

APPENDIX 16.8
Natural Resources Inventory: HSA Property

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NATURAL RESOURCES INVENTORY

HOLY SPIRIT ASSOCIATION PROPERTY

**TOWN OF GREENBURGH and VILLAGE OF TARRYTOWN,
NEW YORK**

Prepared for:

The Westchester Land Trust

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1. Location and Description of Site

The study site has been well described by Buckhurst Fish & Jacquemart Inc. in their June 2001 report entitled "Open Space Analysis and Development Scenarios." The descriptions that follow are excerpted from this document.

The study site is located in Westchester County, New York, just east of the Hudson River, near the Tappan Zee Bridge. The study area is roughly bounded by a rectangle made up of south Broadway (Route 9) to the west, the New York State Thruway to the north (I-87/287) and east (I-87), and unincorporated East Irvington to the south.

The site straddles two municipalities: the Town of Greenburgh and the Village of Tarrytown. It also contains land in two school districts—Irvington and Elmsford—the borders of which are not coterminous with the municipal boundaries; the larger portion sits in Irvington School District. The study area sits approximately two miles southeast of the village center of Tarrytown, two miles west of the center of Elmsford, and two miles north of the center of Irvington.

At its greatest extent, the site is about 1.5 miles east-west and .75 miles north-south. It is composed of approximately 30 parcels under various ownerships; the majority of the parcels are owned by the Holy Spirit Association, while a handful belong to private landowners. The individual parcels range in size from less than an acre up to 92 acres, and the total land area of the site is more than 300 acres.

The site is divided neatly into two portions. East of the Tarrytown/Greenburgh town line (in Greenburgh) the parcels forming the site are contiguous, comprising about 220 acres. West of the town line (in Tarrytown) the parcels—totaling about 100 acres—are separated by subdivision developments and other moderate-sized landholdings. The site contains wetlands, large stands of contiguous forest, slopes exceeding 25 percent, and dramatic views of the surrounding area and the Hudson River. (Buckhurst Fish & Jacquemart Inc, 06/01)

2. Landscape Features

The study area consists of rugged and varied topography, with numerous ridges, hills, steep slopes, and ravines. Altitude in the eastern portion of the site ranges from below 200 ft. up to higher than 530 ft. About half of this portion of the parcel consists of slopes ranging from 15 to 25 percent, and another quarter of this area has slopes in excess of 25 percent. In the western portion of the study site, slopes are generally shallower, although the two parcels south of Lake Drive, on the slope leading up to the Nigerian Embassy, sit on slopes steeper than 15 percent.

The majority of the study site sits in the Sheldon Brook Basin, which drains north towards Tarrytown; only the extreme southern edge drains south, towards Sunnyside Brook in Irvington. Three tributaries of Sheldon Brook drain the high, eastern portion of the property, flowing towards the north. The only freshwater wetland identified by Westchester County department of Planning is on the extreme northern parcel in Tarrytown, sandwiched between I-87/287 and Sheldon Avenue. Water draining out of the eastern portion of the study site is effectively impounded behind the embankment of I-87/287 as its flow takes it to the northern side of the highway. In addition, drainage through two of the site's valleys has been divided into a series of

small to moderate sized artificial ponds and impoundments. The ravine draining northward at the western edge of the Greenburgh portion of the site has a pond that is approximately 100 ft. by 150 ft. which was formerly associated with water provision for a no longer extant residence 110 ft. above the ravine atop a ridge to the east. This ravine eventually drains into the large impoundment on the Bagorotti property in Tarrytown, which is approximately 400 sq. ft. On the northern portion of the Greenburgh portion of the site, another brook also drains northward. It is impounded in a 150-ft. by 150-ft. pond on the Guardia property. It then flows into the large reservoir on the Bagorotti property. Below the earthen dam on the Bagorotti property is a small, forested floodplain wetland that drains northward over a now-gone extension of Sheldon Avenue, and into the larger wetland parallel to I-87/287. There are also several isolated pockets of wetland in low-lying areas along the southwestern edge of I-87, where water draining northward is hindered by highway embankments. The western portion of the site is located entirely within the Sheldon Brook Basin, but by comparison to the rugged eastern portion of the site it is low-lying and flat, and it is already interspersed with development. Two of the parcels contain artificial ponds. The core of the property in Greenburgh encompasses a wetland corridor that runs down-slope from the ridge northwest of Taxter Road. The wetland corridor consists of a variety of habitats that attract a good representative sample of wildlife and plant species. (Buckhurst Fish & Jacquemart Inc, 06/01)

Plant Communities

The predominant plant communities present on the subject parcel consist of a mixed deciduous forested community, interspersed with a riparian wetland system, and forested wetland complex.

Deciduous Forest

The deciduous forest community that is present occurs on relatively well-drained, rocky soils. The forest is similar to the oak-tulip forest type that is described in Ecological Communities of New York State (Reschke, 1990). This plant community type would be classified as a mesophytic hardwood forest that occurs on moist, well-drained soils. The dominant trees form a closed canopy overhead but the understory is usually open, and the shrub layer in many places is sparse or absent entirely. Oak trees tend to dominate the landscape throughout the study site. Significant tree species observed include red oak (*Quercus rubra*), black oak (*Quercus velutina*), chestnut oak (*Quercus prinus*), red maple (*Acer rubrum*), tulip tree (*Liriodendron tulipifera*), white ash (*Fraxinus americana*), shagbark hickory (*Carya ovata*), pignut hickory (*Carya glabra*), hemlock (*Tsuga canadensis*), American beech (*Fagus grandifolia*), black birch (*Betula lenta*), and American elm (*Ulmus americana*). Understory trees that were present consisted of smaller individuals of the same species as the dominant trees. Ironwood (*Carpinus caroliniana*) and scattered white pine (*Pinus strobus*) were other understory trees identified. The shrub layer consisted primarily of spicebush (*Lindera benzoin*), witch-hazel (*Hamamelis virginiana*), burning bush (*Euonymus atropurpureus*), maple-leaved viburnum (*Viburnum acerifolium*), Japanese barberry (*Berberis thunbergii*) and multiflora rose (*Rosa multiflora*). Oriental bittersweet (*Celastrus scandens*), poison ivy (*Rhus radicans*) and wild grape (*Vitis* spp.) were also present. Common groundlayer species observed include Christmas fern (*Polystichum acrostichoides*), garlic mustard (*Aliaria petiolo*), Virginia creeper (*Parthenocissus quinquefolia*), Pennsylvania sedge (*Carex pennsylvanica*), wood ferns (*Dryopteris* spp.), Japanese stilt grass (*Microstegium vimineum*), and white wood aster (*Aster divaricatus*).

