I. Natural Resources

100. Definitions

For CEQR, a natural resource is defined as plant and animal species and any area capable of providing habitat for plant and animal species or capable of functioning to support ecological systems and maintain the City's environmental balance. Resources such as surface and ground-waters, soils (upland and wetland), drainage systems, wetlands, dunes, beaches, grasslands, woodlands, landscaped areas, gardens, parks, and built structures used by wildlife may be considered, as appropriate, in a natural resources analysis.

While plant and animal species are considered natural resources, the approach most often used for CEQR is to consider plant and animal species in the context of the surrounding environment, or habitat. For CEQR evaluations, an action's potential to affect that environment is the primary consideration. Of course, those plant and animal species that are known to be threatened, rare, endangered, or otherwise sensitive or worthy of protection are given individual consideration.

Descriptions of the various natural resources that should be evaluated in a CEQR assessment are described in this chapter. Additional information on natural resource habitats can be found in the New York Natural Heritage Program's document entitled "Ecological Communities of New York State". Descriptions of the various communities highlighted in this publication can vary widely with respect to the species composition in New York City. Therefore, careful attention in the field to dominant and co-dominant vegetation, understory species composition, soils, and hydrology will provide additional information as to the correct ecological community classification.

110. WATER RESOURCES

New York City is situated on a large, natural, shallow-water harbor, and has many fresh water bodies. Since its founding in the early 1600's, the City has relied on its water resources for a variety of uses, including: fishing; transportation; recreation; commerce; and water supply. The role of water resources has evolved over the last four centuries, and these resources are still extremely important to the City's environment.

111. Surface Water Bodies

Surface water bodies are important natural resources; in the City they serve as: (1) habitat for a wide variety of aquatic life, including finfish and bottom organisms ("benthic organisms") ; (2) resources for shipping and boating; (3) recreational resources; and (4) in limited cases, water supply. The City contains a wide variety of water bodies, including the following:

- The Atlantic Ocean, along the south shores of Brooklyn, Queens, and Staten Island.
- New York Harbor, which is a tidally influenced estuary, subject to the mixing of salt water from the ocean with fresh water primarily from the Hudson River. It is divided at the Verrazano Narrows into Upper and Lower New York Bays.
- Long Island Sound, is a long and relatively narrow tidal water bordering Queens, and is separated from the Atlantic Ocean by Long Island (including Queens and Brooklyn).
- Bays, basins and coves, which are enclosed or partially enclosed tidal waterbodies, generally fed by freshwater streams or rivers with limited outlets to larger bays or the ocean. The City's waterfront contains a number of bays, basins, and coves. Jamaica Bay is the largest and most important as a natural resource; it is an enclosed bay in Brooklyn and Queens, fed by a number of creeks and streams, with an outlet to the Atlantic Ocean. Other bays include Little Neck Bay, Bowery Bay, and Powell's Cove in Queens, and Pelham Bay and Eastchester Bay in the Bronx.
- Tidal straits, including the East and Harlem Rivers, which connect Long Island Sound, and the Hudson River with Upper New York Harbor; and the Kill Van Kull and Arthur Kill, which connect Upper and Lower New York Bays around the north and west sides of Staten Island.
- Rivers, the largest of which is the Hudson River, which originates in the Adirondacks and makes its way to New York Harbor. In the City and north to the Federal Dam at Troy, NY, the Hudson River is a tidal estuary. Other rivers include the Bronx River and Hutchinson River in the Bronx. Rivers draw their waters

from streams, groundwater, and overland runoff from a large area, referred to as a drainage basin, catchment area, or watershed.

- Streams and kills (the Dutch word for stream), which usually have their headwaters and outlets in a relatively small drainage area (a portion of a borough, for example). Examples of the City's streams and kills include Spring Creek in Brooklyn, and Fresh Kills and Richmond Creek in Staten Island.

- Ponds and lakes, include all non-free-flowing, contained freshwater bodies, either built or naturally occurring. The City's lakes and ponds are found in all five boroughs. Prominent natural ponds include Kissena Lake in Queens, Van Cortlandt Lake in the Bronx, and Brooks and Clove Lakes in Staten Island; built ponds include the Lake in Central Park and other water bodies in Central Park, and Prospect Lake in Prospect Park. The Jerome Park Reservoir is used to store the City's drinking water and regulate its flow to consumers.

112. Groundwater

The water that is contained beneath the surface in various types of soils, fill, and rock is groundwater; the geologic systems containing groundwater are called aquifers. Groundwater is usually fresh water and, in the City, is replenished through rainfall that percolates into the ground. Along the coast, harbor, and river waterfronts, the tides influence groundwater; in these areas groundwater can be saline or partially saline (brackish). The importance of groundwater as a resource is: (1) as a source of water supply for drinking water, domestic applications, business, and industry; (2) as a source of water for surface water bodies and wetlands; (3) to serve critical geotechnical functions related to structural load bearing capacity (lowering the water table may cause subsidence); and (4) as a barrier to salt water intrusion.

Although all five boroughs contain groundwater, the major resources in the City lie beneath Brooklyn, Queens, and Staten Island. There, the major aquifers include the Raritan formation beneath Staten Island, southeastern Brooklyn, and the eastern half of Queens; the Lloyd and Magothy aquifers, beneath southern and central Brooklyn, eastern Queens, and Staten Island; the Jameco aquifer, beneath limited areas of Brooklyn and southern Queens. Groundwater between these aquifers may or may not be connected. The Lloyd aquifer is deepest and is just over bedrock. This aquifer is covered with a layer of confining clay. The Magothy aquifer is found above this clay formation and below the Upper Glacial aquifer. Both the Magothy and Upper Glacial aquifers are in contact in some areas and are isolated in other areas depending on the location of lower permeable clay and silt deposits. The Upper Glacial aquifer is rarely used, because it is highly turbid and often impacted from activities on the surface. Only the aquifers in Brooklyn and Queens are regularly used for water supply; the New York City Department of Environmental Protection taps the Magothy Aquifer and serves a portion of southeastern Queens and western Nassau County with potable water. Industries are permitted to install wells for process water, and homeowners may drill wells for irrigation, but this is not potable water. In addition to drinking water considerations, groundwater is also a concern because it could act as a medium for the spread of contamination to other water resources and wetlands.

113. Other Water Resource Systems

As discussed above, a variety of water sources feed the City's water bodies and wetlands (see Section 120, below), including other water bodies and groundwater. Critical components of water resources systems are stormwater and the natural and built systems that convey it to a receiving water or wetland resource. Although stormwater is not usually a habitat and does not usually support an ecosystem, it has a powerful effect on conditions in the waters or wetlands to which it flows. In considering water resources and wetlands under CEQR, stormwater is an important element. The following aspects may be of concern, depending on the action in question:

- *Overall drainage system.* The method by which stormwater is conveyed to a receiving water generally falls under the heading, "drainage." This refers to the physical configuration of the land that drains towards the water body or wetland, including those elements that determine the volume and velocity of flow for a given rainfall: its slope, soils, vegetative cover, and hard (impervious) surfaces. Drainage also includes any built drainage or stormwater systems, including catch basins, pipes and outfalls, swales, channels, and culverts. The quality and quantity of the stormwater that flows to a water body or wetland is in large measure determined by: (1) the uses and activities that take place in a drainage area; (2) sediment and erosion control measures; (3) the type and extent of vegetation; and (4) soils.

- *Floodwater system or floodplain.* Within the drainage system, an important consideration is that portion of the area that is low enough to hold flood during large storms. When the banks of rivers or streams overflow during a storm the wide, flat floodplain spreads the water, reducing its velocity and force; it permits the water to flow more slowly to the stream or river and, in some cases, its vegetation removes pollutants. Thus it is a very important element in protecting water resources. The floodplain has been defined by regulation (see Section 710) and includes the areas that flood during storms of a statistical frequency occurrence of once in 100 years (the 100-year storm) and once in 500 years. These are referred to as zones A and B, respectively, in federal legislation. The City's administrative code (27-316) restricts uses in the 100-year floodplain (Zone A).

120. WETLAND RESOURCES

Wetlands are areas where the periodic or permanent presence of water controls the characteristics of the environment and associated plants and animals. They include marshes, swamps, and similar areas found in flats, in depressions in the landscape, on slopes where groundwater emerges to the land surface, and between dry land and open water along the edges of streams, rivers, lakes, and coastlines. Wetlands include the portions of water bodies shallow enough to permit sun to reach the bottom, thus potentially allowing vegetation to take root, and the portions of land that regularly, frequently, or continually contain standing water or water within six inches of the surface.

This transition zone of land and water can support a particularly rich assortment of plant and animal life. This community begins with the microscopic plankton and algae that are the primary generators of food sources and also includes worms, slugs, clams, and other bottom organisms; amphibians; reptiles; birds; and mammals. Wetlands also serve the important physical function of floodwater retention, and they can filter pollutants from these waters. Wetlands are often important to the public for recreation and open space and to commercial operations as sources of food or other materials. In some areas wetlands also function to permit groundwater or surface water replenishment (also known as "recharge").

Wetlands are sensitive resources, so the upland area adjacent to them is usually included when impacts on wetlands are assessed. The following definitions are grouped into two major wetland types: those containing fresh water and those influenced by tides and salt water.

121. Freshwater Wetlands

Freshwater wetlands are associated with freshwater systems. They can be found adjacent to ponds and streams (often the smaller water bodies themselves are included in the wetland definition) and in low-lying or poorly drained areas. In the City, freshwater wetlands can be found in the coastal zone, quite close but unconnected to a tidal water body, or they can be found perched in an upland environment. (Perched wetlands are those that are over an impermeable layer so that the water in the wetlands does not feed the groundwater system, but is trapped above it.) The different types of freshwater wetlands are referred to by a number of names, including swamps, marshes, bogs, fens, and flats. There are no officially adopted names associated with particular types of wetlands (each agency with jurisdiction over wetlands has its own system of titles and classifications). Wetlands either can always be covered in water, can hold water within a few inches of the surface, or can experience times when soils are dry and when soils are inundated. In addition, they can either be unvegetated, or they can contain floating or submerged plants, herbaceous (non-woody) plants, or a mixture of herbaceous and woody (trees and shrubs) plants.

Freshwater wetlands are regulated by New York State in Parts 662 through 665 of Title 6 of the *Official Compilation of Codes, Rules and Regulations of the State of New York* (6 NYCRR). Under this regulation, freshwater wetlands of 12.4 acres or larger are protected, although smaller wetlands can also be protected if the DEC commissioner has determined that they have unusual local importance. In addition to the wetland itself, a buffer area around the freshwater wetland, called the "adjacent area," is also protected. The freshwater wetland "adjacent area" refers to the contiguous upland area the condition of which affects conditions in the wetland. State regulation sets the adjacent area within 100 feet of the wetland. However, a larger wetland buffer should be provided when critical hydrological, habitat, and other ecological functions related to the wetland are outside the 100 foot regulated adjacent area. Many of the City's freshwater wetlands are in Staten Island, which contains more than 2,000 acres of this resource. These include Mariner's Marsh, in the Port Ivory section; Graniteville Swamp, a swamp forest in the northern part of the island; and Goethals Bridge Pond. Others are in Queens, including Alley Pond Park. Characteristic plants include buttonbush, willow, sedges, coarse grasses, rushes, reeds, cattails, swamp azalea, and others, depending on soil characteristics, the degree and duration of inundation, and land use history.

122. Tidal Wetlands

Tidal wetlands are found in and around the City's tidal water bodies. Since the City has more than 500 miles of tidal waterfront, the opportunity for tidal wetlands is vast. And, despite all of its development, the City still contains a substantial variety of tidal wetlands. Most of these are in Jamaica Bay, and in the inlets and coves that line the shores of northern Queens and southeastern Bronx, particularly at Udall's Cove, Alley Pond Park, and the mouths of the Bronx and Hutchinson Rivers.

Tidal wetlands are regulated by New York State in Parts 660 and 661 of Title 6 (*6*NYCRR). As for freshwater wetlands, in addition to the tidal wetland itself, a buffer area around the wetland an "adjacent area" is also protected. In the City of New York, the tidal wetland adjacent area as defined by State wetland regulations, usually includes the landward area within 150 feet of the wetland. As noted in Section 121 above, however, based on the relationship of the wetland and its surrounding area, a different protective buffer is sometimes appropriate. In 6 NYCRR 661.4, tidal wetlands are grouped according to characteristic ecological zones, as follows:

- *Littoral zone.* The littoral zone is defined in 6 NYCRR 661.4 as the tidal wetlands zone that includes all lands under tidal waters, to a depth of six feet at mean low water, that are not included in any of the other categories listed below. In ecological terms, the littoral zone is that portion of a tidal water that is shallow enough to let sunlight penetrate to the bottom , thereby permitting the opportunity for a variety of rooted and floating aquatic plants and animals to take hold. Although the richness of the ecological systems in a littoral zone can vary widely, its location at the edge of land makes this zone important for removal of pollutants that come from activities on land and for tidal flood control. The land under water adjacent to nearly all the shoreline in the City is classified as littoral zone by the New York State Department of Environmental Conservation (DEC).

- *Coastal shoals, bars, and flats.* These wetland types are defined in 6 NYCRR 661.4 as the wetland zone that (1) at high tide is covered by water; (2) at low tide is exposed or is covered by water to a maximum depth of approximately one foot; and (3) is not vegetated by low marsh cordgrass *Spartina alterniflora*. Like the littoral zone, this area can perform a number of valuable functions, such as supporting varied and productive plant and animal life and serving as feeding habitat for wading birds. Some examples of coastal shoals, bars, and mudflats in the City of New York are located along Coney Island Creek in Brooklyn; along Pugsley's Creek, the mouth of Westchester Creek, and the many small inlets near Clasons Point in the Bronx; and throughout Jamaica Bay, in Queens, where there are 350 acres of tidal mudflats.

- *Intertidal marsh.* The intertidal marsh is defined in 6 NYCRR 661.4 as the vegetated wetland zone lying generally between average high and low tidal elevation. Thus, this area is subject to inundation by tidal flows twice daily. This and the coastal fresh marsh tidal wetlands defined below are generally considered the most biologically productive of all tidal wetlands areas. Since they receive twice-daily tidal flushing, they are effective at cleansing ecosystems and absorbing silt and organic material. In addition, the plankton that flourish here, as well as decomposed organic matter, are easily transported to adjacent waters for use in the food chain. Intertidal marsh is suitable for fish spawning, and, where the area is also rocky, it supports encrusting organisms as well. Intertidal marsh is also very effective for flood and hurricane storm protection. The predominant vegetation is low marsh cordgrass (*Spartina alterniflora*). Jamaica Bay includes some 950 acres of intertidal marsh. Other examples of intertidal marsh, often located beside high marsh (see below), are found at Mariner's Marsh on the northern shore of Staten Island in the Port Ivory section; in Flushing Bay, Powell's Cove, and along Jamaica Bay in Queens; and along Pugsley's Creek and the mouth of Westchester Creek in the Bronx.

- *Coastal fresh marsh.* Coastal fresh marsh is defined in 6 NYCRR 661.4 as the tidal wetland zone found primarily in the upper tidal limits of riverine systems where significant fresh water inflow dominates the tidal zone. The grasses that typify the coastal fresh marsh are different from those of the intertidal marsh. Like the intertidal marsh, the coastal fresh marsh is biologically productive and effective in flood and storm protection. Plants found here include narrow-leaved cattails, tall cord grasses, and freshwater species such as arrow arum, pickerel weed, and cutgrass. Examples include Lemon Creek, Fresh Kills Creek, and the Mariner's Marsh shoreline near Port Ivory on Staten Island.

- *High marsh or salt meadow.* High marsh or salt meadow is defined in 6 NYCRR 661.4 as the uppermost tidal wetland zone that is periodically flooded by spring and storm tides and is usually dominated by salt hay and spike grasses. Other plants include low vigor, seaside lavender, black grass, chairmaker's rush, marsh elder, and groundsel bush. Because the high marsh receives only occasional tidal flooding, its value for marine food production is somewhat less than the lower-lying marshes. However, it is very important for feeding, resting, and some nesting by birds, and for foraging by some amphibians and reptiles. Also, high marshes are particularly efficient at absorbing silt and organic material; they are also extremely valuable for flood and hurricane and storm control. High marshes cycle nutrients for the benefit of intertidal marshes, near which they are often located. In New York City, the high marshes are found predominantly in the Jamaica Bay area, where there are about 530 acres of high marsh. They are also located along the Port Ivory shoreline on Staten Island; at Flushing Bay and Powell's Cove in Queens; and at Pugsley's Creek and along the Saw Mill Creek in the Bronx.

- *Formerly connected tidal wetlands.* Formerly connected tidal wetlands are defined in 6 NYCRR 661.4 as the tidal wetlands zone in which normal tidal flow is restricted by man-made causes. These wetlands normally occur in lowland areas, in which connections to tidal waters have generally been limited by construction of dikes, roads, and other structures. These areas, however, may still function as productive natural resources and such wetlands are considered on a case-by-case basis for their value as resources. These wetlands may continue to support the wetland plants established from their previous condition, or they may be infiltrated with common reed (*Phragmites australis*). Old Place Creek on western Staten Island is an example of a formerly connected tidal wetland. In addition, some areas, such as the Idlewild landfill area in southern Queens, show no surface connection but still contain underground tidal flow. Therefore, landfills at the water's edge often have "inland wetland vegetation."

