts to osprey.

Bald Eagle

Bald eagles are known to breed at Ashokan and Rondout Reservoirs, and have the potential to breed at West Branch, Croton Falls, and Cross River Reservoirs. Migrants can occur every month of the year depending on their origin. Southern breeding birds move through from April through October and may summer in New York after breeding. Northern breeding birds and fledglings from Eastern Canada and northeastern US move through and /or into the state September through March. In the winter, when foraging areas to the north freeze over, individuals move into New York to areas with open water (November through March with peaks in January and February) (Levine 1998). Because this species breeds early (mating beginning in February with eggs in nests starting mid-March and fledging from July through August), breeding pairs, wintering individuals, and migrants have the potential to be significantly adversely impacted by noise-generating management measures during the period for implementing waterbird management measures at Ashokan or Rondout Reservoirs.

Nesting bald eagles have been found to elicit alert responses to approaching aircraft. Perching and nesting bald eagles appear to exhibit a stronger reaction to approach of nests and perches by boats and pedestrians (flushing), than to aircraft, or noise from ground-based military activities that are not visible to the eagles. This suggests that nesting or perching areas located in portions of the reservoirs distant from high dispersion areas where noise from management measures may still be heard but not seen, or that are distant from boat activity, would have a lower potential for being impacted than those closer to the high dispersion zones. Investigators have recommended buffers for activities on the water and on land to protect nesting and overwintering bald eagles and recommended temporal restrictions on some activities to avoid disturbing eagles during the daily feeding period. At Ashokan and Rondout, overwintering eagles typically feed in the early morning, between 5:00 and 7:00 AM. Therefore, the typical late afternoon and evening period proposed for use of pyrotechnics, boats and distress tapes should not interfere with bald eagle foraging patterns. The results of empirical studies and the noise assessment suggest that bald eagles have the potential to be significantly impacted. NYCDEP will coordinate with NYSDEC and the USFWS to develop mitigation measures to be implemented during use of waterbird management measures at Rondout and Ashokan Reservoirs, and any of the other three reservoirs should nesting or wintering individuals be observed, to avoid adverse impacts to nesting and overwintering bald eagles. "Mitigation" below, discusses mitigation to avoid adverse impacts to bald eagles.

Common Nighthawk

This species has the potential to use the woodland habitats and clearings within the vicinity of the reservoirs during spring (May) and fall (August through September) migration. Because these migratory periods occur after the period of implementation of waterbird management measures ends in the spring (generally in March), and before the start of the period of implementation of waterbird management measures in the fall (generally not before November), significant adverse impacts to this species would not be expected. When common nighthawks occur at the reservoirs during the spring, this nocturnal insectivore can occur in large numbers that may feed over the reservoirs for a few days. Nighthawk feeding has the potential to be affected by the use of pyrotechnics. Although significant adverse impacts to common nighthawk would not be expected as a result of the Expanded Program, measures would be implemented to reduce potential impacts to this species because of concerns over its potential to occur at the reservoirs at the same time as the period for implementation of avian dispersion measures if extended later into the spring.

POTENTIAL IMPACTS TO NATURAL RESOURCES FROM NON-NOISE GENERATING WATERBIRD MANAGEMENT MEASURES OF THE EXPANDED PROGRAM

Management measures proposed as part of the Expanded Program that do not generate noise include lasers, meadow management, shoreline modification, barrier fences along the shoreline, netting and mylar tape grids over structures, visual deterrents, modification of human behavior, alewife management, reproductive control, and capture for removal from the reservoirs. The impacts of these measures are discussed below.

Because lasers are silent and can be directed at target birds, they would have minimal impacts to non-target waterbirds and other wildlife at the five reservoirs. Studies conducted by USDA have found that the lasers do not cause any deleterious effects to birds' health or eyes.

While meadow management might result in permanent loss of feeding and resting areas for resident Canada geese and gulls, these areas do not make up a large proportion of the habitats available around the five reservoirs. Therefore, the loss of this habitat would not significantly adversely affect available food resources for geese, or resting areas for gulls. In addition, meadow management has the potential to result in improved habitat for non-target birds and mammals.

Shoreline modification has the potential to result in positive impacts such as creation of natural conditions for the reestablishment of native plant species and associated wildlife populations; creation of nursery and feeding habitat for fish; and improved nutrient filtration. Shoreline modification has the potential to result in increased suspended sediment within the vicinity of the area being modified, but these increases would be temporary and localized, and would not be expected to result in adverse impacts to aquatic habitat. Shoreline modification may result in additional permitting requirements under NYSDEC freshwater wetlands and protection of waters regulatory programs, as well as Section 404 of the Clean Water Act, which is under the responsibility of the US Army Corps of Engineers.