The forest community on site is second growth and reaching towards maturity. Average diameter at breast height ranges from 12 inches to 18 inches. Several larger den trees of greater diameter (20-24 inch DBH) are also scattered throughout the forested areas. The canopy coverage is fairly complete, although there are several areas where dead or fallen trees have created openings in the canopy. The vegetation within these areas is dominated by a thicker assemblage of understory trees, shrubs and vines of species previously highlighted. In general, the understory is relatively sparse and open representative of typical forested conditions in the northeast. The forest floor consists of a good level of leaf litter, and numerous fallen logs and tree limbs. Boulders and rock outcrops, along with sections of old stone walls are common. Evidence is abundantly present of prior human use of the property. A multitude of debris can be found throughout the site.

The hilltop areas to the east that parallel Taxter Road and I-87/287 consist of drier slopes with very little soil moisture development. As a result plant species adapted to dry summer conditions are more prevalent. More unusual species of trees at the upper slope areas include chestnut oak and black oak. Low bush blueberry (*Vaccinium* spp.), huckleberry (*Gaylussacia baccata*) and little bluestem grass (*Andropogon scoparius*) are more prevalent in the understory and ground layer.

Wetlands and Watercourses

The wetlands and watercourses are classified as a palustrine forested wetlands complex. This wetland complex includes intermittent watercourses that generally flow towards the Hudson River to the west and empty into the wetlands and artificial ponds that have been created throughout the site. The intermittent watercourses originate from surface water runoff and groundwater seeps.

The forested wetland complex is similar to the red maple hardwood swamp community as described by Reschke (1990). Red maple is the dominant tree and sapling species within each of the wetlands on the subject parcel. Other tree species observed included American elm, green ash (*Fraxinus pennsylvanica*) and hemlock. Several upland tree species were also observed along the outer edges of the wetlands. The shrub layer consisted predominately of spicebush, arrowwood viburnum, sweet pepperbush, witch hazel, winterberry (*Ilex verticillata*), silky dogwood (*Cornus amomum*) and highbush blueberry. Ground layer species observed included skunk cabbage (*Symplocarpus foetidus*), sensitive fern (*Onoclea sensibilis*), sphagnum moss (*Sphagnum* spp.), cinnamon fern (*Osmunda cinnamomea*), garlic mustard, and various sedges (*Carex* spp.), and rushes (*Juncus* spp.). The canopy coverage for the red maple dominated swamps are fairly uniform and closed with some scattered pockets that allow for successful establishment of shrubs and herbaceous vegetation. The watercourses were intermittent in nature and indicated signs of periodic inundation and heavy flows.

Due to the location of the wetlands within the regional landscape, and their context within the watershed, these wetlands provide important environmental benefits. The principal functional values provided by these wetlands are the role that they play in water quality protection and maintenance. Due to the structural diversity, landscape position, and vegetative biomass provided by wetland plants, these wetlands assist with filtering and retention of sediments and other non-point sources of pollutants; they help to store and trap excess nutrients; and attenuate the impact of surface runoff from storm events. In addition to the storage capacity and retention, the slow release of water helps to replenish surface and ground water resources. The wetlands also provide important habitat for plants and animals that require wetlands for part of their life cycle.

The wetlands and watercourse areas exhibit significant signs of human disturbances from prior and current land use practices. Despite these impacts, several sensitive wildlife species were observed to be present within the study site.

3. Natural Resource Inventory

Botanical Survey - Methods and Results

Vegetative survey methods involved direct field identification of every plant observed within the project study area. Inventory included random linear searches throughout the project impact area. All plants that could be visually observed and identified were recorded. The entire project impact area was surveyed to observe all plants present. Plants were identified by flower type and floral structure, by plant type, and leaf shape and arrangement. Plants were identified in both flowering and non-flowering conditions. When necessary, individual plants were collected if they required laboratory verification to specific species. Plants within the genus *Carex* and some of the grass genera were collected and later verified to species. Individual plants were identified by common name and scientific name (genus and species), and recorded for each impact area. The New York State Department of Environmental Conservation's publication "New York State Endangered, Threatened and Special Concern Species 1998," was used as the definitive list for determining whether any plants observed on the study area would be considered Endangered, Threatened or Special Concern status.

The vegetative survey was conducted from April 04 through July 23, 2001. A total of 36.0 hours were spent in the field, plus an additional 6.0 hours of laboratory work keying out individual plant species. Weather conditions were conducted during optimal field conditions, sunny, warm conditions with average temperature in the mid 70's F.