130. UPLAND RESOURCES

Upland resources include all natural areas that are not water resources or wetlands. In New York City, upland resources are enormously diverse. Although the function, productivity, and value of specific uplands may vary considerably, generally these resources provide wildlife habitat, open space and recreational opportunities, and particular functions such as storm and flood control or wetland protection. With the exceptions of beaches, dunes, and bluffs, upland resources are generally described by their vegetation.

131. Beaches, Dunes, and Bluffs

The City contains a variety of coastal uplands associated with its shoreline. Beaches, which can be found all along the City's Atlantic Coast, along the East River and Long Island Sound in the Bronx and Queens, and along southern Staten Island, are major recreational resources. As ecological zones, they are relatively tolerant of public use. There is very little vegetation on the beach itself. Instead, the land is shaped and reshaped by the winds, waves and tides every day. The species that live here tend to be hardy. Birds, some reptiles, and small mammals also use the beach for foraging, resting, or as a path from shelter to the water. However, during breeding seasons, public use and the needs of nesting shore birds often conflict. For example, the piping plover, which is an endangered species, nests on beaches at Arverne, in the Rockaways.

Dunes are recent accumulations of sand formed by sea winds and waves. Although their form is very fragile, they perform an essential function in protecting both the beaches in front of them and land behind them from wave and storm forces. The grasses and herbs that can grow on dunes, particularly where they face the sea, are among the few species that can live with limited water supply. Their roots form a mat that stabilizes the dune face. The back side of the dune can support a somewhat wider variety of plant life. This ecological zone supports beachgrass, bayberry, and other grasses and shrubby species, but it is very intolerant of recreational use or any kind of construction that alters the dune's shape. Some coastal areas in the City have both primary and secondary dunes; others have just one line of dunes.

Bluffs are steep formations of soft erodible materials, such as clay and sand. Bluffs, like dunes, are particularly effective in protecting against coastal erosion. They absorb wave energy, particularly during storms, and provide sand for the beach and for offshore sandbars and shoals. Also like dunes, the toe, rise, and tops of bluffs are fragile; loss of vegetation will lead to erosion, slumping, and possible destruction of the bluff itself. Bluffs therefore are not suitable for recreation or for development. In considering beaches, dunes, and bluffs, it is important to remember that the system that formed these resources is not static. Sands shift, new dunes are formed, bluffs erode—nowhere are the forces of nature to create or remove land so evident as in these coastal areas. The Atlantic shoreline along the Rockaways and southern Staten Island includes notable expanses of beach with some dunes; the southeast shore of Staten Island features bluffs.

132. Thickets

Thickets are characterized by low, shrubby species such as bayberry, beach plum, sumac, poison ivy, and greenbrier. They are found most frequently on dunes, particularly where they face away from the sea, on the toe and tops of bluffs, and on the islands in Jamaica Bay. Like grasslands, the low-lying plant life supports insects, small mammals, snakes and other reptiles, and birds, and they provide forage for larger animals and birds.

133. Grasslands

Grasslands are plant communities in which grasses and herbaceous plants are dominant and trees and shrubs are sparse or absent. In New York City, near the influence of salt spray, are maritime grasslands containing those species that can survive in the harsh conditions that strong winds and salt spray create. Predominant plants are hairgrass, switchgrass, bluestem, poverty oat grass, and seaside goldenrod. Grasslands are habitats for small mammals, snakes, insects, and birds. Birds of prey and some larger species also forage in grasslands. Grasslands in the City are found predominantly near the beaches and coastal areas, particularly at Breezy Point and on the islands in Jamaica Bay. Grasslands also prevail in areas subject to frequent fires (Blue Heron Park, Staten Island), on serpentine soils (Latourette Park, Staten Island), on landfill soils created with sand dredge spoils (Marine Park, Brooklyn), and on thin mineral soils (Pelham Bay Park, the Bronx).

134. Meadows and Old Fields

Meadows are plant communities that become established in areas where a disturbance (either natural or human-induced) cleared the area of shrubs and trees. Meadows are dominated by herbaceous plants, such as grasses and ferns, which require periodic maintenance to prevent colonization by woody plants. Examples of this habitat in New York City are the wildflower meadows in Central Park in Manhattan and Alley Pond Park in Queens. Old fields are created where forests have been cut to accommodate another activity (e.g., agriculture, or building sites that have since been cleared), and then that activity is abandoned. For many years, these fields will support grasses and other low vegetation. Without maintenance, woody species will eventually begin to colonize, and a natural process of foresting the land, called succession, will take over. However, while these fields still offer only low cover for wildlife, they will provide habitats similar to other grasslands and grassy areas.

135. Woodlands and Forests

Before European settlement, nearly all of the City's uplands were forests or woodlands. Typical woodlands were mixed deciduous hardwoods—maples, oaks, and beech, with associated tuliptree, ash, cherry, and hickory—and stands of conifers, with white pine and hemlock. Much of the forest was destroyed, first by farming and then by urbanization, and no "first growth" woodland remains. However, second-growth forest stands can be found in the Bronx, Queens, Manhattan, and Staten Island. For example, the oak-chestnut association, located in the central hills of Staten Island, is well known. In addition, some of the stands in and near the New York Botanical Garden in the Bronx and in Inwood Hill Park in Manhattan are extensive, and a developing oak woodland exists at Mott Point in the Rockaways. In addition to native tree species, a number of introduced tree species (such as London plane, stock pine, Norway spruce, European larch, and ginkgo) were brought to the City from Europe and Asia; these are often intermingled with native species in the City's woodlands. Woodlands can offer shelter and food for a full range of animal species. This function is also valuable when a woodland is adjacent to a wetland or water resource.

The City also contains barrens, which are intermediate wooded areas characterized by sandy, dry soils, and exposure to sea winds. The sandy soils hold little moisture, and they lack the nutrients that most plants require. However, these soils can support a particular group of woody species, such as black oak, white oak, chestnut oak, post oak, blackjack oak, and pitch pine. Known as sandy oak barrens, these resources are similar to the Pine Barrens in southern New Jersey. Greenbrier and other thicket species, such as highbush and lowbush blueberry, hackberry, and huckleberry, are also found in the sandy oak barrens. Small mammals and reptiles, such as turtles, are common in barrens. This habitat is located primarily in the southwest area of Staten Island.

136. Gardens and Other Ornamental Landscaping

The City is dotted with a variety of gardens, landscaped areas, and small parks, as well as larger, landscaped parks, such as Central Park, Prospect Park, and the many cemeteries in Queens and Brooklyn. Vegetation here is usually not natural, but these areas are nonetheless useful resources for recreation and some bird, small mammal, and insect habitat.

140. BUILT RESOURCES

Over the years, as the City's once natural environment has evolved to one of dense development, certain wildlife species have adapted. Today, although the organisms inhabiting the City's resources are less abundant and diverse than they once were, a number of species live not only in "natural" areas, but some also utilize piers, bridges, buildings, and other structures as habitat. In addition, a variety of structures have been built to replace some of the environment's natural functions for flood and erosion control. These built resources include the following:

- *Piers and other waterfront structures.* Most of the City's waterfront structures, whether functioning or not, provide habitat for certain marine species. These can include: plankton; encrusting organisms, such as algae, mussels, and barnacles, which live on the structures and are food sources for creatures higher on the food chain; benthic species such as clams; and fish, including striped bass, winter and summer flounder, American eel, Atlantic herring, white perch, bay anchovy, and many others, depending on the location of the habitat.

- *Old piers, pile fields, and other ruins.* Many waterfront and other structures that have been abandoned by humans are now in active use by a range of wildlife. In addition to the species that use active waterfront structures (see above), the lack of human activity makes pile fields and old piers attractive to a number of birds, which nest and/or forage there. The pile fields and decaying piers, particularly on the Brooklyn and Staten Island waterfronts, are favorite living places for cormorants. At Shooters Island in the Kill Van Kull, hundreds of abandoned marine vessels attract many species of herons, kingfishers, cormorants, and gulls for foraging and, in some cases, nesting. On North Brother Island and Roosevelt Island, ruins of hospital and other public buildings are now the home for bats, snakes, heron colonies, and feral animals.

- *Beach protection structures.* Many of the City's beaches are protected by groins, jetties, and breakwaters that break the force of ocean waves and slow the drift of sand. Groins in New York City, such as those at Coney Island and Rockaway, and the abandoned groins along the south shore of Staten Island, are typically stone and timber structures perpendicular to the beach, erected to minimize erosion. Jetties are larger rock structures used to stabilize inlets; Rockaway Inlet is held in position by such jetties. Other protection structures used in the City include small timber wave breaks used to prevent waves and ship wakes from disturbing moored boats in marinas, and breakwaters, which are larger structures, usually constructed of stone, timber cribs, and/or steel, that serve a similar purpose.

- *Flood protection structures.* In several low-lying areas, flood protection structures have been installed. These include tide gates (such as at the mouth of Flushing Creek), weirs (found, for example, along Wolfe's Pond Creek in Staten Island), and pumps (such as in the College Point area along the shores of Flushing Bay).

- *Other structures.* A wide variety of structures in the City may offer habitat for some species. One example is the peregrine falcon's use of tall buildings and bridge towers. These birds prefer to nest in high places within sight of water. Until the 1930's, the falcons nested on cliff ledges on the Palisades. However, the pervasive use of DDT and other pesticides caused their extirpation from the area due mainly to eggshell thinning, which drastically lowers breeding success. Today, these birds are enjoying a limited resurgence due to the banning of DDT in 1971 and artificial rearing (hacking). The number of peregrine falcons has grown steadily since 1983, when the first peregrines in decades returned to nest on bridges in the City. They can now be found once again on building ledges and other tall structures around the City, such as skyscrapers in Midtown Manhattan and the Marine Parkway Bridge in Brooklyn.

150. SIGNIFICANT, SENSITIVE, OR DESIGNATED RESOURCES

The City, state, and federal governments have all recognized the value, rarity, and sensitivity of many of the City's natural resources. State and federal interest is generally focused on the City's coastal areas, but the City also recognizes a number of upland areas as having significant value. Most often, these areas combine several of the natural resources defined above. The following resources are designated significant, sensitive, or worthy of protection. The legal protections for these natural resources are described below in Section 710.

- *Waters.* All of the waters of New York City—both surface and groundwater—are considered important resources and are regulated by the State. This includes tidal and freshwater wetlands, coastal estuarine waters, and all other water resources (see Section 110 above).

- *Jameco and Magothy Aquifers.* Beneath Brooklyn and Queens, these aquifers are designated sole source aquifers (i.e., they are used to supply drinking water) and are thus afforded special protection under the Clean Water Act.

- *Coastal resources.* In New York City, all coastal resources are considered important and are protected by the State's Coastal Management Program. Any area within New York City's coastal zone boundary, as defined under the City's New Waterfront Revitalization Program, is considered an important coastal resource.

- *Gateway National Recreation Area.* This National Park Service property encompasses some 26,200 acres of coastal area, almost all of which (24,500 acres) is in New York City. It includes the following areas:

  1. A stretch of shoreline along southeastern Staten Island (about 1,210 acres, including the Oakwood, New Dorp, Midland, South Beaches, Great Kills Park, Miller Field, Fort Wadsworth, and two small islands);
  2. About 1,000 acres at Breezy Point, the western end of the Rockaway peninsula south of Jamaica Bay;
  3. Jamaica Bay, comprising about 4,500 acres (including Floyd Bennett Field; shorelands at Bergen Beach, Plumb Beach, and Dead Horse Bay; the parklands at Canarsie, Frank Charles, and Hamilton Beach Parks; land at Spring Creek Park; the landfills at Pennsylvania and Fountain Avenues; and the waters, lands, marshlands, and islands within Jamaica Bay itself); and
  4. Sandy Hook (an area outside of New York City) comprising about 1,700 acres on a peninsula at the northern end of the New Jersey coastline.

- *Jamaica Bay.* Jamaica Bay is one of the largest coastal wetland ecosystems in New York State, and provides a variety of habitats, including surface waters, tidal wetlands, grasslands, beach, dunes, thickets, and woodlands. Jamaica Bay is used by nesting birds and wintering waterfowl in concentrations of statewide importance. Islands in Jamaica Bay are important rookeries for a variety of heron species. The only population of laughing gulls in the state is also found in Jamaica Bay, as are numerous other gull colonies. The islands and shorelines of Jamaica Bay are used by a variety of reptiles, amphibians, and small mammals. In addition to these significant wildlife concentrations, Jamaica Bay is a productive area for marine finfish and shellfish. For these reasons, Jamaica Bay has been designated by DEC as a State Significant Fish and Wildlife Habitat (defined below) and a State Critical Environmental Area (as defined in 6 NYCRR 617.2: a geographic area designated by a state or local agency as having exceptional or unique characteristics that make it environmentally important), as part of the Gateway National Recreation Area (see above), and by the U.S. Department of Interior as a National Wildlife Refuge. In addition, the City has designated its shorelines as a Special Natural Waterfront Area under the City's Waterfront Revitalization Program. The exact area encompassed by each of these designations differs, as described below.

1. Significant Coastal Fish and Wildlife Habitat. About 10,000 acres of the Jamaica Bay area (bordered by the mean high water line along the shorelines, including the fringing tidal marsh and adjacent upland areas) are designated as a significant coastal fish and wildlife habitat.
2. Critical Environmental Area. All of the mapped tidal wetlands in Jamaica Bay, including the various basins, are designated as a State Critical Environmental Area.
3. Gateway National Recreation Area. This national recreation area includes all of the islands, marshes, submerged lands, and waters in Jamaica Bay, as well as uplands north of the bay (see above).
4. Jamaica Bay Wildlife Refuge. Within the Gateway National Recreation Area, approximately 2,500 acres consisting of the water and islands of Jamaica Bay are designated as a national wildlife refuge. This includes uplands and low-lying islands surrounded by salt water, fresh water, and brackish impoundments, and excludes the community of Broad Channel and certain City rights-of-way, located on the largest island in the bay.
5. Special Natural Waterfront Area. The majority of the outer shoreline of Jamaica Bay is included in the designation as a Special Natural Waterfront Area. This designation includes the shorelines of Breezy Point; Fort Tilden; Riis Park; the north shore of the Rockaway peninsula; Vernam and Barbadoes Basins; Brant Point; Motts Point; Motts Basin; Head of Bay; Hook Creek and Marsh; the northeast shore of Grassy Bay; Hawtree Basin; Old Mill Creek and Spring Creek; Fresh Creek; Paerdegat Basins; and the vicinity of Mill Creek and Gerritsen Creek.

- *Other State significant coastal fish and wildlife habitats.* As part of the New York State Department of State's Significant Coastal Fish and Wildlife Program, the DEC recommends for designation by the Department of State areas it considers significant coastal fish and wildlife habitats. These are habitats that are essential to the survival of a large portion of a particular fish and wildlife population; that support populations of protected species (see below); that support fish and wildlife populations that have significant commercial, recreational, or educational value; and/or that are types not commonly found in the state or region. In New York City, there are 15 designated significant coastal fish and wildlife habitats. In addition to Jamaica Bay, described above, these are as follows:

1. Lemon Creek, Staten Island—A 70-acre area of salt marsh and coastal fresh marsh that is the only undisturbed tidal wetland area on the south shore of Staten Island.
2. Fresh Kills, Staten Island—About 1,000 acres of tidal wetlands, including those on Island of Meadows and along Great Fresh Kills, Little Fresh Kills, Richmond Creek, and Main Creek. These wetlands, although degraded, are valuable habitats for concentrations of fish and wildlife species, and they are also a wintering area for a threatened species (Northern harrier).
3. Prall's Island, Staten Island—An 80-acre, uninhabited island maintained by the City of New York Department of Parks and Recreation. This island has historically been used by large numbers of colonial water birds, including herons.
4. Sawmill Creek Marshes, Staten Island—These marshes, including Chelsea Marsh and Merrell's Marsh in northwestern

Staten Island, although greatly affected by human activities, are one of the few locations inhabited by a population of southern leopard frogs.

5. Goethals Bridge Pond, Staten Island—A large shallow freshwater pond and wetland system that is an important feeding area for three major heronries and one of the few known breeding areas in the City for several waterfowl species.
6. Shooters Island, Staten Island— An island that has been used for nesting by large numbers of colonial water birds, and has historically been occupied by one of the area's largest heronries.
7. Lower Hudson Reach—The portion of the Hudson River extending 19 miles from Battery Park to Yonkers, including deep water, shallows, piers, and interpier basins. This habitat sustains a diverse community of benthic, planktonic, and pelagic species, and provides important wintering habitat for large numbers of striped bass.
8. North and South Brother Islands, Bronx—Two relatively undisturbed islands that are used for nesting by a large number of colonial water birds, and contain one of the area's largest heronries and one of only two double-crested cormorant colonies in southeastern New York State.
9. Pelham Bay Park Wetlands, Bronx—Two major coastal areas within Pelham Bay Park, including a 475-acre area of high marsh, intertidal marsh, and salt flats; and the lagoon, a 275-acre narrow bay and wetland complex. This area is used as feeding or resting area for a large number of birds.
10. Little Neck Bay, Queens—The open water in the bay, which is of regional significance as one of five major waterfowl wintering areas on the north shore of Long Island, a significant striped bass nursery areas in the region.
11. Alley Pond Park, Queens—Including salt marsh, tidal flat, and freshwater wetlands, which are used by concentrations of fish and wildlife species, including the Northern harrier, which overwinter here.
12. Udall's Cove, Queens—One of the last undeveloped tidal salt marshes in the northern Queens County and East River area, rare in the county and rare in an ecological subzone in New York.
13. Meadow and Willow Lakes, Queens—Two freshwater lakes and a connecting channel that are one of the largest expanses of fresh water in Queens County.
14. Breezy Point, Queens—The 290-acre westernmost tip of a 10-mile-long barrier beach, including the dune areas and sand beaches. This is the only relatively undeveloped barrier beach in the City, and provides an important habitat for breeding colonies of endangered and threatened shorebird species. (Breezy Point is also part of the Gateway National Recreation Area, described above.)