The use of barrier fences would restrict access between land and water for not only geese, the target of this management measure, but also for other wildlife. However, because fences will only be used in areas that are currently used or have the potential to be used as nesting areas by Canada geese, which make up a small portion of the shoreline habitat for the five reservoirs,

sufficient unimpeded shoreline access would be available to other wildlife. There may be some adverse impacts to non-target shorebirds such as killdeer and spotted sandpiper that may also be using these areas, but these impacts would not be expected to be significant.

Meadow management, shoreline modification and barrier fences have the potential to result in significant adverse impacts to threatened or endangered plant species that may occur where land disturbing activities are undertaken. "Mitigation" below, discusses measures that will be implemented to minimize adverse impacts to threatened or endangered plants.

Grids over structures focuses on loafing or roosting areas used by gulls and geese, and therefore would not result in the loss of any natural habitat areas, no significant adverse impacts to non-target wildlife would be anticipated from this measure. Netting, on the other hand, would have the potential to impact non-target birds and other wildlife through entanglement, depending on the height above ground and mesh size, but these impacts would not be expected to be significant.

One disadvantage of some visual deterrents may be their low visibility during evening and night hours (Boag and Lewin 1980) when migratory birds may be approaching waterbodies. The visual deterrents would be selected to target waterbirds that are the focus of management measures at each reservoir and would not be expected to result in significant adverse impacts to non-target species.

As a condition to the depredation permit, the USFWS requires NYCDEP to institute measures to minimize public feeding of waterbirds. This measure focuses on removing artificial food supplies for Canada geese and gulls. Because it does not affect existing natural food resources for target or non-target waterbirds, significant adverse impacts would not be expected to these resources.

Alewife management does have the potential to adversely affect bald eagle foraging at the Rondout Reservoir, since NYCDEP and NYSDEC have frequently observed individuals foraging on alewives flushed out of the East and West Delaware Influents at the western end of the reservoir. However, because sufficient foraging resources would be available to eagles in the absence of the alewives, these impacts would not expected to be significant.

Proposed reproductive management measures include nest destruction and egg addling to reduce nesting by resident Canada geese, mute swans and double-crested cormorants. Because these measures target resident Canada geese, mute swans, and double-crested cormorants, migratory geese and other non-target waterbirds would not be adversely affected by these reproductive control measures.

Under the depredation permit issued to NYCDEP by the USFWS, NYCDEP is currently authorized to capture a specified number of Canada geese from the city's reservoirs to be euthanized with complete destruction of the carcass through burial or incineration, or for transport to processing center for distribution to a local food bank. As a standard condition to the depredation permits issued by the USFWS, all takings of migratory birds (removal of individuals or eggs from the population) must be done as part of an integrated wildlife damage management program, using appropriate non-lethal management techniques. Non-lethal techniques must be used to the extent appropriate in an effort to minimize lethal takes. In compliance with this condition, NYCDEP anticipates capture and removal activities to be limited, and that capture with euthanasia would be the predominant removal measure. Capture with processing for human consumption would require ensuring the quality of the product delivered to the consumer, which may not be possible under the Expanded Program. To date, NYCDEP has not conducted

euthanasia under this permit. Geese are usually rounded up during the molting period when they are flightless. Because capture for removal targets resident Canada geese, migratory geese and other non-target waterbirds would not be adversely affected.

F. VISUAL RESOURCES

No new structures would be constructed as part of the proposed project. However, there are several avian deterrence and avian dispersion measures that could be visible from areas around the reservoirs. Public views of the reservoirs are primarily from roads. Motorists traveling through the area would have views of short duration, particularly since many of the measures would occur over short periods (i.e. pyrotechnics, boats) or be located in limited areas (e.g., meadow management) primarily near the intake structures and dams. Roads that travel up the hillsides are a considerable distance from the reservoirs and have only partial views. Due to their mobility, motorboats would likely be seen for only limited periods from any vantage point. NYCDEP regularly uses motorboats at each of the reservoirs for water sampling and therefore, the addition of these boats would not be a substantial change over current conditions.

Other than from roads, the most notable views of the reservoirs can be seen from the publicly accessible walkway at the Ashokan Reservoir and by anglers who fish from rowboats or along the shoreline of the reservoirs. Due to the size of the reservoir, pyrotechnics and boats would likely be seen at a distance from the walkway and would seem relatively small in context. In addition, dispersion measures are expected to be used from November through March, and only rarely beyond these periods, whereas the walkway is most heavily used from the late spring through early fall. The program would be implemented outside the primary fishing season when few anglers would be expected on the reservoir.