Results

One of the primary objectives of the field survey was to determine whether any endangered, threatened or special concern status species were located within the study area. The results of the field survey found no endangered, threatened or special concern status plant species within the proposed study area. Several environmentally sensitive plant species were observed during the inventory but none that were on the published list. A total of 181 plant species were observed to be present throughout the study area. This represented 35 species of trees, 32 species of shrubs and vines, and 114 species of forbs (wildflowers, ferns, grasses and grass-like plants). Despite

evidence of current and past land use practices within the study area, the forest composition, species diversity and plant community is fairly well intact and representative of a majority of sites throughout Westchester County. Several invasive plant species have become established within the study area, but not at what would be considered alarming levels. The forested wetland adjacent to I-87/287 has experienced the most severe case of disturbance and spread by invasive species. *Phragmites* has become dominant throughout the wetland to the detriment of other typical wetland plant species. A list of observed plant species follows:

Trees:

Common Name	Scientific Name
Norway Maple	<i>Acer platanoides</i>
Red Maple	<i>Acer rubrum</i>
Sugar Maple	<i>Acer saccharum</i>
Black Birch	<i>Betula lenta</i>
Yellow Birch	<i>Betula lutea</i>
Ironwood	<i>Carpinus caroliniana</i>
Pignut Hickory	<i>Carya glabra</i>
Shagbark Hickory	<i>Carya ovata</i>
American Chestnut	<i>Castanea dentate</i>
Flowering Dogwood	<i>Cornus florida</i>
American Beech	<i>Fagus grandifolia</i>
White Ash	<i>Fraxinus americana</i>
Green Ash	<i>Fraxinus pennsylvanica</i>
American Holly	<i>Ilex opaca</i>
Eastern Red Cedar	<i>Juniperus virginiana</i>
Sweet Gum	<i>Liquidambar styraciflua</i>
Tulip Poplar	<i>Liriodendron tulipifera</i>
Crab-apple	<i>Malthus spp.</i>
Tupelo	<i>Nyssa sylvatica</i>
Hop Hornbeam	<i>Ostrya virginiana</i>
Norway Spruce	<i>Picea abies</i>
White Pine	<i>Pinus strobes</i>
American Sycamore	<i>Platanus occidentalis</i>
Black Cherry	<i>Prunus serotina</i>
White Oak	<i>Quercus alba</i>
Pin Oak	<i>Quercus palustris</i>
Chestnut Oak	<i>Quercus prinus</i>
Red Oak	<i>Quercus rubra</i>
Black Oak	<i>Quercus velutina</i>
Black Locust	<i>Robinia pseudocacia</i>
Weeping Willow	<i>Salix babylonica</i>
Sassafras	<i>Sassafras albidum</i>
Basswood	<i>Tilia americana</i>
Eastern Hemlock	<i>Tsuga canadensis</i>
American Elm	<i>Ulmus americana</i>

Shrubs & Vines:

Common Name	Scientific Name
Shadblow	<i>Amelanchier canadensis</i>
Porcelain berry	<i>Ampelopsis brevipedunculata</i>
Japanese Barberry	<i>Berberis thunbergii</i>
Oriental bittersweet	<i>Celastrus orbiculatus</i>
Summersweet	<i>Clethra alnifolia</i>
Silky dogwood	<i>Cornus amomum</i>
Autumn olive	<i>Elaeagnus umbellata</i>
Winged Euonymus	<i>Euonymus atropurpurea</i>
Forsythia	<i>Forsythia</i> spp.
Huckleberry	<i>Gaylussacia baccata</i>
Witch hazel	<i>Hamamelis virginiana</i>
Winterberry	<i>Ilex verticillata</i>
Mountain Laurel	<i>Kalmia latifolia</i>
Spicebush	<i>Lindera benzoin</i>
Japanese Honeysuckle	<i>Lonicera japonica</i>
Fly honeysuckle	<i>Lonicera morrowii</i>
Virginia Creeper	<i>Parthenocissus quinquefolia</i>
Pink Azalea	<i>Rhododendron nudiflorum</i>
Brambles	<i>Rubus</i> spp.
Poison Ivy	<i>Rhus glabra</i>
Staghorn sumac	<i>Rhus typhina</i>
Blackberry	<i>Ribes allegheniensis</i>
Multiflora Rose	<i>Rosa multiflora</i>
Pink flowering raspberry	<i>Rubus odoratus</i>
Wineberry	<i>Rubus phoenicolasias</i>
Greenbrier	<i>Smilax</i> spp.
Steeplebush	<i>Spiraea tomentosa</i>
Highbush Blueberry	<i>Vaccinium corymbosum</i>
Lowbush Blueberry	<i>Vaccinium</i> spp.
Maple-leaved Viburnum	<i>Viburnum acerifolium</i>
Arrowwood Viburnum	<i>Viburnum recognitum</i>
Grape	<i>Vitis</i> spp.

Forbs (wildflowers, ferns, grasses and grass-like plants):

Common Name	Scientific Name
Yarrow	<i>Achillea millefolium</i>
White Baneberry	<i>Actaea pachypoda</i>
Maidenhair Fern	<i>Adiantum pedatum</i>
Garlic mustard	<i>Alliaria petiolata</i>
Pigweed	<i>Amaranthus</i> spp.
Ragweed	<i>Ambrosia</i> spp.
Little bluestem	<i>Andropogon scoparius</i>
Wood anemone	<i>Anemone quinquefolia</i>
Spreading dogbane	<i>Apocynum androsaemifolium</i>
Wild columbine	<i>Aquilegia canadensis</i>
Jack-in-the-pulpit	<i>Arisaema atrorubens</i>
White wood aster	<i>Aster divaricatus</i>
New England Aster	<i>Aster novae-angliae</i>
Wood Aster	<i>Aster</i> spp.
Lady Fern	<i>Athyrium filix-femina</i>
Bluejoint	<i>Calamagrostis canadensis</i>
Marsh Marigold	<i>Caltha palustris</i>
Yellow sedge	<i>Carex flava</i>
Pennsylvania sedge	<i>Carex pennsylvanica</i>
Tussock Sedge	<i>Carex stricta</i>
Fox sedge	<i>Carex vulpinoides</i>
Spotted knapweed	<i>Centaurea maculosa</i>
Celandine	<i>Chelidonium majus</i>
Lamb's quarters	<i>Chenopodium album</i>
Spotted Pipsissewa	<i>Chimaphila manulata</i>
Oxeye daisy	<i>Chrysanthemum leucanthemum</i>
Chickory	<i>Cichorium intybus</i>
Enchanter' nightshade	<i>Circaea quadrisulcata</i>
Bull thistle	<i>Cirsium vulgare</i>
Yellow clintonia	<i>Clintonia borealis</i>
Virginia dayflower	<i>Commelina virginica</i>
Crown vetch	<i>Coronilla varia</i>
Umbrella sedge	<i>Cyperus strigosus</i>
Queen Anne's lace	<i>Daucus carota</i>
Hay-scented fern	<i>Dennstaedtia punctilobula</i>
Deptford pink	<i>Dianthus armeria</i>
Dutchman's breeches	<i>Dicentra cucullaria</i>
Crabgrass	<i>Digitaria</i> spp.
Marginal Wood Fern	<i>Dryopteris marginalis</i>
New York Fern	<i>Dryopteris noveboracensis</i>