- In addition to these areas, New York City has recognized certain areas within the City as possessing unique natural features that should be protected. These are designated through special zoning districts in the City's Zoning Resolution, designed to preserve their natural characteristics, as follows.

1. Special Natural Area District 1—Emerson Hill, Dongan Hills, Todt Hill, Lighthouse Hill, and the central wetlands area of Staten Island. The hills are characterized by steep slopes, rock outcrops, erratic boulders, and ponds, lakes, swamps, creeks, and trees; many of the high and low central wetlands are still in their natural state.
2. Special Natural Area District 2—Riverdale, Spuyten Duyvil, and Fieldston (the Bronx). This area includes a ridge with steep slopes, rock outcrops, ponds, brooks, swampy areas, and mature trees; marshes; and the Hudson River shoreline.
3. Special Natural Area District 3—Shore Acres Area (Staten Island). This area, surrounding and including Shore Acres Pond, is a resting area for migratory and local fowl.
4. Special Fort Totten Natural Area District 4 (Queens). This area protects open areas, historic resources, and natural resources, including the shoreline along Little Neck Bay and Long Island Sound.
5. Special Hillside Preservation District. This district was established to preserve the hilly terrain and unique natural features of New York City. The City's goals are to reduce hillside erosion, landslides, and excessive stormwater runoff by conserving vegetation and protecting natural terrain; to preserve hillsides with unique aesthetic

value; to protect areas of outstanding natural beauty; and to protect neighborhood character.

6. Special South Richmond Development District (Staten Island). Established to guide the development in the southern half of Staten Island, it mandates tree preservation, planting requirements, and controls on changes to topography. It defines a network of open space for preservation in its natural state. An owner of such space is permitted to transfer its development rights to the remainder of his/her property.

- *Special Natural Waterfront Areas.* Under the City's Waterfront Revitalization Program, New York City has also designated a number of Special Natural Waterfront Areas. In addition to those described for Jamaica Bay, above, these include:

  1. The shoreline from the mouth of the Bronx River at Hunts Point and Soundview Park, stretching along the shoreline to the mouth of Westchester Creek and Ferry Point Park.
  2. The shoreline along Hammond Cove and the mouth of Wier Creek.
  3. The shoreline along Palmer inlet.
  4. The shoreline adjacent to Pelham Bay Landfill, following the shoreline along the banks of the Hutchinson River and stretching east along the Westchester County border in Pelham Bay Park.
  5. The shoreline of Hart Island.
  6. The shoreline along the west coast of Little Neck Bay, Alley Pond Park, Udall's Ravine, Udall's Cove, and stretching along the Nassau County border to the East River.
  7. The shoreline along Powell's Cove.
  8. The shoreline along North and South Brother Islands.
  9. The shoreline of Shooters Island.
  10. The shorelines of the marshes, creeks and islands on western Staten Island, starting just north of the Goethals Bridge, stretching south along the eastern shoreline of the Arthur Kill, continuing south along Prall's Island to the south shoreline of Great Fresh Kill, then stretching east along the south shore of Great Fresh Kill and both shores of Richmond Creek, then turning north and weaving around the boundaries of Fresh Kill Marsh, Sawmill Creek Marsh, Mariners Marsh, and Old Place Creek Marsh.

- *Wildlife refuges and sanctuaries.* New York City has a number of wildlife refuges and sanctuaries, most located in City parks. In addition to the Jamaica Bay Wildlife Refuge (above), examples of such resources include:

  1. Thomas Pell Refuge and Wildlife Sanctuary, in Pelham Bay Park, a 50-acre tidal wetland area.
  2. Hunter Island Marine Zoology and Geology Sanctuary, in Pelham Bay Park, with woodlands used by numerous wildlife species.
  3. Udall's Cove Wildlife Preserve, in Queens and Nassau County, covering about 90 acres, some 33 of which are in New York City.
  4. Clay Pit Ponds State Park Preserve, on Staten Island. This 260-acre park includes ponds, wetlands, woodlands, including sandy oak barrens, and streams. About 70 acres of this preserve were designated a Unique Natural Area under the State Nature and Historical Preservation Trust.
  5. William T. Davis Wildlife Refuge, on Staten Island. This 260-acre area includes wetlands around New Springville Creek.
  6. High Rock Park Conservation Center, on Staten Island. This hilly 94-acre park rises to 225 feet above sea level.

- In addition to particular areas of the City that are recognized and called out as unique, certain species and habitats are also considered important and worthy of protection, wherever they may occur.

  1. Protected species. Both the federal and state laws designate certain species of plants and animals as protected, because they are rare or in danger of extinction. Certain habitats are also designated as rare. Under federal law, plant or animal species can be considered endangered or threatened; under state law, animal species can be considered endangered, threatened, or of special concern, and plant species can be endangered, threatened, exploitably vulnerable, or rare. Other species that are not in these categories can also be protected. Protected species that may be found in New York City include such bird species as piping plover, least tern, common tern, northern harrier, peregrine falcon, osprey, Coopers hawk, short-eared owl, least

bittern, upland sandpiper, and grasshopper sparrow; marine turtles; amphibians such as southern leopard frogs; and such fish as shortnose sturgeon.

2. New York State Natural Heritage Program. The Natural Heritage program maintains a database of information on rare animals, rare plants, and significant natural communities of New York State. This includes an inventory of all the different ecological communities—rare and common—that occur in New York State, representing the full array of biological diversity in the State. It also includes an inventory of rare plants, fish, and wildlife in the State, including some that are not currently protected by State law. All of the habitats and species listed in the program are given a ranking indicating their rarity both globally and in the State. Although the Natural Heritage Program rankings do not provide legal protection, they can be used for assessment of an action's impacts on rare species.

200. Determining Whether a Natural Resources Assessment is Appropriate

Two possibilities determine whether an adverse impact on a natural resource might occur, and therefore an assessment may be appropriate: the presence of a natural resource on or near the site of the action; and an action that involves disturbance of that resource.

Bearing in mind the types of disturbances listed in Section 341, if the following are all true for a given action, then no natural resources assessment is necessary:

- The site of the action is substantially devoid of natural resources, as defined in Section 100 above *or* the site of the action contains natural resources or important subsurface conditions, but no activity associated with the action (see Section 341) would disturb them, either directly or indirectly.

- The site of the action contains no "built resource" that is known to contain or may be used as a habitat by a protected species as defined in the Federal Endangered Species Act (50 CFR 17) or the State's Environmental Conservation Law (6 NYCRR Parts 182 and 193).

- The site of the action contains no subsurface conditions, the disruption of which might affect the function or value of an adjacent or nearby natural resource (for more information, see Chapter 3J, "Hazardous Materials").

- The site of the action is near or contiguous to natural resources as defined in Section 100 above, but no activity associated with the action would disturb them, either directly or indirectly.

- As determined by satisfying all of the above criteria, the proposed action involves the disturbance of a natural resource, but that impact has been deemed insignificant by a government agency with jurisdiction over that resource and conditions have not changed significantly since the permit was issued. An example would be the repair or replacement of piers, piles, bulkheads, and other waterfront structures. These actions have been classified as environmentally insignificant in the U.S. Army Corps of Engineers' "Nationwide Permit" for such actions (see Section 710 below).

If the action does not meet all of these conditions or if it is unknown whether the action meets one or more of these conditions, then an assessment of natural resources is appropriate.

300. Assessment Methods

The assessment of potential impacts on any natural resources contains three basic elements. These elements are the same, although the level of detail may vary for site-specific, area-wide, or programmatic (generic) actions. The elements are as follows:

- For existing and future no action conditions, determine the value of the natural resource, as demonstrated by the uniqueness, variety and density of its species; its use for recreation, open space, or commerce; its relationship to neighboring resources and to the overall area ecosystem; or its role in ecosystem cleansing or storm and flood management.

- Examine the environmental systems that support the natural resources in the study area.

As described in Section 143, these are most often the water resource systems that transport or retain water to maintain vegetation and provide aquatic habitat. The interrelationships among resources also create environmental support systems, as described in the introduction to the Natural Resources section. In another example, an intertidal wetland flushed twice daily by the tide becomes the source from which vegetative and organic materials are transported to adjacent waters for use in the estuarine food chain.

- Describe fully and in appropriate detail the construction and operational activities associated with the action and analyze their interaction with the resource itself and the environmental systems that support it.

These three elements are interrelated and, therefore, the order in which the analyses are conducted may vary with a particular action. For example, it is often most efficient to evaluate the resource first. This will help set the level of detail required for the analysis of the action and of the underlying elements serving the resource. However, if an assessment is required because the lead agency or applicant is unsure of the extent of disturbance that an action would cause, then part of the third task (describing the project disturbance in detail) would be completed first. If completion of that task identifies the potential for an indirect effect, say, a change in drainage patterns near a running stream, then the second task might be undertaken before the first, as well. Before determining the value of that stream, it might be most prudent to examine the drainage system serving the stream. If the action changes drainage patterns, but this change would be minimal to the surface and ground waters serving the stream, then the action's impact would not be significant and there would be no need for further analysis. However, no matter which of the three tasks comes first, the assessment always begins with selection of a study area. The following discussion addresses the study area, then describes each of the three general tasks listed above—evaluation of the resource; assessment of environmental support systems; and assessment of probable impacts of the action. These sections are followed, in Section 360, with discussions of those issues that may apply specifically to each of the resource types defined in Section 100.

310. DEFINE THE STUDY AREA

Determination of the limits of the study area for the assessment of natural resources depends on the potential effects of the action and the resource(s) in question. The study area should include the project site and resources (including adjacent areas, as applicable) that may be affected by activities on the project site. Where a resource is small enough that the proposed action would affect it in its entirety, the study area may encompass the entire resource. An example is a small pond where only a portion of its surface water, surrounding wetland, and adjacent area lie within the site. Proposed activities may directly affect only those portions of the pond within the site; however, the overall functions or value of the remainder of the pond may also be altered by the activity (for example, loss of minimum area to provide wildlife habitat). To understand impacts on this resource, it may be necessary to assess conditions in the complete aquatic, wetland, and adjacent habitat. If this is the case, then the study area includes the entire pond and related habitats. Similarly, where a small portion of a very large resource (such as Jamaica Bay) is located within the project site, it may not be necessary to include the whole resource; it may be more appropriate to focus on a portion of the resource within and adjacent to the project site, while providing a more general discussion of the larger resource for context.

320. ASSESS EXISTING CONDITIONS

This task assesses a natural resource to understand its value for one or more of a number of functions—such as recreation, open space, visual quality, wildlife habitat, ecosystem cleansing, groundwater recharge, flood or storm control, or erosion control. This includes learning what qualities are present in the resource (and will be present in the future without the action) and determining which of these are most important for a given function. As with all technical analysis areas, the approach to the analysis is to match the level of detail and effort to the anticipated effect of the action. However, in this technical analysis area, absent any specific information, the resource is usually presumed to be important and valuable. The evaluation either confirms this assumption or shows the extent to which the presumption of value cannot be confirmed. The tasks below outline general approaches to evaluating the City's natural resources. For most of the work outlined below, the use of an ecologist or related discipline may be appropriate.

321. Field Reconnaissance

A field reconnaissance of the study area, based one or more reasonable site visits at the appropriate season for reviewing that particular resource, allows the analyst to understand the extent of the resource, the context of its surroundings, and the area where the action will take place. The field visit is the first step in determining the scope of the natural resources assessment. In some cases, evidence gathered in an initial field reconnaissance may successfully support an assessment showing that a resource is of limited value and/or that an action's disturbance would not be significant. A field reconnaissance can include one or more of the following tasks, as appropriate:

1. Identification of major resource or habitat types. An initial reconnaissance may not be sufficient to identify subtle differences within resource types (for example, the distinction between the various types of fresh marshes often requires a number of site visits to determine the marsh's physical characteristics under varying weather conditions and a detailed listing of specific vegetative species). However, the reconnaissance can identify major resource types and locate these on a map (although boundary conditions would be approximate).
2. Initial characterization of resource type and condition. The analyst notes as much as possible in an attempt to characterize the resource(s) in the study area. Important to these observations are date and time of field visit; weather and, if appropriate, tidal stage; general type and approximate size of each resource area; plant and animal species observed; general soil types; presence of wet or poorly drained areas, rock outcrops, steep slopes, and other topographic features; conditions (whether the resources appear disturbed); and use (what types of activities the resource is subject to—such as passive or active recreation, commercial use, or unauthorized uses like dumping or off-road vehicles).
3. Organization of field notes and observations. The field reconnaissance is documented with a field log including the items listed in item 2, above. Photographs (preferably in color) with an accompanying site diagram are important to support the observations.
4. Assessment and conclusions. Based on the observations from one or more reasonable site visits at the appropriate season for reviewing that particular resource, the analyst assesses general conditions of natural resources in the study area. If conclusions about the value of a natural resource are clear from the reconnaissance (for example, the vegetated area is highly disturbed and unlikely to offer significant habitat, to function as a buffer for higher quality habitat, or to provide recreational opportunities—or the resource, such as a dune, is clearly present, clearly undisturbed, and hence clearly highly valuable), then this part of the analysis need go no further. More often, the conclusions of the reconnaissance will serve to focus more detailed study. For example, reconnaissance could reveal that the site is partially forested and could potentially support valuable species that are only observable during specific conditions (for example, herbaceous plants during the growing season; nocturnal animals at night; migrating birds in the spring and fall). This would call for further observation under the appropriate conditions to determine if that species is present. There are also situations where a potentially valuable habitat is seen, but its value cannot be deduced based solely on the site reconnaissance without observations of the larger surrounding area. For example, if the survey reveals that the site contains a barrens habitat, a wider area would be surveyed to determine the extent of this habitat.

322. Literature Search and Other Research

If the field reconnaissance has identified a potentially valuable or sensitive resource, or if the presence in the study area of such a resource is already known (e.g., if it is one of the designated resources listed in Section 150, above), research is useful in helping to assess conditions and make an evaluation. The research may include one or more of the following steps:

1. Locate the study area on a U.S. Geological Survey (USGS) topographic map and identify and outline potential natural resource areas. The USGS maps are most useful for the less developed areas of the City.
2. Submit letters to the U.S. Fish and Wildlife Service and the New York State Natural Heritage Program requesting a file review on

any threatened or endangered species or species of special concern in the project area, as well as any unique plant associations or communities in the project area (see Section 730 for contacts and addresses). The request letter should contain a copy of the project location indicated on a USGS topographic map.

3. Review sources of information that identify natural resources of interest in the study area, including any protected species. These resources include those designated resources listed in Section 150, above, as well as any other designated or important resources. Sources of information to be reviewed would include, as appropriate: the City's *Comprehensive Waterfront Plan* and the *New Waterfront Revitalization Program*, both of which identify particularly valuable habitats in coastal areas; the DEC's maps of regulated freshwater and tidal wetlands; federal flood hazard area maps; City zoning maps; Department of Parks and Recreation GIS maps; county soil surveys; results from DEC's Breeding Bird and Herpetological Atlases; information on any designated significant coastal fish and wildlife habitats (e.g., Essential Fish Habitat, or EFH) or critical environmental areas; coastal erosion hazard area maps; National Wetland Inventory (NWI) maps (prepared by the U.S. Fish and Wildlife Service from aerial photographs as part of the National Wetland Inventory Program, these are maps of all the wetlands of the United States, down to about one-half acre in size), etc. (see Section 730). The State's list of protected fish and wildlife are located in 6 NYCRR, Part 182; the list of protected plants and trees is in 6 NYCRR, Part 193. In addition, local universities and organizations can be a good source of information, as these groups often sponsor or conduct ecological studies in New York City and the Harbor.
4. Review specialized maps, where available. Examples are nautical charts, drainage maps, county soil atlases, soil and ground coverage diagrams, and plots of slopes.
5. Review recent aerial photographs or advanced infrared and other photo imaging. These will help in pinpointing the extent of vegetated and wetland areas and will show disturbed areas. However, before examining these photographs, evaluate local climatological data to determine whether the photo year had normal or abnormal precipitation within the year prior to the date of the photograph. If the resource is affected by tides, the stage of the tide when the image was formed will need to be determined from Tide Tables.
6. Review available site-specific information, if any. New York City has many specialized libraries that hold reports and papers, such as theses and dissertations that can contain valuable local studies. These include the Hudson River Foundation, the library at Queens College, and the United Engineering Library (see Section 730). Specialized computerized data bases, such as the DIALOG and BIOSIS information systems, can also be used to retrieve reports and publications related to natural resources that may apply to the site. For example, a paper about the Atlantic flyway—a route used by migrating birds that passes over New York City—could identify the avian species that might be expected in a particular area, and how they would use that area. This information could be applied to particular project sites in that area. Previous environmental assessments prepared for other actions can also contain surveys and analyses of the area. Environmental assessments prepared under CEQR can be examined at the offices of OEC or the lead agency; EPA and the U.S. Army Corps of Engineers keep copies of Federal environmental assessments. The National Park Service headquarters for Gateway National Recreation Area has a library of surveys and studies prepared for that National Recreation Area, and the City of New York DEP Office of Environmental Planning and Assessment and the Parks and Recreation Natural Resources Group keep data on a number of natural resources studies and assessments in the City. The New York City Department of Environmental Protection (DEP) has water quality data for sampling locations distributed in the Harbor. The DEP reports these data annually in their Harbor Water Quality reports. The primary water quality indicators used in these surveys are dissolved oxygen, fecal coliform, enterococci, chlorophyll 'a', light transparency and nutrients such as phosphorus, ammonium and nitrite-nitrate.