The avian deterrence and avian dispersion measures would not significantly alter views of or the visual character or the reservoirs. Therefore, with the proposed action, potential significant adverse impacts on visual resources are not expected to occur.

G. SOCIOECONOMIC CONDITIONS

POTENTIAL IMPACTS ON LOCAL ECONOMIES

The use of avian dispersion measures would reduce the attractiveness of the reservoirs for fishing and may discourage fishing activities during periods when they are being used. The primary fishing season at the reservoirs generally runs from April 1st through November 30th, although a limited number of anglers use the reservoirs during other months for panfishing or ice fishing (East of Hudson reservoirs only). Avian dispersion measures would rarely be implemented outside the November through March period. Therefore, it is not expected that waterfowl management activities would substantially overlap with the fishing season or with most anglers who use the reservoirs. In general, anglers who fish in the morning hours would not be affected, since dispersion measures would typically be implemented in the late afternoon through the evening hours. In addition, motorboats are currently being used by NYCDEP on the reservoirs for water sampling. If anglers were present during the proposed management activities, NYCDEP would be sensitive to their presence by maintaining the maximum practical distance while still achieving the goals of the management program, reducing boat speed to minimize wake, and alerting the anglers of pyrotechnics usage prior to their discharge.

For the East of Hudson Reservoirs, there are several other factors that would minimize potential socioeconomic effects. At Croton Falls and Cross River Reservoirs, avian dispersion measures would only be employed during pump station operations or one month prior to their anticipated start-up, which is expected to occur infrequently. In addition, there are numerous similar fishing sites in the vicinity of the affected East of Hudson Reservoirs. Ice fishing east of the Hudson generates very small at-location expenditures.

For these reasons, it is anticipated that only small reductions in fishing activity would occur due to the implementation of the proposed Expanded Program. These reductions in fishing activity would have only a limited impact on local businesses that serve anglers in the areas near the reservoirs. Furthermore, angler expenditures represent only a small percentage of the local economy. For these reasons, no potential significant business or employment displacement or other significant adverse socioeconomic impacts are expected to occur due to implementation of the proposed action.

Upstate communities may incur some additional costs to address issues associated with displaced waterbirds. Under the Expanded Program, waterbirds are likely to be dispersed to the areas of the five reservoirs that are not being actively managed. Waterbodies and grassy areas in the vicinity of the reservoirs are likely to already be experiencing problems associated with high abundances of waterbirds such as goose or gull droppings since similar waterbirds are prevalent throughout the area; however, the displacement of waterbirds to other areas has the potential to compound existing problems that may already exist in some of these areas.

The mitigation measures described in "Mitigation" below to address potential significant water quality impacts from bird displacement to other waterbodies will also minimize socioeconomic impacts. The mitigation measures will include contacting local government agencies and surface water suppliers prior to employing avian dispersion measures and potentially modifying the implementation of these measures in response to reported increases in gulls and Canada geese in nearby areas due to NYCDEP's program. Several local communities are currently implementing and supporting waterfowl management programs of their own. Local taxpayers would be affected only marginally, such that no displacement or other significant socioeconomic impacts are expected.

POTENTIAL IMPACTS TO RATEPAYERS

For the programs committed to by the City in the 2002 Filtration Avoidance Determination (2002 FAD), it is estimated that the City will expend approximately $145 million for both capital and expense costs during the 2002-2007 period. The cost of the NYCDEP Waterfowl Management Program, including costs to implement the Kensico Program, which account for a majority of these costs, are estimated to be approximately five percent of these costs over the five year period. The costs to implement the proposed Expanded Program would amount to less than three cents per month for each housing unit in New York City. Costs to commercial, industrial, and other sectors would likewise be minimal. These costs would not be expected to result in potential significant residential displacement or other significant adverse socioeconomic impacts.

H. HISTORIC RESOURCES

It is not expected that the proposed action would have any significant adverse noise-related contextual impacts on architectural resources. Architectural resources with noise-sensitive uses

include residences, cultural and performing arts centers, churches, libraries and schools, and cemeteries. As discussed in "Land Use, Zoning, Community Character, and Open Space" above, the proposed action would not significantly alter the use of these facilities in the areas impacted by noise. Therefore, the uses of historic properties would not be significantly adversely affected by the proposed action, and their context would not be significantly adversely altered.

Historic outdoor concert pavilions, among the most sensitive uses, would not be significantly affected. Maverick Concert Hall and Caramoor are located beyond the noise impact areas and no potential significant adverse noise impacts are expected on these resources.