Forbs (continued):

Wood Fern	<i>Dryopteris</i> spp
Barnyard grass	<i>Echinochloa crusgalli</i>
Wild rye	<i>Elymus virginicus</i>
Horsetail	<i>Equisetum arvense</i>
Daisy fleabane	<i>Erigeron annuus</i>
Trout lily	<i>Erythronium americanum</i>
Meadow fescue	<i>Fescue elatior</i>
Wild strawberry	<i>Fragaria virginiana</i>
Marsh bedstraw	<i>Galium palustre</i>
Wild geranium	<i>Geranium maculatum</i>
Yellow avens	<i>Geum aleppicum</i>
Gill-over-the ground	<i>Glechoma hederacea</i>
Manna grass	<i>Glyceria obtuse</i>
Jewelweed	<i>Impatiens capensis</i>
Wild morning glory	<i>Ipomoea</i> spp.
Blueflag	<i>Iris versicolor</i>
Soft rush	<i>Juncus effuses</i>
Path rush	<i>Juncus tenuis</i>
Rice cut grass	<i>Leersia oryzoides</i>
Duckweed	<i>Lemna</i> spp.
Butter-and-eggs	<i>Linaria vulgaris</i>
Cardinal flower	<i>Lobelia cardinalis</i>
Ground Cedar Clubmoss	<i>Lycopodium complanatum</i>
Purple loosestrife	<i>Lythrum salicaria</i>
Canada Mayflower	<i>Maianthemum canadense</i>
Yellow sweet clover	<i>Melilotus officinalis</i>
Wild mint	<i>Mentha arvensis</i>
False Solomon's Seal	<i>Mianthemum racemosum</i>
Japanese stilt grass	<i>Microstegium vimeneum</i>
Patridgeberry	<i>Mitchella repens</i>
Forget-me-not	<i>Myosotis verna</i>
Sensitive Fern	<i>Onoclea sensibilis</i>
Cinnamon Fern	<i>Osmunda cinnamomea</i>
Interrupted Fern	<i>Osmunda claytoniana</i>
Royal Fern	<i>Osmunda regalis</i>

Forbs (continued):

Deer-tongue grass	<i>Panicum clandestinum</i>
Paspalum	<i>Paspalum</i> spp.
Reed-canary grass	<i>Phalaris arundinacea</i>
Timothy	<i>Phleum pratense</i>
Wild blue phlox	<i>Phlox divaricata</i>
Common reed	<i>Phragmites communis</i>
Pokeweed	<i>Phytolacca americana</i>
Clearweed	<i>Pilea pumila</i>
Common plantain	<i>Plantago major</i>
Pinkweed	<i>Polygonum pennsylvanicum</i>
Solomon's seal	<i>Polygonatum pubescens</i>
Common smartweed	<i>Polygonum hydropiper</i>
Arrow-leaved tearthumb	<i>Polygonum sagittatum</i>
Christmas fern	<i>Polystichum acrostichoides</i>
Selfheal	<i>Prunell vulgaris</i>
Tall buttercup	<i>Ranunculus acris</i>
Field sorrel	<i>Rumex acetosella</i>
Curled dock	<i>Rumex crispus</i>
Bloodroot	<i>Sanguinaria canadensis</i>
Soft-stem bulrush	<i>Scirpus validus</i>
Blue-eyed grass	<i>Sisyrinchium montanum</i>
Deadly nightshade	<i>Solanum dulcamara</i>
Canada goldenrod	<i>Solidago canadensis</i>
Sphagnum moss	<i>Spagnum</i> spp.
Chickweed	<i>Stellaria alsine</i>
Skunk cabbage	<i>Symplocarpus foetidus</i>
Common dandelion	<i>Taraxacum officinale</i>
Tall meadow rue	<i>Thalictrum polygamum</i>
Marsh fern	<i>Thelypteris thelypteroides</i>
Field pennycress	<i>Thlaspi arvense</i>
Red clover	<i>Trifolium pratense</i>
White clover	<i>Trifolium repens</i>
Wheat	<i>Triticum aestivum</i>
Broad-leaved cattail	<i>Typha latifolia</i>
Blue vervain	<i>Verbena hastate</i>
False hellebore	<i>Veratrum viride</i>
Smooth Yellow violet	<i>Viola pensylvanica</i>
Common blue violet	<i>Viola papilionacea</i>

Mammal Survey Methods and Results

Mammals were surveyed by active ground searches looking for evidence of any animal activity. The primary survey method involved time-constrained, systematic physical ground searches along random transects throughout each of the habitat types. Unless noted, all species listed were documented through direct observation. Direct observation included visual as well as auditory observation, and evidence of animal signs such as fur, tracks, droppings, scrapings, and bones. Surveys were conducted either between sunrise and two hours after sunrise, mid-day, and/or one hour before and after sunset. All animals observed were identified and recorded to genus and species name. No animals or animal evidence observed during the investigation were collected as voucher specimens. The mammal survey was conducted from May 04 through June 15, 2001.

A total of 11.0 hours were spent in the field. Weather conditions were conducted during optimal field conditions, sunny, warm conditions with average temperature in the mid 70's F.