323. Determine Whether Field Surveys are Appropriate

Field visits of the study area are recommended to support and document the data in the literature. If the information collected in the study area during field visits, and from the literature (as described in Section 322), is detailed enough to determine potential impacts of an action, then additional field work is not necessary.

Again, if all of the conditions identified in Section 200 are determined to be true, then no additional evaluation is appropriate. If one or more of these conditions are not true, or if it still cannot be determined whether all of these conditions are true, then a field survey is appropriate.

324. *Habitat Characterization*

The habitat within and adjacent to the project site should first be characterized. A habitat type can be defined as an area with distinct vegetative and abiotic attributes that support a specific grouping of species. Habitat characterization is the procedure of identifying the dominant vegetative and physical characteristics of an area to assess its value. Habitat types are primarily described by their dominant vegetation, sources and permanence of water, and their relationship to other habitat types. In addition, the site's history, geomorphology, soils or sediments, climate, past and present human disturbance, and other abiotic features are important.

Generally, the question to be answered when characterizing the habitat at a site is whether the habitat is capable of supporting fish, invertebrates, and/or wildlife, including threatened and endangered species and species of special concern. Thus, habitat characterization guides the remainder of a natural resources assessment. In addition, it provides information for permitting and regulatory approval, particularly if unique habitats, wetlands, or watercourses are involved.

Prior to conducting a habitat survey, the following general steps should be followed:

1. Based on the preliminary reconnaissance, subsequent research, and a complete understanding of the location and extent of disturbance associated with the proposed action (see 330, below), identify the resource areas of concern on an accurate map with clearly shown off-site reference points, such as a USGS topographic map, soil survey map, City map, Sanborn map, or map prepared by site engineers.
2. Estimate the size of the area to be studied.
3. Determine as much about the area as possible from the initial field reconnaissance and subsequent research; tentatively map the types of resources and habitats that may be present.
4. Identify areas where previous disturbance has occurred.

Once these steps have been followed, focused field studies can be performed to characterize the habitat. Field studies for habitat assessment and vegetative communities are best conducted when growth is most evident and identifiable, typically mid-May to mid-September, or during traditionally wet seasons (e.g., April) if habitat types such as vernal pools may be present. Several surveys spaced over the growing season are recommended because some species are only present seasonally or will be more identifiable at certain times when vegetative growth, flowers, or seeds are present. If this is not feasible, inferences should be made about the potential presence of seasonal vegetation, judging from the site's overall characterization. Surveys of nontidal watercourses should be conducted during both low-flow and high-flow periods. Surveys during low-flow conditions facilitate observations of streambank conditions, channel morphology and in-stream plant growth, while surveys conducted during high-flow periods allow observations of intermittent streams and vernal pools. Surveys of intertidal wetlands should be carried out throughout the tidal regime to facilitate observations of inundation and intertidal versus high marsh vegetation. Since vegetative succession on abandoned sites in the City tends to proceed rapidly, habitat types can change in a matter of several years. Thus, depending on the length of the review process and construction schedule, habitat characterization surveys may need to be conducted over several years.

A number of factors should be considered when characterizing a habitat; these include size, shape, and the relationship of the habitat to adjacent areas. Rounder natural areas tend to be more valuable than oblong or linear ones of the same size (area) and vegetative composition, since round habitat patches possess more interior than linear ones. For example, a two-acre round patch of shrubland may provide a better buffer with more interior space, and hence better habitat, for more yellow warblers than a five-acre narrow rectangle. Larger areas also tend to be more valuable than smaller ones of the same shape and vegetative composition. A large, blocky natural area, even one with low vegetative diversity, can be valuable. For example, large disturbed sites dominated by common reed or mugwort serve as good winter foraging habitat for raptors, can ameliorate the urban heat-island effect, and can buffer or connect to higher quality natural areas.

In addition, disparate habitat patches are more valuable if they are linked by corridors of appropriate vegetative cover. For example, Forest Park, Queens contains 413 acres of forest that is connected by a predominantly wooded parkway (the Jackie Robinson Parkway) to a golf course, several cemeteries, Highland Park, and three vegetated, inactive reservoirs. The ecological value of the 413 acre core is greatly augmented by the adjacent, contiguous habitat corridor. The ecological value of the park is further enhanced by its proximity to the Jamaica Bay Wildlife Refuge to the south and Flushing Meadow/Corona Park to the north. Thus, because Forest Park is in the middle of a wide vegetated corridor that crosses Long Island from north to south, it is a major migratory bird stop-over. In this way, a natural area must be evaluated in the context of contributions it makes to the ecological function and biodiversity of adjacent and proximal natural areas of higher value.

Several habitat evaluation procedures have been developed, but these procedures are generally not appropriate for CEQR evaluations, since they were developed for and validated in non-urban environments. These include the Habitat Evaluation Procedure (HEP) and the Wetland Evaluation Technique (WET). For CEQR habitat evaluations, the following methods can be employed to characterize habitat:

- *Ecological Communities Analysis.* Every detailed natural resources evaluation should incorporate an ecological communities analysis. This consists of identifying, describing, and mapping the community types present within the project area. The characterization of ecological communities is primarily based on vegetative types, but it may also consider abiotic factors and wildlife usage. Descriptions of ecological communities should generally follow the New York State Natural Heritage Program's (NHP's) document titled "Ecological Communities of New York State." In some cases, the dominant plant species listed in the community descriptions contained in this document may differ from the matching urban communities found in New York City. Descriptions of the various plant communities can vary widely with respect to the species composition in New York City. Careful attention to dominant and co-dominant vegetation, understory species composition, soils, and hydrology will provide guidance as to the correct "plant community" classification. If an ecological community is not listed, a new descriptive habitat type should be developed, based on the existing plant diversity of dominant or co-dominant species, soils, hydrology and understory composition, when necessary. An example of a descriptive habitat type that is not listed in NHP's document would be "Urban Nonnative Forest." An example of this community type can be found near the Staten Island portion of the Goethals Bridge and is dominated by nonnative species such as tree-of-heaven, royal paulownia, white mulberry, Russian olive, Asian bittersweet, and garlic mustard. Other descriptive habitat types may be developed as necessary. Once the ecological communities have been identified and described, they should be mapped, and the areal coverage of each should be estimated. Another source of information on habitat types in New York City is the U.S. Fish and Wildlife publication "Significant Habitats and Habitat Complexes of the New York Bight Watershed." It includes maps that indicate where each habitat type is located within the New York Bight, descriptions of the physical setting and lists of species that are commonly found within the habitat.

- *Wetland delineation.* If a federal or state-regulated wetland is present on or adjacent to a site and project-related activities will take place in this wetland or its adjacent area, an official delineation of the wetland boundaries should be performed. An exception to this would be if the wetland boundary is obvious without an official delineation, such as a functional riprap shoreline. Delineation and mapping of state and federal wetland boundaries provides information on habitats present, plant species, and the uniqueness of a site. Delineation methods are based on three parameters: soils, vegetation, and hydrology. Issues related to wetlands delineation and the methods that should be used are discussed in Section 352.

- *Tree survey*. Trees provide valuable habitat to many species of birds and some mammals. A tree survey should be conducted when trees are present on-site and would be cleared or otherwise impacted (for example, by soil compaction, which can adversely affect the root system) due to project-related activities. Trees located on adjacent properties that may be subject to the "edge effect", (i.e., trees that were once part of protected interior of the forest are now located on the perimeter due to clearing) should also be surveyed. A tree survey is used to assess the number, location, and diversity of trees on a parcel. The minimum diameter of trees to be surveyed and the methodology to conduct the survey should be determined in consultation with the appropriate Borough Division of the New York City Forester of Parks and Recreation, the New York City Department of Environmental Protection, and any other applicable resource agencies. In general, each tree to be surveyed should be marked with a unique identifier and identified to the lowest possible taxonomic level (preferably species). The tree's diameter is then typically measured at breast height (4.5 ft above ground level) and recorded. If a tree has multiple trunks at breast height, the diameter of each trunk should be measured and recorded separately. The identifier (e.g., identification number), diameter(s), and species (or genus) should be recorded for each tree, and each tree should be mapped. The location of each tree can be identified using a Global Positioning System (GPS) or a land surveying team. In some instances, such specificity may not be necessary if the approximate location of each tree is sufficient to identify whether it would be impacted by the project. The results of a tree survey are used to determine what trees would be impacted by project-related activities and, if appropriate, to develop compensatory mitigation for these impacts (see Section 550).

- *Quadrant Approach*. This technique is used to identify a plant species' presence and dominance in a predetermined area, typically one square meter, in size. Typically multiple quadrants are located in a grid-type fashion over a parcel and the plant species within the quadrant are identified, vegetative strata represented, and percent dominance for each species determined. Additional quadrants can be added to the grid to ensure that all habitat types are represented. The study results can then be subjected to statistical analyses to assess habitat variability and diversity.

- *Transect Approach*. This method is most applicable to linear projects (roadways, transportation corridors, and greenways) and involves the establishment of a baseline and perpendicular transects. Dependent upon the size of the parcel and the diversity of the habitats, transects can be closely (every fifty feet) or widely (every quarter-mile) spaced. Transects are walked and changes in plant species and dominance are noted.

- *Habitat heterogeneity*. When additional information is necessary regarding the value of a habitat type, an evaluation of habitat heterogeneity may be appropriate. Since a diverse plant community that produces a diverse crop of seeds, berries, nuts, and green growth can typically support a diverse wildlife community, the number of species (and codominance among several species) is often indicative of the habitat's value to wildlife. Heterogeneous habitat may also provide a seasonal or year-round important food supply for wildlife, such as acorn production in an oak-dominated forest or muskrat habitat in a cattail monoculture. The determination of habitat heterogeneity involves identifying the plant species in each vegetative stratum (groundcover, shrub layer, vines, understory, and canopy) and documenting the number of species in each stratum.

- *Increment borings*. Increment borings are small diameter cores taken from a living tree that are used to determine the age of the tree by counting growth rings. The age and height of the tree can give a qualitative measure of the rate of growth. In addition, the age can be used to determine the minimum amount of time vegetative succession has been occurring in a particular community. Increment borings would rarely be necessary for a CEQR evaluation, but this method may be applicable at the discretion of the resource agencies.

- *Water quality analysis*. Available harbor survey data in the vicinity of a potential impact should be compared to New York State DEC's water quality standards to assess existing water quality. Additional information on water quality analysis and modeling is given below in Section 350.

325. Characterization of Animals Utilizing Habitat

Prior to conducting animal surveys, it must first be determined, based on the results of the habitat characterization and literature research described above, whether the habitat(s) at the site are likely to support fish, invertebrates, or wildlife. If the results of the habitat characterization indicate that the site contains no value for these organisms, then an animal characterization survey is not necessary. If, however, it is determined that the site is valuable for fish, invertebrates, or wildlife, or if it cannot be determined whether the site would have value for these organisms based on the vegetation, an animal characterization survey should be conducted.

If it is determined that an animal assessment survey is necessary, the level of detail and types of data to be obtained must first be determined. Many different types of data can be collected for a variety of objectives, goals and priorities. General characterizations about animals on a site can be made from knowledge about the available habitat at a site or from literature documenting animal species in an area. Without animal surveys detailing the utilization of animal species at a site, conservative assumptions should be made about animal inhabitance based on vegetative data and the available literature. Animal surveys should be used to confirm the potential for a significant impact if there is doubt concerning the available data or if is conflicting.

Depending on the level of detail determined, animal surveys may only entail a few days of observation, or they may require more lengthy observation periods in one or more seasons of the year. For very small projects with little ground disturbance, even in sensitive areas, a one-time survey for the affected resources may be sufficient. With mammals, reptiles, birds, and finfish, it is usually necessary to make observations during spawning/breeding seasons and times of migration. For example, a three-day late spring and early summer survey for birds, mammals, and invertebrates might provide sufficient information to describe the resources accurately and provide a basis for determining the potential impact the project would have on them. If the organism(s) being surveyed have short life cycles and/or are prevalent during known periods of time, a one-time sampling event at the appropriate time and place may be adequate. For larger projects in or near sensitive resources, as described above in Section 150, surveys in the spring, summer, and autumn might be necessary to adequately describe the animal resources. In the most complex cases, animal surveys can take place in three or four seasons of the year for up to three years. This is generally only applicable for very large, complex, City-wide or Harbor-wide projects.

In addition to the type and amount of data to be collected, the methods used to collect that data must also be determined. This includes both the sampling distribution as well as the techniques that will be used for sampling. A variety of sampling distributions are used in habitat and wildlife surveys. Some of the more common ones suggested for CEQR evaluations are listed and described below. This is not intended to be an all-inclusive list, but rather provides guidance as to the most common sampling plans used for CEQR evaluations. The ecological literature should be consulted for additional guidance on these and other sampling plans as may be appropriate for the action which is proposed.

- *Habitat specific.* In these searches, selected habitats are searched because certain species and groups can only be found, or the probability of a sighting is greatly increased, in certain habitats. In addition to threatened and endangered species, these searches are useful when surveying reptiles (snakes and turtles), amphibians (frogs, toads, and salamanders), and colonially nesting birds. Examples of specific habitats include wetlands, vernal pools, and certain beach areas. The number of individuals found and the time spent in each search should be recorded.

- *Point stations.* Point stations can be located evenly or randomly along a transect line or on a grid. At each point, the species observed and numbers of each are recorded. The time spent at each station as well as the distance and direction of the observation in relation to the station should also be recorded.

- *Transects.* The transect method involves travel along a line or transect (usually through a large area) and recording the species wildlife observed. Transects need not be straight; they can follow paths, trails, roads, etc. Depending on the size of the project site or the diversity of habitats, transects can be spaced either close together (e.g., every fifty feet) or widely spaced (e.g., every quarter mile). Transects can also be set up with perpendicular transects spaced at intervals along the baseline transect.

- *Plots.* Plots are generally used for sessile animals or animal sign. A plot is generally a rectangle or a square (quadrat), although circles or other shapes can sometimes be used. The area within the shape is surveyed for animals or animal sign. Plots can be randomly selected within a grid-like framework that covers either the entire project site or a particular habitat type or types. Plots can be very small (e.g., one square meter) to very large (e.g., ¼ acre). An example of a plot used for benthic organisms would be the use of a Surber sampler to survey macroinvertebrates (see below).

In addition to the sampling distributions described above, a number of sampling techniques are available. Many animal sampling techniques require special permits, licenses, and/or authorization letters from any or all of the following resource agencies: the New York State Department of Environmental Conservation, the U.S. Fish and Wildlife Service, the National Park Service, and the National Marine Fisheries Service. Each of these agencies should always be contacted for the appropriate requirements prior to conducting an animal survey. In addition, certain site-specific permits may also be required. For example, permits should be obtained from the New York City Department of Parks and Recreation if work is to be conducted in a City park. In addition, the New York City Department of Environmental Protection should also be contacted for any additional local requirements.

Descriptions of some animal sampling techniques are provided below for invertebrates, fish, and wildlife (wildlife includes amphibians, reptiles, birds, and mammals). This is not intended to be an all-inclusive list, but rather it should serve to provide examples of and distinguish between some of the techniques that are more commonly used in CEQR evaluations and those that would only be used under special circumstances. The ecological literature should also be consulted for additional explanation of these and other methods.

Invertebrates:

Invertebrate surveys are generally performed for threatened and endangered species (TES), species of special concern, or commercially important species (e.g., blue crab). Some species of butterflies, moths, mayflies, dragonflies, beetles, and molluscs are listed by NYSDEC as either threatened or endangered or as species of special concern. In addition, aquatic invertebrates, especially emergent aquatic insect larvae and crayfish, can serve as indicators of stream health.

A variety of techniques are used to sample and survey for invertebrates. Some of the more common methods that may be applicable for CEQR studies include the following:

- *Observation.* This is often the easiest and least disruptive method to survey for invertebrates; however, an experienced invertebrate zoologist is required to identify specimens observed in the field. If specific TES and special concern species are targeted, experienced field biologists can review descriptions and life histories, examine known museum specimens including similar species that could also occur in the area, and other available information to make themselves capable of finding and identifying target species. The American Museum of Natural History is a good source for museum specimens. Observations can be categorized as direct or indirect, both of which are described below:

1. *Direct observation.* Direct observations may include observing invertebrates with the naked eye, through binoculars, or via another apparatus. It may be used for any type of invertebrate species. For aquatic organisms, a mask and snorkel may be appropriate. Direct observations may be made with or without collection of the organism in question.

2. *Indirect observation.* Indirect observations may include evidence of invertebrates, such as cast exoskeletons (exuviae), spent shells, or egg and larval stages. Spent shells can be found at muskrat middens and along watercourses and they serve as an especially good indicator for the presence of freshwater mussels.

- *Insect netting*. Insect netting, or sweep netting, is a general method for collecting insects and consists of using a net specially tailored for capturing flying insects.

- *Trapping*. Two types of traps used to capture invertebrates are described below:

  1. *Light traps*. Light traps use an ultraviolet or black light to attract insects, especially moths, where they are collected in a trap or attracted to a white sheet and selectively identified and removed. This is one of the better methods to survey moths.