I. TRAFFIC, AIR QUALITY, AND ENERGY

The number of vehicular trips generated by the proposed action is well below the threshold that would trigger a detailed traffic analysis and potential significant impacts would not occur with the proposed action. The proposed action would not generate significant new emissions or result in exacerbations of any national or State air quality standard. There would be no significant use of fuel or other energy sources. Therefore, with the proposed action, potential significant adverse traffic, air quality, or energy impacts are not expected.

J. MITIGATION

CEQR and SEQRA require that identified potential significant adverse impacts be minimized or avoided to the fullest extent practicable and that mitigation measures be identified and evaluated in an EIS. Where no mitigation is available, the EIS must disclose the potential for unmitigable significant adverse impacts.

The EIS predicted the following potential significant adverse impacts that could occur due to the implementation of the Expanded Program:

- Potential significant adverse noise impacts may occur on sensitive receptors (see "Noise" above) at each of the five reservoirs.
- Potential significant adverse community character impacts due to significant noise impacts are projected for the area within the noise contour surrounding the eastern half of Rondout Reservoir.
- Potential significant adverse water quality impacts on Class AA and Class A waterbodies in the vicinity of the reservoirs due to the potential displacement of waterbirds from the five reservoirs.
- Potential significant adverse natural resources impacts were identified for the Bald Eagle, Osprey, and several threatened and endangered plant species.

The following sections present mitigation measures proposed to avoid, reduce, or minimize potential significant adverse water quality and natural resources impacts from the Expanded Program. Potential significant noise impacts and the potential significant community character impact at Rondout Reservoir would not be mitigable. These unavoidable impacts are discussed in "Unavoidable Impacts" below.

WATER QUALITY

NYCDEP expects that under the Expanded Program, which is much more limited in scope than the program at Kensico Reservoir, waterbirds are likely to be dispersed to the areas of the five

reservoirs that are not being actively managed with concentrated dispersion measures. If displacement to other waterbodies occurs, the additional birds would not be expected to affect the ability of nearby drinking water supplies to meet drinking water quality standards. However, the displacement of waterbirds to Class AA and A waters has the potential to significantly increase coliform levels in these waterbodies and could result in potential significant water quality impacts.

NYCDEP is proposing the mitigation measures outlined below to mitigate potential significant adverse water quality impacts to Class AA and Class A waters due to potential displacement of waterbirds from the five reservoirs. These measures would minimize the potential significant adverse impacts to the best extent practicable, however it may not ensure full mitigation for all potential adverse water quality impacts to these waters.

- Except under emergency conditions, contact local municipalities and surface water suppliers within a five-mile radius of the reservoirs, prior to implementation of avian dispersion measures. Under emergency conditions, contact will be made as soon as possible after measures are employed. This mitigation measure would alert potential affected communities to NYCDEP activities that may displace waterbirds to their locales.
- Monitor waterbird movements at the five NYCDEP reservoirs in response to avian dispersion techniques. This mitigation measure would provide information on types and numbers of waterbirds that may be relocating elsewhere on NYCDEP reservoirs and/or off these reservoirs altogether.
- Provide a NYCDEP contact to receive reports from local municipalities and surface water suppliers of increased problems, particularly elevated coliform levels in nearby Class AA and A waterbodies, associated with increased numbers of Canada geese and gulls during implementation of avian dispersion measures at the five NYCDEP reservoirs. This mitigation measure would provide information to water supply managers to achieve common water quality objectives.
- Evaluate potential modifications to the application of avian dispersion measures, as necessary, in response to observed and reported increases in gulls and Canada geese, and elevated coliform levels in nearby areas due to implementation of the avian dispersion measures under the Expanded Program. This commitment for adaptive management would help resolve the potential for undesirable relocations of waterbirds that are displaced from any of the five reservoirs.

NATURAL RESOURCES

The following sections describe mitigation measures proposed to avoid or minimize potential significant adverse impacts to the bald eagle, osprey and several plant species. Although potential significant adverse impacts are not expected to occur to the common nighthawk and American black dock, measures will be undertaken to minimize the potential for impacts to these species during program implementation.

BALD EAGLE

Noise from pyrotechnics and boats, and movement of boats on the reservoir for waterbird management have the potential to interfere with bald eagle nesting success and foraging during breeding season, and with foraging and roosting for overwintering individuals.

NYCDEP is proposing the following bald eagle protection measures in consultation with NYSDEC to avoid significant impacts to bald eagles in accordance with the Endangered Species Act and the Bald and Golden Eagle Protection Act. NYCDEP will strictly adhere to the measures put forth below when performing the proposed waterbird dispersion techniques. In addition, NYCDEP would continue to coordinate with NYSDEC and USFWS concerning information on the status of bald eagle breeding and overwintering activities at all five reservoirs.