Field investigation confirmed the presence of 16 different mammal species on the project site. Gray squirrels, eastern chipmunks, white-tailed deer, raccoons and deer mice were the most commonly observed mammals. Deer were especially abundant as evidenced by numerous well-worn trails, bedding areas and abundant droppings. Chipmunks and gray squirrels were most common along stonewalls and rock outcrops, throughout the forested sections, and along wetland corridors. Raccoon sign was observed primarily along the watercourse corridors and within the wetlands. Coyote droppings were observed along the eastern corridor in the higher slope areas of the property. Despite the property being surrounded by an extensive and impenetrable road network, existing mammal populations are well represented by species that would be considered common and readily observed within urban areas. None of the species would be considered unusual to find south of I-87/287. Coyote and white-tailed deer have been observed in previous studies by this author as far south as Mamaroneck and portions of the Bronx.

Mammals:

Common Name	Scientific Name
Virginia Opossum	<i>Didelphis virginiana</i>
Short-tail Shrew	<i>Blarina brevicauda</i>
Eastern Cottontail	<i>Sylvilagus floridanus</i>
Eastern Chipmunk	<i>Tamias striatus</i>
Woodchuck	<i>Marmota monax</i>
Gray Squirrel	<i>Sciurus carolinensis</i>
Southern Flying Squirrel	<i>Glaucomys volans</i>
Red Squirrel	<i>Tamiasciurus hudsonicus</i>
White-footed Mouse	<i>Peromyscus leucopus</i>
Meadow Vole	<i>Microtus pennsylvanicus</i>
Norway Rat	<i>Rattus norvegicus</i>
Red Fox	<i>Vulpes vulpes</i>
Coyote	<i>Canis latrans</i>
Raccoon	<i>Procyon lotor</i>
Striped Skunk	<i>Mephitis mephitis</i>
White-tailed Deer	<i>Odocoileus virginianus</i>

Breeding Bird Survey Methods and Results

The principle survey method involved time-constrained, systematic physical ground searches along random transects throughout each of the habitat types. Unless noted, all species listed were documented through direct observation. Direct observation included visual as well as auditory observation, and evidence of avian activity such as feathers, droppings, tracks, scrapings, and bones. Surveys were conducted between sunrise and two hours after sunrise, mid-day, and/or one hour before and after sunset. All birds observed were identified and recorded to genus and species name. No birds or bird evidence observed during the investigation were collected as voucher specimens. The breeding bird survey was conducted from 04-04-01 through 06-15-01, for a total of 30.5 hours. The analysis of the data from several site visits help provide a picture of the number of breeding pairs throughout the study site. An individual singing male needed to be recorded a minimum of 5 times to be counted as a breeding pair.

Several other site visits were made to gather data on species using the area during the spring migration season. Bird species observed at the site during spring migration were conducted over 6 visits to the study area, from 05 May through 8 June 2001. A total of 94 individual species of birds were observed during spring migration. Fifty (50) of the 94 species observed were confirmed as summer residents and likely breeding.

Of particular importance is the number of forest interior species that were observed to be present within the study area. The majority of the forest interior species were observed within the older aged forested sections of the property. The older aged second growth forest, and the total size of the property appears to serve as important nesting habitat for several forest interior species. This is of particular importance due to the proximity of the adjacent road corridors. The forest provides a large block of forest canopy that is not only attractive to nesting species but for migration as well. The use of this site could be equated with the well-documented high bird use of Central Park in New York City. None of the species identified are listed as threatened or endangered in New York State. Several of these species have however, been placed on watch status and/or listed as high conservation priority species. Westchester County has recently listed worm-eating warblers on a watch list, indicating that this species is declining throughout its range. Fifteen forest interior species were observed within this area, including:

- o Scarlet Tanager
- o Rose-breasted
- o Wood Thrush
- o Red-eyed Vireo
- o Black-throated Green Warbler
- o Worm-eating Warbler
- o Ovenbird
- o Eastern Wood-Pewee
- o Hairy Woodpecker
- o Sharp-shinned hawk
- o Veery
- o Black-and-White Warbler
- o Black-billed Cuckoo
- o Black-capped Chickadee
- o Great-horned Owl

The younger second growth forested areas parallel to the linear wetlands complex, the wetlands complex of forested, scrub-shrub, and riparian habitats, the edges closest to residential properties along the middle of the property, and the existing estate properties provide a combination of habitats for several more common and adaptable transition and edge type bird species. Forest interior species noted above, was also observed to utilize these other habitat areas of the property.

A total of 94 different bird species were observed within the study area during the spring season. As noted above, approximately 50 of these species represent summer resident breeding bird species. The regional complex of relatively intact forested lands serves as an important resource for spring migration. Six species of thrushes were observed, along with 20 different species of wood warblers. The prominent ridgelines, forested canopy and proximity of the lakes and reservoirs provide ideal stopover areas for migratory bird species. Ninety-four different bird species is a good representative number for spring migration throughout the Westchester area. Several more species could be added to this list if water birds that frequent the adjoining reservoirs and Hudson River were taken into consideration.

Based upon the results of the breeding bird survey and spring migration data, the study area plays a very important role as part of a regional movement corridor for migratory species and supports a diverse assemblage of sensitive forest interior and more common bird species.

The tables below provide information on avian species that were observed to be breeding and those that were observed as spring migrants.

Breeding Bird Species

<i>Common Name</i>	<i>Scientific Name</i>	
Mallard	<i>Anas platyrhynchos</i>	
Sharp-shinned Hawk	<i>Accipiter striatus</i>	
Red-tailed Hawk	<i>Buteo jamaicensis</i>	
Wild Turkey	<i>Meleagris gallopavo</i>	broken eggs found
Killdeer	<i>Charadrius vociferous</i>	
Rock Dove	<i>Columbia livia</i>	
Mourning Dove	<i>Zenaida macroura</i>	nest found
Black-billed Cuckoo	<i>Coccyzus erythrophthalmus</i>	
Eastern Screech-Owl	<i>Otus asio</i>	
Great Horned Owl	<i>Bubo virginianus</i>	feathers, dead bird observed
Pileated Woodpecker	<i>Dryocopus pileatus</i>	
Red-bellied Woodpecker	<i>Centurus carolinus</i>	
Downy Woodpecker	<i>Picoides pubescens</i>	
Hairy Woodpecker	<i>Picoides villous</i>	
Northern Flicker	<i>Colaptes auratus</i>	
Eastern Wood-Pewee	<i>Contopus virens</i>	
Eastern Phoebe	<i>Sayornis phoebe</i>	
Blue Jay	<i>Cyanocitta cristata</i>	