  2. *Baited traps or stations*. Invertebrates are attracted to bait (e.g., honey) and become trapped or feed at a station. Traps can be left over time but bait stations must be visited at regular intervals to increase the chance of encountering feeding individuals.

- *Grab sample*. A grab sample is a single sediment sample taken from a particular location. Various types of equipment are available for collecting grab samples. Some of the more common sediment grab sampling devices include the Ponar sampler, the Ekman dredge, and the Smith-McIntyre substrate sampler. Each of these provides a quantitative sample. For a qualitative grab sample, a simple trowel or shovel can be used in shallow water.

- *Surber sampler*. A Surber sampler is used for quantitative sampling in shallow (30 cm or less), flowing water. It consists of a double-framed structure, hinged along one edge, with a net attached to one of the frames. One of the frames is positioned securely on the stream bottom in riffle/run areas, and the other frame with the net is placed perpendicular to the bottom. The operator disturbs the area encompassed by the frame placed on the bottom and removes any attached organisms. Detached and disturbed benthic organisms then flow with the current into the net attached to the other frame.

- *Drift net*. This sampling device consists of a net that is anchored in flowing water to catch macroinvertebrates that have migrated or become dislodged into the current. Sampling should be done for a predetermined amount of time, and nets should be checked frequently to prevent clogging. Sampling between dusk and 1:00 AM is optimal.

- *Tow net*. Tow nets are used for qualitative sampling of benthic invertebrates, and they include devices ranging from simple sled-mounted nets to complex devices. These nets are towed behind boats and can yield quantitative results when towed for a standardized unit of time.

- *Kick net/Dip net*. These types of nets are very versatile for collecting in shallow, flowing water. Generally, these devices are used for qualitative sampling, although when used with a standardized kicking technique, they can also be used for semi-quantitative sampling.

- *Clam rake*. This device selectively retains larger items and organisms and is appropriate for use when performing qualitative sampling for mollusks. Generally, it is used along shorelines of creeks and rivers to supplement information obtained from other sampling techniques.

- *Trawl*. A trawl is a funnel type net towed behind a boat. Generally, the only invertebrate targeted using this method is the blue crab, in which case the net would be set along the bottom of the water body.

- *Artificial substrate sampler*. These types of samplers are of a standard composition and configuration and are placed in the water for a predetermined period of time, after which the degree of colonization by macroinvertebrates is determined. A variety of artificial substrate samplers are available, including the Hester-Dendy sampler and the basket sampler.

Fish:

Fish survey techniques are specific to species and habitat types. Generally, more than one technique should be used, since most methods target only certain populations.

- *Observation*. Direct observations of fish species can be made from shore or from a boat. Sunglasses with polarizing lenses or binoculars are often useful tools when using this technique. Although observations are useful, they seldom account for all species present. Thus, if used, they should be combined with some of the additional techniques described below.

- *Electroshocking.* Electroshocking is probably the best method to use for general fish surveys when there is no specific target species. Nevertheless, its effectiveness varies according to the species, habitat, and the size of the fish. Although the operative salinity range of the shocking units varies, electroshocking is not effective in moderate to high conductivity water bodies. Three types of electroshocking units are available.

  1. *Backpack Electroshocker.* For a backpack electroshocker, the power unit is strapped backpack-style to the operator's back, and the anode and cathode probes are held by hand usually in front of the operator, although the cathode probe may trail behind. Since this type of electroshocker is operated while wading in the waterbody, it can only be used in smaller streams, creeks, and brooks.

  2. *Stream Electroshocker.* A stream electroshocker consists of a power unit, usually powered by a generator, that is generally rested on the stream bank or floated in the water on a small boat. The operator operates the probes while wading in the waterbody, and usually two additional people are required to net the fish. This type of electroshocker is generally reserved for creeks, brooks, and small rivers.

  3. *Boat Electroshocker*. A boat electroshocker is generally used in deeper water (rivers, large ponds, and lakes). For this type of electroshocker, the entire unit, including the power source, generator and probes, is housed on a boat. Generally, one person guides the boat while two people net the fish and operate the probes. The probes are usually operated by pressing a pedal.

- *Trawls.* A trawl is a funnel type net towed behind a boat. It can be set at different depths in the water column and is generally used for juvenile and adult fish.

- *Seines.* A seine is a type of net that is used along the shoreline to encircle fish and pull them to shore. Seines work well in little to moderate current where there are few underwater obstructions and the shoreline is generally sloping. This method is used to collect fish that utilize nearshore habitat.

- *Trap Nets.* Trap nets are designed to lead migrating fish into the trap of a net. Various designs of trap nets exist, but they typically have one to three leads or wings of webbing that are designed to intercept migrating fish. The leads and wings extend from the mouth of the net to an anchor and when fish encounter these obstacles, they swim around them and into the mouth of the net. Use of trap nets is a passive method that works well in waters with little current. This method causes little damage to the fish, except that predation can occur in the trap. It is also selective for migratory fish species that swim parallel to shorelines or structures. Trap nets are most commonly used in nearshore or shallow water.

- *Gill Nets.* Gill nets are nets with a specially designed mesh size that causes fish to become entangled in the net by their gills. The target fish that are too large to move through the net, and attempt to escape by swimming backwards causes the gills to catch in the net. Gill nets are generally used in non-flowing waters, but they are sometimes also used in larger rivers. Since gill nets may cause severe damage to fish (loss of slime coat, loss of scales, stress, and possible suffocation), they are not commonly used.

- *Larval/Ichthyoplankton nets.* Larval or ichthyoplankton nets are fine mesh nets that capture early life stages of fish. They can be towed behind boats along the bottom or in the water column. Some are attached to benthic sleds. Their placement depends on the type of eggs (demersal, adhesive, pelagic) and the behavior of larvae (pelagic, demersal, etc.). Use of these nets should be timed according to the occurrence period of the species and life stage(s) targeted.

- *Benthic sled.* A benthic sled is a sled-like structure that is towed behind a boat and has a net attached to it. Most often, this sampling device is used in conjunction with a larval net to collect early life stages of fish that occur along the bottom.

- *Creel Survey*. A creel survey is selective for game species and consists of surveying anglers about their catch. In some cases, the captured fish can be weighed and identified. In other cases, information is obtained verbally from the angler.

- *Hook & Line*. This method employs the use of a rod and reel and can be employed from a boat, shoreline, pier, or dock. Since this is a selective, often time-consuming method, it should generally only be used for qualitative studies of species presence/absence and to supplement other techniques.

- *Dipnet*. A dipnet is a small hand-held net that can be used to collect small fish along shorelines, banks, etc. Like the hook & line method, it is selective for certain species and is often time-consuming. It should therefore only be used in conjunction with other techniques.

Wildlife:

The design of wildlife studies requires knowledge of the species expected to be present, especially when threatened and endangered species or species of special concern are likely to occur. Thus, information on habitat types, as well as general information on the seasonal occurrence, activity patterns, and behavior of the wildlife expected in the area, is essential in order to select stations and to time the surveys to maximize the chances of encountering various species. In addition, reconnaissance surveys help to identify what species may be present in the area and to select sampling locations. Areas of potentially suitable habitat for TES or species of special concern should be searched at times when TES are most likely to be found. Other special habitats should also be selected and searched. These might include vernal pools, seeps, streams, rock outcrops, snags, etc. For species-specific TES surveys, a wildlife biologist with experience finding the target TES should be used. Performing wildlife observations requires trained personnel with the ability to identify rapidly wildlife species by sight, sound, and sign. Figures, photos, or even video help to illustrate the location and distribution of sampling stations for the various types of surveys used.

Observation. Observations of wildlife can either target certain species at certain times of day and during certain seasons, or they can be incidental while conducting other surveys. For example, incidental observations of wildlife can be recorded while performing a wetlands delineation. Incidental observations should only be used when only a general idea of the types of wildlife utilizing a site is necessary or to focus additional wildlife surveys. Both focused and incidental observations can be direct or indirect, as follows:

1. *Direct observation*. Direct observations may include observing wildlife with the naked eye, through binoculars, spotting scopes, or via another apparatus. This technique can be used for any type of wildlife species. Direct observations can be made with or without collection of the organism. The probability of direct observation of small mammals, reptiles, and amphibians is increased by searching under debris, logs, and rocks.

2. *Indirect observation*. Indirect observations include evidence of wildlife, such as amphibian and bird calls, bird songs, tracks, droppings, burrows, runs, caches, and remains, such as feathers, bones, skeletons, and roadkill.

- *Live & Snap Traps*. Because small mammals are secretive and nocturnal, trapping may be the best way to determine if they are present. Small mammals may be captured using live traps (traps designed not to kill the animal) and snap traps (traps designed to kill the animal instantaneously). Live traps work well for a variety of small mammals, and if needed, various baits can be used to target certain species. Snap traps should be avoided, unless required by a natural resource agency. If used, specimens killed should be salvaged and provided to museums with information on where and when they were collected. Trapping results can provide information on both absolute (if live traps are combined with marking) and relative abundance.

- *Pitfall Traps*. Pitfall traps are depressions in the ground that animals fall into and from which they cannot escape. They work best when used together with drift fences, which are short vertical fences radiating out from the trap that act as runways that draw the animal(s) into the trap. These types of traps work well for shrews, other small mammals, and salamanders. The trap should be deep enough to prevent escape, but not so deep that it causes injury to the animal. If salamanders are targeted or are likely to be captured, enough water should be placed in the trap to prevent desiccation, but not too much to cause drowning of the animal(s). Pitfall traps should be designed with raised covers to prevent drowning due to excessive water accumulation in the trap and to prevent excessive sun exposure. The use of pitfall traps should be carefully considered prior to use, as they must be checked at frequent intervals to prevent undue heat or cold exposure, stress, or starvation of the trapped animal(s). This is a time intensive method.

- *Cover Boards.* Cover boards are placed on the ground to attract small mammals, snakes, and salamanders for long term studies. They are left out for extended periods of time and are checked occasionally. The species found under the boards are identified and recorded. Cover boards can be made of a variety of materials, such as exterior plywood or corrugated roofing.

- *Hair Snares.* Hair snares are devices made of carpet attached to a small (about 4x4 inches) piece of wood that is nailed to a tree approximately two feet above the ground. The device may be modified by attaching a piece of velcro. The hair snare is then "baited" with commercially available animal scent that lure the target animal to the snare. The scent induces rubbing on the snare, and hairs of the animal are left on the device for later identification. This method is appropriate for identifying the presence of large carnivores, such as coyote and fox, and it requires a knowledgeable biologist with the ability to identify large carnivore hairs.

- *Hair Snare Tubes.* Hair snare tubes are tubes with velcro inserts to snare the fur of small mammals passing through them (Hecht, 2001). Similar to hair snares, these tubes can be baited, usually with food, which induces the animal to enter the tube. Similar to a regular hair snare, the use of hair snare tubes requires a knowledgeable biologist with the ability to identify small mammal hairs.

- *Owl Pellets.* Owls are known to roost in certain areas. If owls are foraging on the site and their roosts are known, their pellets can provide a source of local small mammals skulls and bones that can be sorted and identified. This technique requires knowledge of the foraging range of the species of owl in question in order to determine whether the prey could have been captured off-site.

- *Call playback.* Call playback is usually used to survey for birds, but it can also be used for coyotes. This method entails playing recordings of calls or songs and listening for a response. The call or song can be of the species being surveyed or of another species that is expected to elicit a call from the species being surveyed. Calls are generally played for three minutes followed by a one-minute listening period. Examples of uses of the call playback technique include, but are not limited to, the following:

  1. *Diurnal raptor surveys.* Recordings of selected hawks and owls can be played at call stations to stimulate diurnal raptors to respond. Call stations for hawks (Cooper's, red-shouldered, northern goshawk, and sharp-shinned) are surveyed from sunrise to about mid-morning. Calls used at hawk stations should include the great horned owl because hawks often respond to this call. The barred owl call can also be played in the early morning, as this species often responds during these hours.

  2. *Nocturnal raptor (owl) surveys.* Recordings of owl calls can be played to stimulate owls to respond. Call stations for owls are surveyed from sunset to early morning using specific calls for the species being surveyed.

  3. *Marsh bird surveys.* Marsh birds are surveyed during the evening and at night. During these surveys, playback recordings of American bittern, least bittern, black rail, sora rail, Virginia rail, pied-billed grebe, sedge wren, and marsh wren should be played, either from a canoe or on foot.

- *Turtle Traps*. Turtle traps are traps with funnel-shaped entrances that minimize the ability of the animal to exit the trap. It can have wings or leads to draw the animal into the trap. Turtles traps set in water should be staked so that part of the trap is above water to prevent drowning of the animal. Like other live trapping devices, these traps must be monitored at frequent intervals to prevent undue stress or starvation of the trapped animal.

Advanced Techniques:

Advanced survey techniques for fish and wildlife studies are generally not required for CEQR evaluations. However, under unique circumstances, they may be the best way to determine the presence, movements, and habitat use of a particular species if such information is necessary. Examples of some advanced techniques include radiotelemetry, banding, marking, bat surveys, mist netting, and nest surveys/counts.

- *Radiotelemetry*. Radiotelemetry involves attaching a radiotransmitter to an organism and using a receiver to detect radiofrequencies emitted by the transmitter. This technique is an efficient method to locate an individual, track its movements, and determine its habitat usage and home range. Radiotelemetry can be used to determine if a TES or species of special concern identified outside the project area moves into the project area, thereby subjecting it to project-related effects. This technique is also especially useful for determining corridors used by individuals to move from or to a project area or specific habitat (such as a nesting site, overwintering site, foraging area, etc.). However, this technique is very expensive and thus is rarely applicable for CEQR evaluations.

- *Banding*. Banding can be used for birds or bats and consists of attaching a circular band with a unique identification code to the leg (or neck for long-necked birds) of the captured organism. When the organism is recaptured, it can be identified to the individual. Banding procedures are generally used to determine long distance movements and usually have little practical use for CEQR evaluations. However, in unique circumstances, banding may be used to determine local movements and population estimates. This technique is time consuming, and its usefulness should be considered carefully prior to implementing it.

- *Marking*. Marking encompasses any method to attach a unique identification number or other code to individual fish, amphibians, reptiles, and mammals. Marking for these organisms can take the form of tagging, shell notching, painting, toe clipping, branding, body markings, and other methods. Marking studies are generally used to determine local movements, estimate local population size/density, and to avoid counting the same individual more than once.

- *Bat surveys*. Surveys for bats are difficult and time consuming and should not be necessary for CEQR evaluations except under very exceptional circumstances. To survey for bats, bat detectors, mist netting, radiotelemetry, and searching underground areas, tunnels, mines, old barns, and attics, and other habitat are used.

- *Mist netting*. Mist nets are nets used to capture birds and bats. They are made of a fine threaded material that is difficult to see and are placed in areas through which birds and bats are known to travel. Birds and bats are captured in the net and removed by field personnel for identification and/or banding. Mist netting can cause significant stress to an animal, especially if the animal is left in the net for long durations. Thus, it is necessary to monitor the net at frequent intervals, making this method very time consuming. In addition, significant training and experience are required. Although this method is sometimes useful for breeding bird surveys and movement studies, this method would not normally be used for CEQR evaluations and should be avoided unless specifically required.

- *Nest surveys/counts*. Nest surveys or counts entail physically counting and/or monitoring bird nests to obtain information on productivity and territoriality. These types of surveys are often labor-intensive and time consuming and require significant training in identifying nests. In addition, nests are usually very difficult to identify correctly. Therefore, this technique should only be used when necessary and only for those species whose nests are easily identified.

326. *Analysis of Data*

Data collection is not an end unto itself, but the data are used to assess the value, resilience, uniqueness, and function of the resource. From the literature search and multiple appropriately-timed field surveys, the natural functions of the resource can be established. Some resources will have multiple functions while others will have only one. A wetland can serve as flood control, water cleansing, groundwater recharge, and specialized habitat for plants and animals. Beaches can serve as erosion protection, as bird breeding and foraging territory, as well as for human recreation. An open site in a densely developed area could serve as a foraging area for certain birds. Natural resources' different functions will be a prime consideration later in assessing how a proposed action would affect the resource.

Some resources are known to be valuable from the start. These are generally those designated resources listed in Section 150, above. However, the designated resources tend to focus primarily on the larger coastal and other wetland areas. There are a number of other, primarily terrestrial resources that do not have designation but are nonetheless very valuable. Some contain rare plant and animal species, as well. In addition, there are resources and species that are valuable or sensitive because they are rare in New York City, although they may be common elsewhere (e.g., northern plants at their southern range and southern plants at their northern range). Therefore, each analysis of existing conditions must consider each resource encountered on its own merits, whether or not its value has already been recognized by others.

A number of factors enter into determining the value of the resource. The results of the literature searches and other background research (see Sections 321 and 322) can provide much information on the value of the habitat. The results of the habitat characterization, if performed, further define the ability of the habitat(s) to support invertebrates, fish, or wildlife. Factors to consider when assessing the value of a habitat are discussed in Section 324. Finally, if animal surveys are conducted, the value of a habitat can be further defined. This requires an analysis of the data collected from these surveys. Data from wildlife surveys can be analyzed at both the species and community levels. Some examples of data endpoints that can be calculated and used to assess the value of a habitat for CEQR evaluations are described for species and communities below. This is not intended to be an all-inclusive list, but rather should guide the reader to those data endpoints that would be most appropriate for CEQR evaluations. The ecological literature should also be consulted for additional information on these and other data endpoints.