- NYCDEP will continue to document observations of active bald eagle breeding sites, and overwintering individuals at the reservoirs during regular waterbird surveys at the reservoirs. Prior to waterbird dispersion activities, a complete reservoir shoreline survey would be conducted to identify the presence/absence and all activities (nesting, foraging, flying over, roosting, etc) of the bald eagle. Reservoir locations and bald eagle presence, time of day, age class, and activity would be recorded.
- An assessment of bald eagle activity would be made in conjunction with spatial and temporal distribution information of waterbirds targeted for dispersion. This information would be the basis for the planned implementation strategy and would be considered when deciding on the type, combination and location of bird dispersion activities to be implemented. This would avoid any compromises to the federal and/or state laws protecting eagles.
- NYCDEP will develop detailed eagle interaction guidelines in conjunction with NYSDEC. These will include, among other things, field data sheets with a distance guideline map to establish a buffer zone around each significant bald eagle location (nesting, roosting, foraging, etc).
  - The buffer zone for use of waterbird management measures including shoreline access for launching pyrotechnics, pyrotechnics launched from the reservoir, and vehicle access for distress tapes shall be a distance of ¾ of a mile from the sensitive location(s) as estimated in the field. Management activities would be restricted to areas outside the buffer zone.
  - A buffer zone of 400 meters, or approximately ½ mile will be implemented for the use of motorboats or airboats for dispersing waterbirds. No motorboats or airboats shall pass within this buffer when bald eagles are present (nesting, roosting, etc) at an identified shoreline location.
- In the unlikely event that bald eagle activity (flying over or feeding) was observed in an area (outside of the established buffer zones) targeted for waterbird dispersion during a management period, all management measures would be suspended for the duration of the bald eagle's presence in such area. Waterbird management measures could resume once the bald eagle has dispersed from the area.
- If any disturbances to bald eagle behavior due to the use of pyrotechnics are observed, all use of pyrotechnics will be immediately discontinued and other management measures will be employed (lasers, motorboats, and airboats). Specific eagle behavior to be monitored includes alert behavior, flushing from nest, time to return to nest after flushing, flushing from hunting perch, and alteration of daily patterns. If the waterfowl management program is canceled for more than one day consecutively due to observed conflicts or disturbances to the eagles or if the suspension of dispersion activities would create conflicts between

needed water quality protection and disadvantages to bald eagle, NYCDEP will discuss this with NYSDEC. If necessary, in coordination with NYSDEC, NYCDEP would propose alternative methods of waterbird dispersion and bald eagle impact avoidance; these may include modification to the buffer zones described above and the exploration of alternative waterfowl dispersion techniques.

- Personnel responsible for carrying out waterbird management measures would be required to report to the NYCDEP Supervisor of Wildlife Studies including a detailed assessment of all field operations. The Supervisor of Wildlife studies will consult with the NYSDEC Endangered Species Unit as necessary and if/when a potential conflict between bald eagle protection and necessary waterbird dispersion arises to find an outcome that would still achieve the desired water quality requirements for these reservoirs.

The goal of these protection measures is to avoid any impacts to bald eagles nesting or wintering at the five reservoirs. NYCDEP will continue to monitor eagle behavior and evaluate and improve upon these management measures, as necessary, for the life of the project and in coordination with the Endangered Species Unit of NYSDEC.

OSPREY

Although the period for implementation of waterbird management measures would likely end before migrating osprey would occur at any of the reservoirs in the spring, and start in the fall after the fall migration period for this species, there is a potential for migrating individuals to be present at the reservoirs when avian dispersion measures are needed. Noise from pyrotechnics and boats, and movement of boats on the reservoir for waterbird management have the potential to interfere with foraging and roosting of migrating individuals. The following mitigation measures are proposed to minimize potential significant adverse impacts to osprey.

- Continue to document observations of individuals at the reservoirs during regular waterbird surveys at the reservoirs.
- Coordinate with NYSDEC concerning information on the status of osprey at all five reservoirs.
- In coordination with NYSDEC, some or all of the following measures will be implemented at all five reservoirs as necessary when presence of overwintering individuals is confirmed:
  - Monitor osprey behavior during implementation of waterbird dispersion activities such as—alert behavior, flushing from hunting perch, etc.
  - Establish buffer zones around preferred foraging areas specific to different activities—boat passage, launching pyrotechnics, shoreline access for launching pyrotechnics, vehicle access for distress tapes
  - Modify avian dispersion measures as necessary based upon monitoring observations.

THREATENED OR ENDANGERED PLANT SPECIES

NYSDEC has identified four plant species of concern within the vicinity of the reservoirs. These species include:

- Ashokan Reservoir—Hyssop-skullcap (*Scutellaria integrifolia*) and woods rush (*Juncus subcaudatus*), both of which are state-listed endangered, plants that occur in forested or emergent wetlands in the vicinity of the reservoir.