Breeding Bird Species (continued)

<i>Common Name</i>	<i>Scientific Name</i>	
Black-capped Chickadee	<i>Parus atricapillus</i>	(fledglings)
Tufted Titmouse	<i>Parus bicolor</i>	(fledglings)
White-breasted Nuthatch	<i>Sitta carolinensis</i>	
Carolina Wren	<i>Thyothorus ludovicianus</i>	
House Wren	<i>Troglodytes aedon</i>	
Veery	<i>Catharus fuscescens</i>	
Wood Thrush	<i>Hylocichla mustelina</i>	
American Robin	<i>Turdus migratorius</i>	(fledglings observed)
Gray Catbird	<i>Dumetella carolinensis</i>	(young observed)
Northern Mockingbird	<i>Mimus polyglottos</i>	
Cedar Waxwing	<i>Bombycilla cedrorum</i>	
Red-eyed Vireo	<i>Vireo olivaceus</i>	
Blue-winged Warbler	<i>Vermivora pinus</i>	
Yellow Warbler	<i>Dendroica petechia</i>	
Black-throated Green Warbler	<i>Dendroica virens</i>	
Black-and-White Warbler	<i>Mniotilta varia</i>	
Worm-eating Warbler	<i>Helmitheros vermivorus</i>	
Ovenbird	<i>Seiurus aurocapillus</i>	
Common Yellowthroat	<i>Geothlypis trichas</i>	
Scarlet Tanager	<i>Piranga olivacea</i>	(fledglings observed)
Northern Cardinal	<i>Cardinalis cardinalis</i>	
Rose-breasted Grosbeak	<i>Pheucticus ludovicianus</i>	/
Rufous-sided Towhee	<i>Pipilo erythrophthalmus</i>	(nest observed)
Chipping Sparrow	<i>Spizella passerina</i>	(young observed)
Song Sparrow	<i>Melospiza melodia</i>	(nest found)
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	(nest observed)
Common Grackle	<i>Quiscalus quiscula</i>	
Brown-headed Cowbird	<i>Molothrus ater</i>	
Northern Oriole	<i>Icterus galbula</i>	
House Finch	<i>Carpodacus mexicanus</i>	
American Goldfinch	<i>Carduelis tristis</i>	
House Sparrow	<i>Passer domesticus</i>	

* Breeding Bird Survey results show a total of 50 individual bird species confirmed to be breeding at the site.

Spring Migration Bird Survey

<i>Common Name</i>	<i>Scientific Name</i>
Great Blue Heron	<i>Ardea herodias</i>
Great Egret	<i>Casmerodius albus</i>
Green Heron	<i>Butorides striatus</i>
Mute Swan	<i>Cygnus olor</i>
Canada Goose	<i>Branta canadensis</i>
Wood Duck	<i>Aix sponsa</i>
Mallard	<i>Anas platyrhynchos</i>
Common Merganser	<i>Mergus merganser</i>
Turkey Vulture	<i>Cathartes aura</i>
Sharp-shinned Hawk	<i>Accipiter striatus</i>
Broad-winged Hawk	<i>Buteo platypterus</i>
Red-tailed Hawk	<i>Buteo jamaicensis</i>
Ring-necked Pheasant	<i>Phasianus colchicus</i>
Wild Turkey	<i>Meleagris gallopavo</i>
Killdeer	<i>Charadrius vociferus</i>
Spotted Sandpiper	<i>Actitis macularia</i>
Rock Dove	<i>Columbia livia</i>
Mourning Dove	<i>Zenaida macroura</i>
Black-billed Cuckoo	<i>Coccyzus erythrophthalmus</i>
Eastern Screech-Owl	<i>Otus asio</i>
Great Horned Owl	<i>Bubo virginianus</i>
Chimney Swift	<i>Chaetura pelagica</i>
Ruby-throated Hummingbird	<i>Archilochus colubris</i>
Belted Kingfisher	<i>Megaceryle alcyon</i>
Red-bellied Woodpecker	<i>Centurus carolinus</i>
Yellow-bellied Sapsucker	<i>Sphyrapicus varius</i>
Downy Woodpecker	<i>Picoides pubescens</i>
Hairy Woodpecker	<i>Picoides villosus</i>
Northern Flicker	<i>Colaptes auratus</i>
Pileated Woodpecker	<i>Dryocopus pileatus</i>
Eastern Wood-Pewee	<i>Contopus virens</i>
Yellow-bellied Flycatcher	<i>Empidonax flaviventris</i>
Eastern Phoebe	<i>Sayornis phoebe</i>
Great Crested Flycatcher	<i>Myiarchus crinitus</i>
Eastern Kingbird	<i>Tyrannus tyrannus</i>
Tree Swallow	<i>Iridoprocne bicolor</i>
Bank Swallow	<i>Riparia riparia</i>
Barn Swallow	<i>Hirundo rustica</i>
Blue Jay	<i>Cyanocitta cristata</i>
American Crow	<i>Corvus brachyrhynchos</i>
Black-capped Chickadee	<i>Parus atricapillus</i>

Spring Migration Bird Survey (continued)