Species:

Presence/Absence. Presence/absence is a simple type of data analysis that entails identifying whether a species is present in a particular habitat type; numbers of individuals are not quantified. This data type is useful in verifying whether a particular species uses a habitat or a project site. Such information can be useful by itself, or it may help focus a survey to site-specific areas, for example, where a threatened or endangered species (TES) or species of special concern might be located. While this method is useful when detailed ecological information is not necessary, or merely to identify whether or not a TES or species of special concern is present on a site, the results from this type of data can change seasonally or from year to year. Furthermore, presence/absence data depends largely on the skill of the observers, timing, weather conditions, survey methods, and other factors. Therefore, multiple presence/absence surveys should be conducted using skilled observers and proper sampling techniques.

Abundance. Species abundance is the number of individuals in a population of a certain species. Data collection for species abundance is widely used for ecological surveys. It is often expressed per unit time (time-restraint) or distance (linear transects). Absolute abundance, or the actual number of individuals in a species, is rarely measured, nor is it recommended, since it is extremely time- and labor-intensive, and methods to estimate abundance have been developed. Estimates of abundance are calculated using indices that are correlated to population size. For example, a common index used with mark-recapture data is the Lincoln-Petersen index.

Density. Species density is the number of individuals in a species expressed per unit area. The area can be naturally or artificially ascribed and depends on the objectives of the study. Usually, density would be calculated for a project location or habitat type within a project location. Similar to abundance, estimates of density should be calculated by using indices that are correlated to population size rather than by attempting to measure absolute density. Only in rare cases, such as for TES or species of special concern, should absolute density be considered.

Spatial arrangement and movement. This type of data describes the location of individuals or species as well as their movements within a community or habitat type or from one community or habitat type to another. Rarely should this type of data be necessary for a CEQR evaluation, unless very specific information is needed, usually for TES or species of special concern.

Communities:

Community measurements are data collected on groups of species. Logical groupings may include groupings by habitat use or guild, by taxonomic classification, by habitat type, or any other logical grouping. The following data endpoints can be calculated to describe communities:

Species richness. Species richness is the total number of species in a community, habitat type, or other logical grouping. To determine species richness, all the species present in the community, habitat type, or other logical grouping are identified. Species richness is useful to compare the richness of different habitat types or project locations. Generally, the total number of species on a site will never be known without exhaustive fieldwork. Species richness will be based mostly on existing habitat valuation and size and will be largely qualitative.

Relative abundance. Relative abundance is the abundance of a species relative to the total abundance (number of individuals) of all species in a community, habitat type, or other logical grouping. Relative abundance provides an indication of the degree of dominance of a species in the community, habitat type, or other logical grouping being studied.

Species diversity. When it is possible to gather data on abundances of each species in a community, habitat type, or other logical grouping, a species diversity index can be calculated. The most commonly used diversity index is the Shannon-Wiener index (Shannon and Weaver 1949; Weiner 1948), which is sometimes erroneously called the Shannon-Weaver index. This index provides an indication of the number of species, together with their abundances, in a single number. Very seldom will species diversity information be required for a CEQR evaluation, since gathering data on abundances of all species in a community is extremely time and labor intensive.

While all of the above data endpoints can be used to describe the value of a habitat, the use of species richness and species abundance to describe a habitat type is often sufficient. A site with high species richness is usually valuable because it supports many different types of organisms. A site with low richness and high abundance of one species usually indicates high disturbance and low value. These sites are often dominated by common reed (*Phragmites australis*) and purple loosestrife (*Lythrum salicaria)* in wet areas, and sumac (*Rhus* sp.) and tree-of-heaven (*Ailanthus altissima*) in upland areas.

327. Assess Environmental Support Systems

A natural resource does not exist alone but is part of a system from which it gains and gives support. Groundwater feeds surface waters, but the streams and ponds also support the groundwater flow. A system is defined as a larger group of interacting and interdependent elements. Examples of such elements are soils, topography, vegetation, and streams, which together make up a drainage basin. Other examples are grasses, shrubs, trees, and surface water, which are exposed to sun and wind, thus forming an identifiable ecosystem. A number of resources are particularly sensitive to changes in their support systems. These include wetlands, streams and their floodplains, dunes and dune growth, grasslands, interior forest areas, which are particularly rare in New York City, and sandy oak barrens. To understand fully the potential impact of an action on such resources, the systems supporting it are assessed.

An important step in the assessment is choosing the size of the system to analyze. Only the part of the system that is likely to be affected by the action is included. If too much of the system is analyzed, impacts of the action could be diluted by the larger system and appear insignificant. For a stormwater drainage analysis, for example, only the affected downstream and/or upstream portions of the system (stream, wetlands, and slopes) until the watercourse enters a large water body, such as New York Harbor, would be included. For wetlands, generally the adjoining wetland area and the immediately contiguous uplands and water body would be analyzed. For upland habitat, the limit of the system would usually be the area containing similar vegetation. Some examples of systems include the following:

- *Surface drainage.* The most common assessment of environmental support systems is that of potential impacts on runoff, flooding, wetlands, and water bodies from changes in drainage. This analysis is typically performed as follows:

  1. Define the whole drainage basin. For most streams, the overall drainage basin has been mapped, but the mapping tends to be generalized and not in sufficient detail for environmental impact analyses. Further, construction that has taken place since the mapping may have changed the contours. The U.S. Geological Survey's topographic maps are the base for mapping the drainage basin. Locate the site on the topographic map and determine the direction water flows onto and off of the site. Runoff flows downhill perpendicular to the contours. Streambeds, gullies, ravines, and other watercourses can be identified on the topographic maps where contour lines appear to form a V. These V's point upstream. The drainage basin can be mapped by following the streams up the contours to the high points (divides), and following the contours downstream to the receiving water body.
  2. Define the analysis conditions. This depends on the issues of concern. For example, for an assessment of an action's effects on flooding, the analysis would consider how the action could affect flooding during an "analysis" storm. Generally, the assessment focuses on the 1-, 5-, and 10-year storms (storms that have a statistical frequency occurrence of once in 1, 5, or 10 years). It considers whether more areas would be regularly flooded during these storms if the action is implemented. The 100-year flood is also considered for an action to conform with regulations (see Section 710). For assessments of erosion, a short, intense rainstorm is analyzed: these storms cause greater erosion than larger storms of longer duration.
  3. Determine spatial and functional relationships of the system and the site of the action. This analysis relates how the system as a whole functions, and the site's role in that functioning. Both the location of the site in the system and its size relative to the system are considered. The location of the site has an effect on its value in the functioning of the system. For example, a site along a steep slope above a stream would have more effect on that stream in terms of drainage than a flat site at a distance from the stream. The size of the site relative to the whole system is also important: a large site is normally more important to the overall system than a small site. However, small sites can sometimes be crucial; this can be determined only by a system-specific analysis. As an example, for stream erosion and flooding, a site's characteristics (flat, steep, with wetlands and hydric soils or rock outcrops) are considered in the context of the system's characteristics. A flat, wide site in a steep drainage system could be a valuable flood storage area, but stormwater would pass quickly through a rocky steep site. The rocky steep site, however, could have highly erodible soils that could cause downstream siltation. The current drainage from the site is plotted, and its contribution to the system calculated using standard engineering techniques. The soil types and slopes are analyzed to determine erodibility and the velocity of the flows into the drainage system. Then, the downstream area is examined to determine its size. All sources and volumes of water added to the downstream area are plotted. The point at which the site's contribution becomes minimal is estimated, and at that point the system analysis is ended. The Bureau of Water and Sewer Operations (BWSO) of DEP is responsible for the operation, maintenance, and protection of the City's wastewater collection (sewer) systems. Actions that potentially affect the combined sewer system or separate sanitary and stormwater sewer systems within the City must be analyzed according to BWSO's guidelines for drainage plans.

- *Coastal erosion.* The analysis for coastal erosion includes an assessment of winds, waves, fetch (distance over open water), and shoreline configuration, all of which can affect erosion. Two aspects are examined in a coastal erosion analysis: 1) is the site subject to erosion to the degree that property and life could be endangered in the foreseeable future; and 2) will the project increase erosion at other locations. To answer the first question, a design storm (usually the U.S. Army Corps of Engineers 100-year storm) is considered. Such a "design" storm would feature particular wind speeds and other meteorological characteristics. The wave heights and storm surge at the site are calculated with the waves coming from the site's most exposed direction. Based on the energy in the waves and the types of soils at the site, the amount of erosion is calculated and the danger of loss or damage to the property assessed.

For potential erosion that might be caused at other locations by the action, the dominant direction of sand movement along the beach is determined. The size and location of the site affected by the action are both important in this assessment. For example, a site at the end of a coastal erosion zone would not affect sand movement at downstream sites, but a site at the beginning of the erosion zone would.

- *Soils.* One of the most important and often overlooked ecological support systems is soils. Soils are an integral component of any habitat type, as they play a significant role in determining the composition, amount, and nutritive value of vegetation at a site, and they provide habitat for microbes and invertebrates that are important food sources for upper trophic level wildlife. Soil is a mixture of solids and pores. The solid fraction consists of a mixture of minerals, from the weathering of rocks, and organic matter from the deposition and decay of plants and animals. The pores can contain either air or an aqueous solution, called porewater, which contains minerals and other substances that are either dissolved or suspended. When describing this ecological support system, the U.S. Department of Agriculture's (USDA's) Northeastern Testing Procedures should be used.

- Other examples of environmental support systems that are sometimes assessed are groundwater and vegetative buffers.

330. FUTURE NO ACTION CONDITION

The impact assessment for natural resources compares the effects of the proposed action to the future without the action. It is probable that many resources will change even in the absence of the proposed action. This will depend not only on future development or public works projects (without the action), but also on expected overall growth and natural ecological processes. In some cases, resources may be expected to improve over time under the future no action condition due to other environmentally beneficial projects that are taking place concurrently. For example, water quality in New York Harbor is expected gradually to improve over time due to a variety of initiatives, such as combined sewer overflow (CSO) abatement projects.

The future no action condition should be evaluated for the build year. In addition, it should generally be evaluated for the study area, as described in Section 310, above. However, anticipated changes to resources outside of the study area can affect the future no action condition within the study area. Therefore, it is important to consider all applicable projects and future anticipated changes both in and around the study area in order to evaluate accurately future conditions in the absence of the action. In some cases, information to support this evaluation may be available from other technical areas, particularly land use, traffic, air quality, noise, and hazardous materials. Most often, the analysis of the future no action condition will constitute a qualitative discussion. Where another environmental assessment has been completed, it may be appropriate to utilize its conclusions. However, in some instances it may be necessary to reassess conditions quantitatively, depending on the nature, scope, and scale of the project and on the anticipated development, other projects, or expected future changes in the resource. An example of a quantitative assessment is the use of water quality modeling.

340. ASSESS FUTURE ACTION CONDITION (ASSESSMENT OF IMPACTS)

Assessing impacts of an action begins with understanding the extent to which the action will disturb or alter a resource in the short- and long-term. Impacts can be categorized into direct and indirect effects. Direct effects are relatively straightforward; indirect effects may require more analysis.

341. Effects of the Action

341.1. Direct Effects

Direct effects of an action include the category of activities that directly alter the condition of a resource. Direct effects include, but are not limited to:

- Removal of vegetation.
- Changing one habitat type to create another.
- Filling, draining, dewatering, or dredging of a water body or wetland.
- Development of roadways, parking lots, buildings, and other paved surfaces on previously vegetated or unpaved surfaces.
- Construction of new marine structures, such as bulkheads, piers, piles, groins, jetties, etc., or floating structures that disturb existing habitat, change water flow patterns, and/or change sediment transport patterns, etc.
- Stream channel changes, such as bank stabilization, widening, narrowing, straightening, culverts, etc.
- Installation of drainage systems, including sewers, culverts, retaining basins, recharge wells, etc.
- Introduction of buildings or structures that cast prolonged shadows on a natural resource, or otherwise alter its microclimate (see also Chapter 3E, "Shadows").
- Introduction of new (particularly non-native) plant or animal species that out-compete for resources.
- Alteration of soil pH, destruction of structural properties of soil, changes to the microclimate, alteration of soil compaction, etc.
- Introduction of noise at the site, either temporarily during construction or permanently during operation (see also Chapter 3R, “Noise”).
- Landscaping with non-native vegetation.
- A change in air quality that may adversely affect native species, either temporarily or permanently (see also Chapter 3Q, “Air Quality”).
- Increased lighting at the site, either temporary during construction or permanent during operation.
- Alteration of physical and chemical quality of waterbodies on the site, including increased turbidity, temperature, nutrients, biological oxygen demand, pesticides, etc.
- Alteration in the water level or surface area of an existing water body on the site.
- Construction of a structure that may impede animal migration and movements.
- Compaction of soil from construction vehicles and heavy equipment.
- Removal of soil during construction, either directly or due to erosion.
- Construction of storm or sewer outfalls.
- Construction or removal of bulkheads, piers, and other structures in the water.
- Introduction of contaminants or contaminated materials to a natural resource.

Usually, the description of direct effects includes a calculation of the area to be affected (in square feet or acres, for example), or volume of soils to be removed. It may also entail describing methods and types of construction at a level appropriate to understand the extent of an effect. This means that the proposed activities or assumed development scenario are defined in some detail. Where specifics are not known, a conservative but reasonable assumption is made. Furthermore, even if compensatory mitigation is planned, the calculation of affected area includes those areas required for construction activities, even if the long-term plan is to restore these areas.

341.2. Indirect Effects

Indirect effects occur when the changes on a site alter conditions in adjacent or nearby resources or on the site itself after construction has ended. Indirect effects include, but are not limited to:

- A change, such as devegetation, dewatering, soil compaction, site clearance, excavation, introduction of impervious surfaces, or any other change in drainage patterns that alters the way in which surface or groundwater flows from the project site to a nearby natural resource or vice versa.
- A change in the degree or period of tidal inundation of a natural resource.
- A change, such as exposure or movement of contaminated sediments or soils, that renders organisms on-site or in nearby natural resources more likely to be exposed to contaminants.
- A change that decreases the quality of surface or groundwater that currently supports a natural resource.
- A change in on-site activities that may increase the number of people, or domestic animals, or increased noise, thereby increasing disturbance to on-site or nearby natural resources.

- A change in on-site conditions that increases or decreases the amount of light that reaches natural resources on or near the site.
- An activity or a change in conditions that either introduces or facilitates colonization by new (particularly non-native) plant or animal species that could overtake existing (particularly native) species either on-site or in nearby resources.
- An activity or change in conditions that will transform stable interior vegetation into potentially unstable edge vegetation (e.g., trees subject to increased wind stress, increased soil evaporation, etc.).
- A change that increases scouring, erosion, or transport of soil, silt, and sediments and alters the quality of an on-site or nearby natural resource.
- A change that increases sediment deposition on-site or in a nearby natural resource.
- A change that could impact the movements or migration of animals between or within habitats.
- A change that could encourage the spread of exotic species such as wooly adelgids and/or Asian longhorned beetles.

If the action under study may possibly indirectly affect a resource, the assessment attempts to describe and measure the extent of that effect. In some cases, this amounts to nothing more than comparing the proposed landscaping to the surrounding area to determine if it would be a similar habitat. In others, it may be necessary to analyze subsurface geology in a small area to track with some accuracy the flow of groundwater to a wetland and estimate the extent to which the action may alter the volume, quality, or direction of that flow.

342. Effect on the Functioning of a Natural Resource

The evaluation of the natural resources in the study area identifies the functions of a resource (under existing and no action conditions) and the elements that are critical to these functions. For example, groundwater flow may be essential to a particular freshwater wetland; in that wetland, the soft soil and fern-lined stream banks may provide essential habitat to an important amphibian. If an action would decrease the groundwater flow to the wetland or somehow compact the soil surrounding it, the water quality and habitat quality may be compromised. In another example, a stand of trees may shade an area, allowing for increased cover and a cool microclimate for small mammals and birds. The loss of the trees would remove a specific habitat. Based on this type of analysis, the assessment of project effects identifies the loss associated with the action and the importance of that loss for the critical functions of the habitat.

A critical facet of the assessment is determining the extent of habitat impairment. As described earlier, resources' resiliency, or ability to accommodate change, are key to the assessment of habitats. The action being analyzed and the resiliency of the resource are compared to determine whether the resource would retain its functions or whether and how much those functions would be impaired by the action. Impairment can range from destruction of the habitat altogether to its partial degradation to minimal impairment. Destruction would include complete elimination of a habitat or removal of a species or a condition (such as regular inundation) essential to its existence. Partial degradation would remove or alter a portion of a resource so that it would continue to have some value as habitat, but its function would be more limited. An example of partial degradation might be to change the size and shape of a woodland area, so the interior habitat, for some species, is effectively diminished, but other species, which are more acclimated to "fringe" habitat, can still flourish. Minimal impairment would include minor or temporary disturbances. The parameters to be examined are physical (e.g., temperature, volume of water, soil types), biological (e.g., diversity, abundance, community structure), and situational (e.g., size, distribution, and shape).

343. Context of the Resource Change

In addition to evaluating direct and indirect impacts as described above, the severity of the impact should also be addressed in terms of the context of the resource change. This evaluation has three components. First, if a resource will be impacted or lost due to project-related activities, these losses must be evaluated in terms of how much of that resource is left in the City. An action that removes an acre of a habitat that is very abundant throughout the City may be less significant than an action that removes an acre of an extremely scarce habitat. The loss of the trees cited as an example in Section 342, above, may not be significant if substantial areas of similar habitat are found within the general region of the study area.