- West Branch Reservoir—Tooth-cup (*Rotala ramosior*), a state-listed threatened plant species that occurs in shoreline areas in the vicinity of the reservoir.
- Croton Falls Reservoir—Cat-tail sedge (*Carex typhina*), a state-listed threatened plant found in wet soils and margins of ponds and lakes in the vicinity of the reservoir.

Shoreline modification, shoreline fencing, and meadow management may be implemented as deterrent measures as part of the Expanded Program. Although they would most likely be limited to the grassy areas in the immediate vicinity of the shaft structures (where these plant species are not likely to occur), they have the potential to disturb threatened or endangered plant species through land disturbance activities. The following mitigation measures have been proposed to minimize potential significant adverse impacts to threatened or endangered plants within the vicinity of the reservoirs.

- Coordinate with NYSDEC and the New York State Natural Heritage Program with respect to known locations of plant species of concern at all five reservoirs.
- In coordination with NYSDEC and the New York State Natural Heritage Program, identify plant species of concern with the potential to occur in the vicinity of areas proposed for meadow management or shoreline modification.
- Conduct field survey prior to conducting meadow management or shoreline modification.
- In response to a positive identification within an area proposed for meadow management or shoreline modification, coordinate with NYSDEC and the New York State Natural Heritage Program, and develop a revised plan to minimize or avoid disturbance in the area, to the extent feasible.

K. UNAVOIDABLE IMPACTS

Unavoidable significant adverse impacts are defined as those that meet the following two criteria:

- There are no reasonably practicable mitigation measures to eliminate the impacts; and
- There are no reasonable alternatives to the proposed project that would meet the purpose and need of the action, eliminate the impact, and not cause other or similar significant adverse impacts.

Unavoidable significant adverse impacts from the Expanded Program have been identified for the following:

- Potential significant adverse noise impacts may occur on sensitive receptors (see "Noise" above) at each of the five reservoirs.
- Potential significant adverse community character impacts due to significant noise impacts are projected for the area within the noise contour surrounding the eastern half of Rondout Reservoir.

NOISE

As discussed in "Noise" above, potential significant noise impacts on residences, noise-sensitive community facilities, and open spaces would occur within identified noise contours around each of the five reservoirs. Within the noise contours, noise generated by the avian dispersion

measures would increase ambient noise levels from between 5 dBA at the outer edge of the noise contour to between 17.3 dBA and 35.3 dBA at the closest sensitive receptors at the five reservoirs. Changes of this magnitude would be readily noticeable, intrusive, and significant.

NYCDEP has designed the Expanded Program to minimize potential significant impacts to the extent feasible. In general, based on the implementation criteria described in "Project Description" above, the bird monitoring data that have been collected to date, and NYCDEP's limited implementation of bird dispersion measures at two of the five reservoirs, NYCDEP expects that the Expanded Program will be much more limited in scope than the program at Kensico Reservoir. NYCDEP has identified areas of potential high, medium, and/or low avian dispersion usage at the five reservoirs under the Expanded Program. The areas of highest potential usage are nearest the intake structures of the reservoirs and/or where waterbirds are known to congregate in large numbers based on avian monitoring surveys conducted to date. In the medium and low dispersion usage areas avian dispersion measures would be implemented considerably less frequently.

Under the Kensico Program, dispersion activities are conducted daily from August 1st to March 31st for up to 13½ hours per day. At Rondout, Ashokan, and West Branch Reservoir, the dispersion activities would be expected to occur from November through March, and may need to be implemented only on an intermittent basis. The program would generally occur for four hours per day from two hours before sunset to 1 to 2 hours after sunset. Implementation at Croton Falls and Cross River Reservoirs would be limited to one month prior to anticipated start up of the Reservoirs' pump stations and during pump station operation, which would occur only during drought conditions.

NYCDEP will implement noise-generating measures (pyrotechnics, motorboats, airboats, and distress tapes) in combination with other measures to minimize their potential use. These measures include the use of lasers to disperse birds as well as avian deterrence and reproductive control measures. However, these measures would be ineffective on their own in meeting the goal of the program to reduce FCB concentrations in the water supply that are due to seasonal waterbirds, and would need to be implemented in combination with the noise-generating measures. NYCDEP has evaluated a wide range of alternative measures (see "Alternatives" below), but these measures were found to have similar impacts, not have substantial advantages over the proposed action measures, or not be effective.