<i>Common Name</i>	<i>Scientific Name</i>
Tufted Titmouse	<i>Parus bicolor</i>
White-breasted Nuthatch	<i>Sitta carolinensis</i>
Carolina Wren	<i>Thyothorus Ludovicianus</i>
House Wren	<i>Troglodytes aedon</i>
Ruby-crowned Kinglet	<i>Regulus calendula</i>
Veery	<i>Catharus fuscescens</i>
Gray-cheeked Thrush	<i>Catharus minimus</i>
Swainson's Thrush	<i>Catharus ustulatus</i>
Hermit Thrush	<i>Catharus guttatus</i>
Wood Thrush	<i>Hylocichla mustelina</i>
American Robin	<i>Turdus migratorius</i>
Gray Catbird	<i>Dumetella carolinensis</i>
Northern Mockingbird	<i>Mimus polyglottos</i>
Cedar Waxwing	<i>Bombycilla cedrorum</i>
European Starling	<i>Sturnus vulgaris</i>
Yellow-throated Vireo	<i>Vireo flavifrons</i>
Red-eyed Vireo	<i>Vireo olivaceus</i>
Blue-winged Warbler	<i>Vermivora pinus</i>
Tennessee Warbler	<i>Vermivora peregrina</i>
Orange-crowned Warbler	<i>Vermivora celata</i>
Nashville Warbler	<i>Vermivora ruficapilla</i>
Northern Parula Warbler	<i>Parula americana</i>
Yellow Warbler	<i>Dendroica petechia</i>
Chestnut-sided Warbler	<i>Dendroica pensylvanica</i>
Black-throated Blue Warbler	<i>Dendroica caerulescens</i>
Yellow-rumped Warbler	<i>Dendroica coronata</i>
Black-throated Green Warbler	<i>Dendroica virens</i>
Pine Warbler	<i>Dendroica pinus</i>
Palm Warbler	<i>Dendroica palmarum</i>
Bay-breasted Warbler	<i>Dendroica castanea</i>
Blackpoll Warbler	<i>Dendroica striata</i>
Black-and-White Warbler	<i>Mniotilta varia</i>
American Redstart	<i>Setophaga ruticilla</i>
Worm-eating Warbler	<i>Helmitheros vermivorus</i>
Ovenbird	<i>Seiurus aurocapillus</i>
Louisiana Waterthrush	<i>Seiurus motacilla</i>
Common Yellowthroat	<i>Geothlypis trichas</i>
Scarlet Tanager	<i>Piranga olivacea</i>
Northern Cardinal	<i>Cardinalis cardinalis</i>
Rose-breasted Grosbeak	<i>Pheucticus ludovicianus</i>
Indigo Bunting	<i>Passerina cyanea</i>
Rufous-sided Towhee	<i>Pipilo erythrophthalmus</i>
Chipping Sparrow	<i>Spizella passerina</i>

Spring Migration Bird Survey (continued)

<i>Common Name</i>	<i>Scientific Name</i>
Song Sparrow	<i>Melospiza melodia</i>
White-throated Sparrow	<i>Zonotrichia albicollis</i>
Dark-eyed Junco	<i>Junco hyemalis</i>
Red-winged Blackbird	<i>Agelaius phoeniceus</i>
Common Grackle	<i>Quiscalus quiscula</i>
Brown-headed Cowbird	<i>Molothrus ater</i>
Northern Oriole	<i>Icterus galbula</i>
House Finch	<i>Carpodacus mexicanus</i>
American Goldfinch	<i>Carduelis tristis</i>
House Sparrow	<i>Passer domesticus</i>

Amphibian and Reptile Surveys - Methods and Results

Surveys for amphibians and reptiles took place between April 18 and July 23, 2001. A total of 68.5 hours were spent in the field, and an additional 15 hours were spent in specimen preparation and identification. Field inventory techniques included visual searches, cover object removal, frog call analysis, larval sampling, egg identification, and the use of minnow and turtle live traps. A detailed description of these techniques can be found in Klemens (1993). Twelve species of amphibians and reptiles were documented; we also received reports of two additional species from residents, which we were unable to confirm.

Salamanders:

Spotted Salamander	<i>Ambystoma maculatum</i>
Two-lined Salamander	<i>Eurycea bislineata</i>
Redback Salamander	<i>Plethodon cinereus</i>

Frogs:

American Toad	<i>Bufo americanus</i> (verbal report-unconfirmed)
Spring Peeper	<i>Pseudacris crucifer</i>
Bullfrog	<i>Rana catesbeiana</i>
Green Frog	<i>Rana clamitans</i>
Wood Frog	<i>Rana sylvatica</i>

Turtles:

Snapping Turtle	<i>Chelydra serpentina</i>
Painted Turtle	<i>Chrysemys picta</i>
Red-eared Slider	<i>Trachemys scripta</i>
Eastern Box Turtle	<i>Terrapene carolina</i>

Snakes:

Milk Snake	<i>Lampropeltis triangulum</i> (verbal report-unconfirmed)
Eastern Garter Snake	<i>Thamnophis sirtalis</i>

The distribution of these species on the site is quite uneven and populations are localized. In addition, most of these species exist at low population densities, which is consistent with the land-use history of the property. The understory and duff layers are quite shallow, resulting in reduced cover for many species. Unlike birds, or even mammals, the amphibian and reptile populations on site show a clear island effect. The dispersal abilities and mobility of amphibians and reptiles is far more limited than either birds or mammals. The site exists as an island, bounded by expressways and dense developments. The ability for amphibians and reptiles to disperse into the site is very small, as opposed to birds and mammals. None-the-less, the site still contains significant species of amphibians and reptiles. The eastern box turtle is a NYS DEC listed "special concern species." The presence of wood frogs and spotted salamanders is significant as these species have all but disappeared from lower Westchester County due to habitat fragmentation. These species are among the special natural resource values of the site, and are included in the significant habitat zone in the Buckhurst, Fish, and Jacquemart report.

Spotted Salamander: This species was documented breeding in the small impoundment in the central north-facing ravine. On April 18th several egg masses were noted, and an adult male was observed under a log at the south end of the pond at the stream inlet. Eggs were observed on May 9th, but it was not clear if they had failed. No salamander larvae were observed in the pond during July. Breeding success of this population appears to be low to non-existent. The presence of a large population of sunfish (*Lepomis macrochirus*) in the pond undoubtedly affects the survivorship of the eggs and young, as may other predators such as a large species of crayfish (*Procambarus acutus*). Aggressive conservation action will be needed to recover this remnant population of spotted salamanders.