In considering the context of a resource change, it is always important to remember that many of New York City's resources may be abundant throughout the region or state, but scarce in the City's dense urban environment.

Second, each individual resource impact must be evaluated in the context of other resource impacts from the project. Impacts to each individual resource or habitat may be seemingly insignificant, but the cumulative total of the impacts may nevertheless be significant. Furthermore, the impacts to one resource could potentially affect the impacts to other resources, and the overall impacts may be synergistic. Thus, a careful evaluation of the sum of all the impacts considered together must be performed to accurately evaluate how natural resources will be affected from a project.

Finally, project-related impacts must also be evaluated in the context of both spatial and temporal changes in natural resources that will occur in the absence of the project. In other words, the anticipated changes in natural resources, both on- and off-site, that were evaluated for the future no-action scenario must also be evaluated together with the impacts of the project in question. For example, if it is determined that a resource will be adversely impacted, not only should it be put into the context of how much of that resource is left in the study area, but also how much of that resource will be left based on what is currently known about future conditions. Again, the project-related and non-project related impacts could potentially be synergistic such that the overall impacts are greater than the sum of their parts. Again, a careful evaluation of the sum of all the impacts, both project and non-project related, must be performed to evaluate accurately the impacts on natural resources from a project.

350. ASSESSMENT ISSUES FOR SPECIFIC NATURAL RESOURCES

351. Water Resources

351.1. Surface Water Bodies

The appropriate function and optimum condition of surface water bodies in the City are set by DEC and appear as water quality standards (see Section 710, below). DEC sets these goals depending on conditions and actual function of a water body as well as its water quality potential. Surface waters are classified as suitable for some or all of the following functions: water supply, contact recreation, fishing and boating, fish habitat, and fish passage. Each classification has a specific set of water quality standards, designed to protect the waters for the designated uses. These standards are expressed as minimum levels of dissolved oxygen that must be present, the acceptable range of pH, maximum coliform levels, and maximum amounts of toxic wastes and deleterious substances. Although these classifications do not necessarily reflect existing conditions, they express public environmental policy for the City's water bodies and, as such, serve as a basis for comparison in the analysis of impacts on surface water resources.

Fresh surface waters in New York State can be classified as N, AA-Special (AA-S), A-Special (A-S), AA, A, B, C, and D. Class N has the highest standards for water quality; Class D, the lowest. All the fresh surface waters in New York City are Class AA, B, or C. *Class AA* waters are best suited as a source of water supply for drinking, as well as for primary contact recreation (such as swimming), secondary contact recreation (boating), and fishing, and are suitable for fish propagation and survival. The City's reservoirs (Jerome Park and Central Park Reservoirs) are classified AA. *Class B* waters are best suited for primary and secondary contact recreation and fishing, and are suitable for fish propagation and survival. Examples include the ponds and lakes in Prospect and Central Parks; Wolfe's Pond, Clove Lake, and Willowbrook Lake on Staten Island; and Meadow Lake, Willow Lake, and Kissena Lake in Queens. *Class C* waters are best used for fishing, and can be used for primary and secondary contact recreation; they are also suitable for fish propagation and survival. Huegenot Pond on Staten Island, Mill Creek in Queens, and portions of Tibbetts Brook in the Bronx are Class C.

Saline surface waters can be classified as SA, SB, SC, I, and SD; Class SA has the highest standards for water quality, and Class SD, the lowest. *Class SA* waters are best suited for shell fishing, fishing, and primary and secondary contact recreation, and are suitable for fish propagation and survival. Much of the Atlantic Ocean around New York City is classified SA. *Class SB* waters are best used for fishing and primary and secondary contact recreation, and are suitable for fish propagation and survival. Jamaica Bay; much of Lower New York Bay, Raritan Bay, and Long Island Sound near Queens and the Bronx; and the Hudson River alongside the Bronx are Class SB. *Class SC* waters are best used for fishing, and are suitable for fish propagation and survival. The water quality is suitable for primary and secondary contact recreation. Class SC waters in New York City include the tidal portions of Lemon Creek and inland portions of Fresh Kills and its tributaries, on Staten Island. *Class I* waters are best suited for fishing and secondary contact recreation, and are suitable for fish propagation and survival. The East River, Harlem River, and Hudson River from the Battery to the Bronx are Class I. *Class SD* waters are best used for fishing, and are suitable for fish survival. This classification may be given to waters that cannot meet the requirements for primary and secondary contact recreation or fish propagation. Erie Basin, Gowanus Canal, Kill Van Kull, and much of the Arthur Kill are all SD waters.

The Interstate Environmental Commission, a tri-state regulatory agency, also sets standards for water quality in the City's tidal waters. Its goal is to prevent water pollution and make more areas available for swimming and shellfishing.

Examples of actions that indirectly affect water bodies are listed in 351.3, below. Examples of actions that directly affect surface water bodies and issues for the assessment include:

- An action that adds to the discharges of pollutants to a surface water. Generally, this activity is limited to industrial discharges or sewage treatment plants, both of which are subject to the State Pollutant Discharge Elimination System (SPDES) permitting procedure (see Section 710, below). When water quality is an issue, the analysis can include one or more of the following:

  1. Collecting available data on water quality. The New York City Department of Environmental Protection (DEP) and the Interstate Environmental Commission (IEC) maintain sampling programs in the City's major waterways. EPA and DEC also perform more limited sampling. Parameters for which data may be available include dissolved oxygen (DO), which indicates the level at which fish life can be maintained; biochemical oxygen demand (BOD), which indicates presence of organic pollution; fecal coliform, which indicates the presence of pathogens that spread disease; heavy metals, such as iron, manganese, copper, zinc, and lead, which are indications of industrial pollution; nutrients, such as phosphorus, ammonia, nitrite, and nitrates, which are discharged from wastewater treatment plants and, in excess, allow algal growth that results in a reduction of oxygen levels; suspended solids; secchi transparency; pH; and chlorophyll 'a', an indicator of the presence of algae.
  2. Where sampling data are not available or where information for smaller areas of a larger water body is required, it may be necessary to take water quality samples. This can range from one-time sampling and testing for the parameters discussed above, to a yearlong survey with samples taken at multiple locations. Generally, runoff or drainage from a small residential development into a water body with good tidal flushing would need only one sample. If the runoff is into water with poor tidal flushing (such as Spring Creek), samples at several locations would be needed to characterize the area's water quality. A large development near a sensitive resource would require a full program. To determine the worst-case water quality conditions, sampling should be conducted during the late summer, when water quality, especially dissolved oxygen, is at its lowest. The program should not be conducted after a recent large storm, which would affect the water quality, if the action does not alter runoff or potential combined sewer overflows (CSO's) or sanitary system overflows (SSO's). Sampling after storms should be performed when stormwater discharges, CSO's, or SSO's are potentially affected by the action.
  3. In some cases, the new pollutants could be expected to affect water quality over a wider area; for these actions, application of a computer-simulated water quality model may be appropriate to assess impacts. A report by the Water Environment Research Foundation (WERF), "Assessment of Availability and Use of Water Quality Models," provides descriptions of the types of models as well as modeling software, including relevant model features (WERF, 2001). This reference is useful in defining the capabilities and limitations of available water quality models and in guiding the selection of a model to meet the objectives of the environmental assessment.

4. For water bodies that contain finfish and other aquatic or amphibian species that are considered significant, the assessment of changes in water quality parameters is also applied to the understanding of the potential for a change in habitat (see discussion in Section 310, above).

- An action, such as the introduction of a new stormwater outfall or construction of a bulkhead, pier, or other waterfront structure, that would disturb a portion of the environment, particularly the bottom. A stormwater outfall could increase the location and velocity of stormwater as it enters the water body, which could scour the bottom of sediments, thus changing the environment for the bottom (benthic) organisms that live there. Placing a new bulkhead or pier could also disturb the bottom, if only during construction, with similar, albeit short-term effects. All of these actions are subject to review and permitting by the State and Federal government (see Section 710) and the stormwater outfall is subject to a SPDES permit.

  The work required to answer questions about impacts on bottom organisms includes gathering available data from the literature, from sampling undertaken nearby, for example. It may be necessary to obtain samples of bottom sediments and bottom organisms. If so, the bottom sediments are analyzed for grain size, water content, organic matter, and pollutants. According to the regional Contamination Assessment and Reduction Project (CARP), the primary sediment contaminants of concern are PCBs, dioxin, polycyclic aromatic hydrocarbons (PAHs), DDT (and its metabolites), chlordane, cadmium, and mercury. The benthic survey would include several grab samples in the area. A preservative would be applied to the samples when they are taken, to kill the organisms and prevent their decomposition. Such surveys are normally performed in the spring, when the highest concentration of organisms is likely. Replicate samples (i.e., more than two) are taken for statistical accuracy. In the laboratory, the benthic species are counted and identified to the species level, where possible. For certain invertebrates, however, it is often impossible to identify to the species level, so higher taxonomic groupings are used. Species abundance and diversity are then calculated and used to characterize the area. Statistical techniques are often used to determine if significant differences exist between samples.

  In rare cases, it may be necessary to assess the impact on finfish and other vertebrates from the bottom sediments if they are suspended in the water. A bioassay test, which determines the potential uptake of pollutants in the sediment by animals, is performed in this case.

- An action, such as maintenance dredging, that would disturb the bottom sediments on a regular basis, altering the composition of the bottom and the volume of suspended solids in the water column. Sediment sampling and bioassay tests are appropriate, so that the effects of dredging on water quality and aquatic life, including the potential release (resuspension) of contaminants into the water, can be assessed. Disposal of dredged materials is also an issue, but this activity is regulated by the federal government. The U.S. Army Corps of Engineers and the EPA review the test data and decide where the materials can be placed without causing environmental impact, or whether restrictions are needed. Approximately ten percent of such dredged materials require restrictions, such as capping with clean materials. Dredged materials from certain locations require special investigations and handling. These include dioxins in the sediments at the convergence of the Kill Van Kull and the Arthur Kill, and the very high pollutant levels in industrialized basins with poor or closed circulation, such as the Gowanus Canal and Newtown Creek. Such issues are disclosed in CEQR review; however, compliance with appropriate regulations would ensure appropriate disposal, based on dredge spoil quality, without creating a significant adverse impact.

- An action that would change a physical condition of the water, such as temperature, currents, flow, channel shape, etc. Examples include installation of piers or platforms that permanently shade portions of the water; cooling water discharges, wave curtains for marinas, culverts and channels often included in roadway design, etc. For certain actions, mathematical modeling may be required to determine if circulation may change, leading to an effect on water quality. Several models for the entire New York Harbor and the adjoining Long Island Sound and New York Bight are used, and these are appropriate for large-scale actions, such as a large industrial facility, that could have Harborwide effects. For smaller actions, models are available as described in the WERF report (WERF, 2001). The potential impacts from marina wave breaks and new piers can be analyzed by hydrodynamic models, several of which were evaluated in the WERF report.

- An action that would result in the draining or filling of a water body or a portion of a water body. Examples include culverts or channel modifications that direct flow away from a pond; filling to create land (such as Battery Park City) or to even out a shoreline in creating a bulkhead, etc. These actions affect water circulation and could lead to increased flooding, both off- and on-site. The potential effects on circulation can be analyzed using the models discussed above. Flooding potential can be analyzed using either hand calculations or computer models, depending on the complexity of the situation.

351.2. Groundwater

As described in Section 112, above, the importance of groundwater as a resource is: (1) to serve as a source of water supply for population and industry; (2) to serve as a source of water for surface water bodies and wetlands; (3) to serve critical geo-technical functions related to structural load bearing capacities; and (4) in some cases, to serve as a barrier to salt water intrusion. Groundwater is therefore a resource unto itself and an important component in environmental systems supporting surface water bodies, wetlands, and some upland habitats.

DEC sets water quality standards for groundwater based on its potential use. Fresh groundwater is generally classified as having the potential to provide potable water supply. However, in New York City, only portions of the Lloyd, Jameco, and Magothy Aquifers are used as drinking water supply. The Jameco and Magothy Aquifers are designated as sole source aquifers in Brooklyn and Queens and are thus afforded special protection. Most actions would not have an impact on these aquifers unless wells are installed or subsurface waste disposal is part of the action. On Staten Island, the underlying aquifers are used for process water or irrigation supply by private interests, but the aquifers are not considered to be sole source. Although some small water-bearing areas can be found beneath Manhattan and the Bronx, these are not used for drinking water supply. Throughout New York City, the Upper Pleistocene soils contain groundwater, which also feeds surface water bodies. Groundwater quality is of concern for natural resources where it supplies water to sensitive habitats and water bodies. Groundwater quality is particularly important to maintain freshwater wetlands, which are located in Staten Island and Queens. The analysis of groundwater quality is similar to that of surface water quality. Samples are obtained, in this case by establishing a sampling well, and chemical tests are undertaken (see also Chapter 3J, "Hazardous Materials").

The quantity of groundwater can also be important, because it supplies water to wetlands and surface water bodies during dry periods. In a contrasting example, groundwater is such a small component of the waters of the lower East River that its flow would not be a concern in this case. The analysis of groundwater quantity and flow is geotechnical and involves establishing the characteristics of the aquifer (the material through which the groundwater moves), the direction and rate of flow, and the rate of recharge. Activities that could affect groundwater quality or quantity and the assessment issues associated with these activities include the following:

- *Installation of industrial or residential water supply wells.* The issue in this case is the potential that pumping will alter the flow of groundwater in a specified area, possibly altering flows to another resource. If pumping takes place close enough to a source of contamination, the action could draw pollutants (such as salt) into the aquifer. (More information on potential contamination is provided in Chapter 3J, "Hazardous Materials.") To assess such potential impacts, several wells would need to be installed, and the water levels recorded. These readings are plotted and drawn as contours to create a piezometric surface, which shows the direction and strength of groundwater flow. If the site is close to a tidal water body, the water levels need to be recorded for an entire tidal cycle to establish the tidal influence on the groundwater flow.

- *Dewatering of a construction site.* This is similar to the installation of wells, in that the activity may alter flow of groundwater in a specified area. However, it is a temporary condition.

- *Permanent Dewatering.* In some instances, as when all or part of a building or subway tunnel is constructed below the water table, dewatering pumps are installed to prevent flooding within the structure. This dewatering condition alters the groundwater table and direction of flow on a permanent basis.

- *Removal of vegetation and/or placing an impervious surface on land used for the recharge of groundwater.* This would clearly diminish the replenishment and ultimately the total volume of groundwater available. Usually as a part of site planning, current runoff and runoff with the action in place are calculated. A number of methods can be used to make this estimate, including the "rational method;" TR-20 and TR-55, computerized models developed by the U.S. Department of Agriculture, Soil Conservation Service; and EPA's Storm Water Management Model (SWMM). These methods calculate the volume of runoff, given the volume of rainfall and the area of impermeable surface. They typically use runoff coefficients based on types and areas of different ground surface on the project site. Using this formula and the average annual precipitation (44 inches in New York City), the current recharge and recharge with the action can be calculated. The significance of the change caused by the action can be assessed by comparing the loss or increase in recharge volume to the volume from the recharge area.

- *Installation of groundwater recharge wells or other recharge facilities.* Where increased impervious surfaces are proposed, they are often accompanied by a plan for recharging groundwater through wells. These wells return the precipitation to the groundwater. Generally, the runoff is collected directly from rooftops and other impervious surfaces. Such recharge wells will not function properly unless the distance from the bottom of frozen soil (3 feet in New York City) to the top of the water table is more than 2 feet; therefore the depth to the water table is considered when assessing the wells.

- *Construction of footings, caissons, basements, and other subsurface impediments to groundwater flow.* Deep foundations can occasionally create wet spots and low-level flooding if they impede the flow of groundwater. The impediment to flow can become noticeable near tidal water bodies with fluctuating groundwater levels.

- *Introduction of an activity on-site with the potential to contaminate groundwater.* Such activities include industries involved in the transport, processing, storage, or disposal of hazardous or toxic materials. In this case, the assessment first addresses the question of whether groundwater on the site is important for on-site or off-site water supply or resource replenishment. If so, the assessment then considers the existing quality of the groundwater, its flow direction and rate, and the pathways to contamination. The analysis undertaken for hazardous materials is described in Chapter 3J, "Hazardous Materials."

351.3. Other Water Resource Systems

As defined in Section 113, above, stormwater and the natural and built systems that convey it to a receiving water or wetland resource are critical elements in the condition and value of that resource. The quality of the stormwater and its velocity and volume as it moves across the land all affect the physical and chemical characteristics of water bodies and receiving waters. This in turn is determined by the slope and coverage of the land, the uses on it, the presence of built systems to convey stormwater flows, the types of storms the area is subject to, and the ability of the low-lying floodplains to retain stormwater and diffuse the force of its flows. Other natural phenomena that strongly affect the environment include the action of tides and waves, which shape the land through erosion or accretion of sand and other materials carried in the waters. A proposed action can alter these systems or combine with them for unexpected results. Examples are as follows:

- Actions that would alter the way in which stormwater flows overland or is absorbed to recharge groundwater. These include activities that displace heavier vegetation (such as woodlands) with lighter vegetation (such as lawns) or add impervious surfaces to the land; alter the shape of the land (cut or fill it to build a road, for example); or introduce a built storm drainage system. Any of these actions may increase the amount of rainfall that arrives at a water body or wetland as surface flow; increase the velocity with which it flows; create an earlier and substantially greater "peak" flow to the receiving water; or change the speed and direction of flow. The analysis of such actions includes assessing the area draining to the water body, as described in Section 330, above.