Because the intent of the program is to create noise, it would not be possible to mitigate noise impacts at the source, by reducing the intensity of the noise. NYCDEP examined two other categories of noise control measures to mitigate significant noise impacts: path treatments and receiver treatments. For receptors located at an elevation that is higher than the reservoirs, which is the case for most impacted receptors within the noise contour around the reservoirs, path treatments, such as barriers, would not be effective. In addition, creating a barrier around the reservoir would be prohibitively expensive and impracticable, and would result in potential significant adverse visual impacts. In addition, due to the number of sensitive receptors that would be significantly impacted (see "Noise" above) and the magnitude of the noise increases, it was determined that receiver treatments such as window-wall attenuation would be prohibitively expensive and is not practicable on private property. Therefore, potential significant noise impacts would remain unmitigated.

COMMUNITY CHARACTER

Rondout Reservoir is located in a rural area and its quiet nature is a key defining element of its community character. Due to the significant noise impacts over large distances, there would be a potential significant impact on community character in the eastern half of the noise impact area that surrounds the high dispersion usage Zones 1, 1.5, and 2. In the western half of the study area, noise impacts are expected to occur considerably less frequently and therefore would not have a significant effect on community character. Because there is no feasible mitigation to address the noise impacts from the Expanded Program, this significant community character impact would remain unmitigable.

L. ALTERNATIVES

NO ACTION ALTERNATIVE

The No Action Alternative (the future without the project) describes the environmental conditions that would exist if the proposed Expanded Program was not implemented. Without the Expanded Program, waterbird counts at certain times of the year would continue to result in elevated concentrations of fecal coliform bacteria (FCB) within the reservoirs and the reservoir discharges and possibly impair the City's ability to meet the requirements of the Surface Water Treatment Rule (SWTR). The No Action Alternative would also put the City in violation of the 2002 Filtration Avoidance Determination (FAD) issued by USEPA, that requires the City to expand the Waterfowl Management Program implemented at Kensico Reservoir to the five additional reservoirs. If the City does not comply with the 2002 FAD, USEPA could require that the Catskill/Delaware System be filtered. Filtration of the Catskill/Delaware System would require the siting, design, construction, and operation of a drinking water filtration plant and could result in potential environmental impacts to the adjacent local community and considerable costs to water and sewer ratepayers.

In the No Action Alternative, there would not be the significant water quality impacts associated with the displacement of waterbirds. However, these impacts will be mitigated under the proposed action.

In the No Action Alternative, there would not be the unavoidable potential significant noise impacts and community character impacts in the eastern half of Rondout Reservoir. While found to be significant under the proposed action, NYCDEP has attempted to limit the program to the extent feasible and impacts would occur only during certain periods of the year, rarely beyond November through March and during 4 hours of the day. Impacts would be less frequent in areas around the medium and low dispersion usage zones and at Croton Falls and Cross River Reservoirs where dispersion measures would only be employed during pump station operation and one month prior to anticipated pump station start-up.

In the No Action Alternative, the Bald Eagle, Osprey, and threatened or endangered plant species would not have the potential to be significantly impacted by noise and other measures included in the Expanded Program. However, these impacts will be mitigated under the proposed action.

ALTERNATIVE MEASURES

This section discusses alternative waterbird management measures to those proposed under the Expanded Program and compares their impacts to those of the proposed measures. The

alternative management measures addressed are listed in Table ES-3. The table also lists management measures that are not applicable to the reservoirs and the rationale for exclusion from further consideration.

ALTERNATIVE DETERRENCE MEASURES

Porcupine wires, used to exclude pigeons from window ledges and rooftops can be used to exclude gulls from resting on window ledges and rooftops of buildings. Pressurized water sprayers with motion detection technology can deter waterbirds from areas. Strobe lights, flashing or rotating lights can be used to startle geese. Flocks of urban waterfowl (i.e., domestic and feral geese or ducks) can act as decoys, attracting migrating waterfowl to a waterbody (Woronecki 1992 in USFWS 2002). Removing "decoy" domestic birds can reduce the number of migratory birds attracted to a waterbody (USFWS 2002). These alternative deterrence measures have not been selected because they do not have substantial advantages over the proposed action deterrence measures, are not as effective, particularly on large waterbodies, and, in the case of strobe lights and light beams, would have larger visual impacts.

ALTERNATIVE DISPERSIVE MEASURES

Dogs can be effective (particularly border collies) in keeping geese off golf courses and other large properties and at displacing waterfowl when the body of water is less than 2 acres in size. Remote-controlled model boats can be used to chase target birds away from certain areas of a waterbody. Noise making devices such as emergency sirens, nautical horns, and electric whistles played loudly can scare geese, and other migratory waterbirds. The alternative dispersion measures have not been selected because they do not have substantial advantages over the proposed action dispersion measures, would have similar impacts, are not as effective, and, in the case of radio controlled boats, are less tested.