Two-lined Salamander: These salamanders were restricted to the headwater, spring fed tributaries to Sheldon Brook. They were documented above and below the spotted salamander breeding impoundment, and in the branch of Sheldon Brook above the impoundment of the Guarda property. The presence of cool headwater seeps and springs on the steep slopes of the site are important to maintain these populations. To protect these critical habitats, forest cover should be maintained and erosion of the steep slopes (resulting in siltation) should be mitigated.

Redback Salamander: These animals are quite abundant on site and were found in areas that contained moist duff. Because of the eroded nature of the site, and the accompanying dryness, most salamanders were noted near the vicinity of seepages, spring, and wetlands.

American Toad: We received a verbal report of a toad found in the yard of a house on the Esposito property near Gracemere Lake.

Spring Peeper: This species breeds in floodplain forest below Bagarotti Pond.

Bull Frog: Bull Frogs were heard calling in July in Gracemere Lake.

Green Frog: The most common frog on site, in both pond and seepage areas. Breeds in the pond used by spotted salamanders. This species was also observed on the Esposito property, and the floodplain forest below the Bagarotti Pond, and in the Guarda Pond.

Wood Frog: In July, numbers of last year's young of this species were found on the slopes surrounding the spotted salamander breeding pond. Several were also found around the Guarda Pond, but whether they bred there or migrated from the spotted salamander pond is unclear. This is a significant species, nearly extinct in southern Westchester County. Like the spotted salamander, it requires wetlands and significant amounts of upland habitat (see Klemens, 2000) to sustain its populations. Removal of fish from its breeding site will help record this population.

Snapping Turtle: One individual was observed nesting at Gracemere Lake.

Painted Turtle: Seven painted turtles were observed at Gracemere Lake; more than 25 were observed in Bagarotti Pond.

Red-eared Slider: This is an introduced species, of which one specimen was observed in April in Gracemere Lake.

Eastern Box Turtle: This species is not common on site, according to residents. Two were found on the spring fed slope (Esposito Property) behind the houses on the road to Gracemere Lake. This is a unique habitat of beech forest, interspersed with spring fed wetlands. Both box turtles were found in the wetland—a young female in May, and an older male in July. Box turtles are long-lived species. They are becoming rare in southeastern New York through habitat loss and the loss of long-lived adults from the breeding population. The population appears to be a very low density, consistent with other species on the site.

Garter Snake: Also at very low density, a single individual was found dead on Sheldon Road at the entrance to the Bagarotti property. Two individuals were observed on the Esposito property—one in the box turtle seepage wetlands, and one in the yard of the inholding.

Milk Snake: Reports of copperheads, one in the cellar, and a young one under a piece of plywood near a well were received from the residents of a inholding owned by Esposito. Given the description of the snakes and the habitat and behavior, these were most likely milk snakes.

4. Management Recommendations: Conservation and Restoration Options

The Holy Spirit properties provide a unique assemblage of habitats and acreage that are capable of sustaining environmentally sensitive and relatively stable populations of wildlife. The proximity of the property to a highly dense population base, its total acreage, accessibility, its unique amenities (such as incredible scenic views of the Hudson Valley), and the diversity of terrain justify this property as a candidate for permanent acquisition as a valuable open space resource locally and regionally.

Specific management strategies are, however, necessary to safeguard what appears to be a declining population of sensitive wildlife species. Most notably, to preserve the spotted salamander, wood frog, box turtle and other sensitive wetland-dependent species will require an aggressive and active management program that is not only scientifically based, but that also includes provisions for follow up monitoring and intervention, if necessary.

The middle corridor of the property as previously discussed by Buckhurst Fish & Jacquemart, Inc. in their June 2001 report is the area of highest environmental value. It is within this area that specific management will be required to protect and preserve critical breeding habitat for resident amphibian species. The breeding pond that is currently utilized by the spotted salamanders is filled with fish that are a detriment to sustaining any viable population of salamanders. An aggressive pond management program that includes removal of fish species, dredging, re-design of the pond, removal of debris, re-planting, and possibly re-introduction of salamanders to the pond may be necessary if the limited population currently present has a chance at survival and sustainability.

Wood frog individuals observed utilize the riparian wetlands and watercourse areas and the ponds. Their population is questionable as to breeding viability. Their population would be assisted with an aggressive pond restoration program and enhancement of the upland buffer areas.

The box turtles observed are located in close proximity to existing residences and interior roadway. The habitat is relatively intact but is encroached upon by garbage and lawn/leaf debris from the nearby residences. This linear wetland area is critical to the long-term survival of the box turtle. Examination of the impact of invasive plant species and siltation, due to dirt bike activities and prior well-digging activities, may impair the functions of these important linear wetland corridors.

Based upon the survey, resident mammal populations should be self-sustaining as long as the area remains intact. Increased fragmentation of the property from surrounding residential development may reduce population numbers and cause some shift in species diversity and abundance.

The study site is currently attractive to forest interior bird species. The size of the property, the extent of forest canopy tree cover, and the naturalized condition of the property should allow resident and migratory birds to continue to thrive in this area. The proximity of the road network will likely limit any additional expanded use of the property beyond its current use. The strongest case for preservation of this area is the size of the parcel and the fact that it is still being used by sensitive forest interior species. Preservation of the forest canopy, prevention of edge areas, and prevention of fragmentation will safeguard this resource for avian species. Land protection strategies of some of the other properties adjacent to the Holy Spirit landholdings are important considerations in maintaining the viability of this site for resident and migratory bird species.

Although the study area has been encroached upon by several invasive plant species, their numbers are not currently alarming. However, it is important that an invasive species management plan be prepared that monitors the spread of invasives, and that active management strategies are in place to counter the spread of these unwanted plants. The Japanese stilt grass appears to be the most aggressive of the invasive plants observed. This species already has a foothold within the wetland corridors and throughout the midslope areas of the property. The amount of forest canopy and shade created will assist in keeping its growth habit lower to the ground, but its eventual spread and domination will occur without some type of monitoring and intervention strategy.

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