ALTERNATIVE REPRODUCTIVE MANAGEMENT MEASURES

The egg addling method currently used by NYCDEP at Kensico Reservoir, and proposed for the Expanded Program, is egg piercing. Other egg destruction methods include shaking, freezing, and oiling. The alternative egg destruction measures have not been selected because they do not offer substantial advantages over egg piercing. Egg piercing is more effective than shaking and is less time consuming and more effective than oiling, and use of dummy eggs incurs additional costs from the purchase of the dummy eggs and requires the disposal of eggs removed.

ALTERNATE REMOVAL MEASURES

NYCDEP does not permit hunting of waterfowl on city-owned property. Unlike deer hunting, the hunting of waterfowl (Canada geese, ducks, coots and mergansers) would typically occur closer to the reservoirs and therefore would have greater safety and water quality concerns. None of the city-owned properties adjacent to the five reservoirs under the Expanded Program are open to deer hunting, with the exception of the area to the north of Ashokan Reservoir, because the properties are too narrow. Waterfowl hunting in the areas north of Ashokan Reservoir would not effectively meet the goals of the Expanded Waterfowl Management Program to reduce fecal coliform bacteria levels. As discussed above, the focus of the Expanded Program is to reduce waterbirds in the areas near the reservoir intakes structures and hunting would not be permitted in these areas. Further, hunting would not address gulls, which are believed to be the major source of water quality problems due to waterbirds at Rondout and Ashokan Reservoirs. Other

Table ES-3
Alternative Waterbird Management Measures

Alternative Management Measures	
Deterrence Measures	
Porcupine Wires	
Sprinklers and Motion Detector-Activated Sprayers	
Visual Deterrents—strobe lights and light beams	
Domestic Waterfowl Removal	
Dispersion Methods	
Dogs	
Radio controlled boats	
Sonic Devices—sirens, horns, whistles, mixed sounds	
Reproductive Management	
Egg Destruction (addling)—shaking, oiling, dummy eggs	
Removal Measures	
Relocation	
Hunting	
Predator Control	
Management Measures Not Applicable to the Reservoirs	
Management Measure	**Rationale for Exclusion**
Deterrence Measures	
Lure Crops	May attract waterbirds to a region, thus increasing the number of birds that may roost on a reservoir; only effective during certain times of the year; may be illegal during hunting season
Electric Fences	Potential for injury to non-target animals and humans
Wire or Mylar Tape Grids Over Water Surface	Impairs navigability of a waterbody; not practical for large water bodies, expensive
Floating Plastic Balls	Impairs navigability of a waterbody; not practical for large water bodies, expensive
Repellents—methyl anthranilate, garlic	May not be permitted for use near waterbodies, particularly drinking water supplies; expensive and requires high maintenance (reapplications)
Dispersion Methods	
Ultrasonic devices	Not shown to be effective
Raptors	Logistically difficult to maintain raptors and may not be effective
Propane Cannons	Not shown to be effective
Radar Activated Hazing Systems	Not commercially available and expensive
Reproductive Management	
Sterilization	Addresses breeding species only such as geese and swans, and does not take into account new nesting
Contraception	No contraceptives currently registered for waterbird control

removal measures include relocating juvenile geese from urban and suburban settings and encouraging natural predators of waterbirds that are indigenous to a region, such as the bobcat that has been reported recently at Kensico, Rondout, and Ashokan Reservoirs, and great horned owl, which occur at all five reservoirs.

The alternative removal measures have not been selected because they do not have substantial advantages over the proposed action measures and because they would not remove enough of the waterfowl population to meet the goals of the program. The measures address only waterfowl, whereas the data suggest that gulls are the major source of elevated FCB associated with waterbirds. Relocation would not likely be feasible due to the difficulty in finding a location that would accept geese and other waterfowl. In addition to potential water quality impacts from hunting, hunting on the reservoirs raises safety concerns, particularly in the areas near reservoir structures such as intakes, in areas with narrow forested buffers, and in areas frequented by the public (for example the walkway to the south of Ashokan Reservoir) and anglers. NYCDEP has and continues to explore the possibility of allowing additional hunting and other recreational uses on its off-reservoir properties within the limits of current State and/or federal regulations.

M. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

The proposed Expanded Waterfowl Program would not require the construction of any new facilities. Resources that would be used for the program would be for operation and maintenance purposes. These include fuel, equipment (such as motorboats, airboats and lasers), supplies (such as pyrotechnics, fencing, and plants for habitat alteration), and the human effort required to plan and implement the program. These resources are considered irretrievably and irreversibly committed, because reuse is not possible or is highly unlikely. No potential significant irreversible and irretrievable resources impacts are expected.

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