- Changes to the floodplain, including the following: placement of structures in the floodplain that reduce its capacity for flood retention or alter stormwater flow characteristics; removal of vegetation that would otherwise reduce flow velocities and promote recharge; and removal of stream bank vegetation, which may destabilize the stream channel or increase water temperatures. The analysis of the floodplain uses engineering techniques similar to those presented for the assessment of overland runoff. To estimate the potential for increased flooding because of an action, the volume of the floodplain occupied by any buildings facilitated by the action is compared with the total volume of the floodplain. Along the Hudson River, even very large projects would have minimal effect, because of the great volume of the total floodplain area; along small streams, such as Lemon Creek on Staten Island, a small project in the floodplain could cause flooding elsewhere.

352. Wetlands

The City, state, and federal government all recognize the critical importance of wetlands in the environment. The scarcity of existing regional wetlands in New York City and the sensitivity of this resource warrant special attention. New York City's existing wetlands are a small vestige of the vital resource extant 100 years ago; by some estimates, 90% of the wetlands that existed prior to 1900 have been destroyed. Wetlands in the City have sustained and continue to sustain cumulative impacts resulting from ditching; draining; filling; oil and fuel spills; non-point source pollution; eutrophication caused by CSO discharges; erodible shorelines resulting from navigation channel dredging and boat wakes; utility line installation; blockage of tidal exchange; introduction of nonindigenous vegetation; and sedimentation from point and nonpoint sources such as roadway and parking lot runoff.

Pristine or relatively undisturbed wetlands possess ecological equilibria that discourage large populations of pest species such as mosquitoes. When wetlands are filled, the textural discontinuity between endemic and fill soils often causes a perched water table. Wetlands that do not possess healthy ecosystems in equilibrium develop and promote mosquito infestation.

As discussed in Section 710, DEC and the U.S. Army Corps of Engineers (COE) require permits for certain actions that would take place in or affect most wetlands and the areas adjacent to them. The COE has jurisdiction over virtually all freshwater and tidal wetlands. DEC also takes jurisdiction over all tidal wetlands and all freshwater wetlands greater than 12.4 acres; smaller freshwater wetlands may also fall under DEC jurisdiction if they are deemed by the Commissioner to be of unusual local importance. In addition to the wetland itself, DEC's jurisdiction extends beyond the borders of the wetland into a buffer area known as the "adjacent area." In New York City, the adjacent area is usually the area within 150 feet of a tidal wetland or 100 feet of a freshwater wetland. For tidal wetlands, this area can be smaller if, in general, a 10 foot rise in elevation occurs less than 150 feet from the wetland or if a functional and substantial fabricated structure of at least 100 feet in length serves to bound the wetland. In these cases, the adjacent area would be the area between the wetland boundary and the 10 foot contour or the fabricated structure. However, in many circumstances it is also appropriate to examine impacts within areas larger than 100 and 150 feet from the wetland boundary. For example, beaches, dunes, bluffs, upland nesting habitat for water birds, and other critical watershed components are often adjacent to but further than 150 or higher than 10 feet from the tidal wetland boundary. In this and many other cases, it may not be appropriate to limit the CEQR impact assessment to the adjacent area definition that constitutes DEC's jurisdictional boundary. Larger areas may need to be evaluated since effects on wetland resources could be overlooked.

In addition, for freshwater wetlands, it is often appropriate to consider wetlands that are smaller than the 12.4 acres. Many vernal pools, bogs, and other freshwater wetlands that are smaller than 12.4 acres are critical to regional biodiversity. Vernal pools, for example, are often smaller than 0.5 acres and are hydrologically isolated from one another, although several may be interspersed across the same local landscape. Because these systems are devoid of fish, they serve as important breeding grounds for amphibians. Amphibians migrate over land from one pool to another to breed. Although these pools are isolated and relatively small, they form an integrated wetland system at the landscape scale. In many cases, especially in fragmented urban ecosystems such as New York City, wetland value is derived from the spatial integration of small wetland units into a whole wetland system that is greater than the sum of its parts. Thus, effects on all wetland systems, regardless of size, should be considered in a CEQR evaluation. Wetland values should be rated according to function, both at the individual and the study area/ecosystem level. In all cases, it is essential for the analyst to define the area in which activities could adversely affect the resource.

DEC and COE have established technical procedures for the definition and evaluation of wetlands. Both procedures acknowledge that three elements work together to create and maintain wetlands: wetland hydrology (the movement of water to and through the wetlands that creates saturated conditions for at least one week during the growing season); hydric soils (generally dark, mucky soils with chemical and organic characteristics that reflect the lack of oxygen [anaerobic conditions] resulting from inundation); and hydrophytic vegetation (plants that can tolerate or that require periodically saturated or inundated conditions and/or anaerobic soil conditions). Tidally influenced wetlands are delineated using the vegetation and hydrologic criteria described in 6 NYCRR Part 661.2. For freshwater wetlands, the COE technical approach emphasizes determination of soil types in delineating wetlands; DEC stresses identification of vegetation in delineating and characterizing wetlands (see 6 NYCRR Parts 660-665 for DEC guidance). Relying on vegetation identification to delineate wetlands is usually more conservative than relying on soils identification; wetland vegetation is often found growing in soils that are adjacent to wetlands soils but are not classified as such. Therefore, a reliance on vegetation will most often result in the delineation of a larger area as wetlands.

DEC uses its March 1995 delineation manual for freshwater wetlands. The COE and EPA have agreed to use the *Corps of Engineers Wetlands Delineation Manual, 1987* (Technical Report Y-87-1) for purposes of administering the program under Section 404 of the Clean Water Act. However, in New York City, soil disturbance, past land use history, and soils on Staten Island derived from red parent rock can create ambiguity in the delineation process that often results in under-representation of wetlands when using the 1987 COE manual. Therefore, caution should be exercised when using the 1987 COE manual to delineate wetlands for a CEQR evaluation. In some cases, especially on Staten Island and in areas of the City in which soils are known to have been disturbed, it may be appropriate to place more emphasis on vegetation than would normally be the case for wetlands elsewhere in the State. The EPA, the COE, the Soil Conservation Service, and the Fish and Wildlife Service are currently considering revisions to the more recently released *Federal Manual for Identifying and Delineating Jurisdictional Wetlands, 1989*. Once revised and accepted, this manual may be more appropriate for use in the City than the 1987 manual.

When an action requires permits from both DEC and COE, consultation with the COE and DEC is recommended prior to fieldwork when wetland delineations are necessary. If permits are required from both DEC and COE, it may be necessary to assess and identify two different wetland boundary conditions. In this case, the larger of the two areas may be identified for use in the CEQR assessment. Actions that might affect wetlands either directly or through changes to their adjacent areas are the same as those discussed above under water resources (Section 361); they fall into the following general categories:

- Any form of draining, dredging, excavation, or removal of soil, mud, sand, shells, gravel, or other aggregate, either directly or indirectly.
- Any form of dumping, filling, or depositing of any soil, stones, sand, gravel, mud, rubbish, or fill of any kind, either directly or indirectly.
- Erecting any structures or roads, the driving of pilings, or the placing of any other obstructions, whether or not changing the ebb and flow of the water.
- Any form of pollution.
- Any other activity that may substantially alter or impair the natural condition or function of a wetland.

The methods for assessing and evaluating wetlands generally follow the outline presented in Sections 320 and 330, above. In addition, the DEC regulations group freshwater wetlands into four classifications based on their intrinsic value; DEC tidal wetlands regulations also offer insight into the comparative value of such wetlands, as summarized below.

352.1. Freshwater Wetlands Classifications

Part 664.5 of 6 NYCRR lists four wetlands classifications. *Class I* wetlands are the most valuable and may contain any of seven specific characteristics: it is a classic kettlehole bog (a rare ecological association not known to exist in New York City); it is resident habitat of an endangered or threatened animal species; it contains an endangered or threatened plant species; it supports a diversity of species unusual in the State; it plays a key role in flood prevention in an inhabited area; it is connected to a surface or groundwater drinking water supply; it contains four or more Class II characteristics.

Class II wetlands are identified as containing at least one of 17 listed wetland characteristics or attributes. The most germane of these for the City are: it is an emergent marsh less than two-thirds covered by purple loosestrife and/or common reed; it contains two or more wetland structural groups (herbaceous, woody, or water); it is adjacent to a tidal wetland; it is associated with permanent open water; it is adjacent to streams classified C or higher (see Section 361, above); it is a traditional migration habitat of an endangered or threatened animal species or a resident habitat of a vulnerable animal or plant species; it supports a diversity unusual for the City or borough; it has demonstrable archaeological significance; or it is within an urbanized area, is one of the three largest in the City or borough, or is within a publicly owned recreation area.

Because New York City is considered an urbanized area, all freshwater wetlands within it are listed by DEC as either Class I or Class II. Consideration of Class III criteria is of interest, however, because the features listed may be of issue in the CEQR assessment. *Class III* wetlands have 15 potential characteristics or attributes, the most relevant of which include: it is a wetland with one of five cover types not listed for Classes I and II (including open water); it is a resident or migration habitat of an animal species vulnerable in the major region of the state in which it is found or is a migration habitat of a vulnerable species in the state; it contains a regionally vulnerable plant species; it receives significant pollution of a type amenable to amelioration by wetlands; it is visible from a major transportation route and serves a valuable aesthetic or open space function; or it is on publicly owned land that is accessible to the public.

Class IV is reserved for wetlands that do not have the characteristics of class I, II, or III above, including wet meadows or coniferous swamps.

352.2. Tidal Wetlands Evaluation

Part 661.2 of 6 NYCRR provides a useful reference for understanding the relative value of tidal wetlands. The discussion notes that all tidal wetlands are potentially extremely valuable: "one of the most vital and productive areas of the natural world." Within this overall evaluation, however, intertidal wetlands and coastal fresh marsh are considered the most biologically productive and worthy of the most stringent protections.

Coastal shoals, bars, flats, and littoral zones can vary widely in their value and contribution to productivity. The discussion acknowledges that biological productivity in these wetlands may have been impaired by pollution; such areas contain few benthic organisms and show little primary productivity. However, where this has occurred, the other important functions of these wetlands (flood, hurricane, and storm control) remain intact.

High marshes or salt meadows are considered valuable particularly for absorption of silt and organic materials and storm control. Their location near the upland makes them important for cleansing ecosystems. They also provide substantial habitat and feeding area for birds, reptiles, and insect populations.

Formerly connected tidal wetlands are variable in their contributions and functioning and are evaluated on a case-by-case basis. They are generally described by whichever of the wetlands categories (intertidal wetlands, high marsh, etc.) they most closely resemble.

353. Uplands

Upland habitats in the City are extremely diverse, and issues for their assessment vary widely. All provide habitat for wildlife, and most function to offer scenic if not also recreational opportunities for the public. Some, including beach, dunes, bluffs, and some thickets, are even more important in controlling erosion and protecting the City's shoreline. The discussion below divides uplands into three major groups, as follows:

353.1. Beaches, Dunes, Bluffs, and Thickets

As discussed in Section 130, dunes and bluffs are critical to maintaining the City's beaches and natural shoreline. Thickets are included in this grouping, because most often this low growth takes hold on dunes and bluffs, helping to stabilize them in the face of waves and winds. The beaches themselves absorb wave and storm energy, thus helping to preserve the shoreline. All of these features are protected under DEC's Coastal Erosion Management program (see Section 710). Few types of actions are now permitted in these areas, but they may include the following:

- Construction of walkways, pathways, boardwalks, or stairs over dunes and bluffs to the beach or along the beach.
- Construction of sheds, cabanas, and other small structures to accommodate equipment and activities at or near a beach.
- "Nonmajor" additions to existing structures.

Usually, the disruption caused by these activities is limited. However, it is appropriate to consider such possibilities as loss of vegetation, including plant species that are endangered, threatened, exploitably vulnerable, or rare; reduction or loss of wildlife habitat; effect of increased public use; and compaction of soils or erosion from construction activities. In addition, where substantial development is proposed upland of a beach or dunes or atop a bluff, it is possible that issues of major erosion control protection may arise.

353.2. Maritime Grasslands and Sandy Oak Barrens

These two habitats are formed by harsh conditions of dry soils and exposure to sea winds. Both are unusual in the City and may contain indigenous plant (examples include the following species: Quercus velutina, Quercus marilandica, Quercus stellata, and Quercus alba) and animal species that are uncommon, rare, or of special concern. Except as listed in Section 150, above, these habitats are afforded no special regulatory protections. However, their fragility makes them susceptible to impact. They cannot tolerate much loss of vegetation; changes in adjacent habitats that act as buffers between these systems and more developed areas can lead to adverse impacts; and changes in drainage can be problematic.

When an action is proposed in or near one of these habitats, a detailed assessment is often appropriate. This may include identifying plant species and delineating the habitat; determining whether any species that are endangered, rare, or of special concern are present; characterizing the "buffer" habitats and their role in protecting the grasslands or barrens; and analyzing drainage patterns serving the habitat(s).

353.3. Meadows or Old Fields, Woodlands, and Gardens

These habitats are usually considered to be common and therefore are not often protected by specific regulation. However, in the City, these areas often support a range of wildlife and plant species and serve one or more important functions—particularly for recreation and open space. For these as well as all other habitats discussed in this section, the CEQR analysis begins by assuming that they are valuable. Using the approach outlined in Sections 320 through 340, above, the resource is characterized according to its vegetation, potential for wildlife habitat, current use, and, as appropriate, the environmental systems that support it. It is then assessed giving consideration to the context of similar habitat in the area, and how the area is used by wildlife. For example, a small park with low shrubs that is located in a densely developed urban area could provide important habitat for nesting birds, but the same park located in a low-density area (such as R1 or R2 zones) would not necessarily be used for nesting.

As another example, in New York City mostly small patches of forest remain, although they are common Statewide. Only a handful of forests, mostly in parks, are large enough to support interior habitat. Thus, a relatively large wooded area, including its buffer—mowed lawn, weedy or shrubby edge, etc.—are important as wildlife habitat and refuge. The survival of forest communities rests on protecting large patches and their buffers, and also on protecting smaller patches that serve as wildlife corridors and seed sources.

354. Built Resources

Where built resources support species that are endangered, rare, or of concern, the resources are considered valuable, and their loss may constitute a potential significant adverse impact. Therefore, the assessment of such resources is focused on determining the extent to which such species may rely on these resources and whether the loss of all or a part of the resource would result in a real loss of habitat, in the context of all such available habitat.

355. Significant, Sensitive, or Designated Resources

Where an action may affect one or more of the resources listed in Section 150, above, a detailed assessment is usually appropriate. This assessment can make use of information that is already available (many of these resources are the subject of ongoing study), but it may also require considerable field work. Before determining the scope of the assessment, it is recommended that the lead agency consult with DEP or with the agency with jurisdiction over the resource.

400. Determining Impact Significance

The approach to determining impact significance takes into account that the City's natural resources are relatively scarce. In general, if a resource has been found to serve one or more of a number of natural or recreational functions and an action would directly or indirectly diminish its size or its capacity to function (as determined in Section 300), the impact is considered to be significant. The following list is not all-inclusive, but serves as guidance in considering impact significance. An impact may be significant if the following would be true:

- An action would likely render a water resource unfit for one or more uses for which it is classified and/or cause or exacerbate a water quality violation.
- An action would, directly or indirectly, be likely to adversely affect a significant, sensitive, or designated resource as listed in Section 150, above.
- An action would likely diminish habitat for a resident or migratory endangered, threatened, or rare animal species or species of special concern.
- An action would likely result in the loss of plant species that are endangered, threatened, rare, or vulnerable.
- An action would likely result in the loss of part or all of a resource that is important because it is large, unusual, or the only one remaining in the area where the action is to take place.
- An action would, either directly or indirectly, be likely to cause a noticeable decrease in a resource's ability to serve one or more of the following functions: wildlife habitat; food chain support; physical protection (flood protection, e.g.); water supply; pollution removal; recreational use; aesthetic or scenic enhancement; commercial productivity; or microclimate support.
- An action would, either directly or indirectly, be likely to contribute to a cumulative loss of habitat or function which diminishes that resource's ability to perform its primary functions.

500. Developing Mitigation

If a significant impact on a natural resource is identified, then mitigation measures should be identified. Mitigation measures fall under five general categories: avoidance, minimization, restoration, reduction, and compensation. The latter (compensation) should be used as a last resort to compensate for the unavoidable impacts remaining after the first four types of mitigation are investigated to the extent practicable. The five types of mitigation are discussed in more detail below:

510. AVOIDANCE

Avoidance techniques involve avoiding the impact by not taking an action or part of an action, or by simply relocating the action or part of an action. In many cases, avoidance techniques are employed very early in the design phase of a project when alternatives are being considered and, in some cases, eliminated due to the probability of impacts associated with certain alternatives. Avoidance techniques are also employed during the construction phase of the project. These generally involve temporal or spatial constraints on construction. These include, but are by no means limited to, the following:

- Delaying or halting construction during ecologically sensitive time periods, such as fish spawning or wildlife breeding periods. These periods are often referred to as "environmental windows."
- Avoiding construction in ecologically important or sensitive areas by either eliminating a portion of a project or relocating it to a non-sensitive area.
- Avoiding the removal or disturbance of specific trees or plants that are known to be ecologically valuable.
- Avoiding the use of heavy equipment in areas vulnerable to the effects of compaction. For

example, construction-related activities should not occur within a minimum of one and one-half times the dripline of any tree, and heavy equipment and stored materials should not be placed or used within a minimum of three and one-half times the dripline of any tree.

- Restricting dredging to areas of low current velocity.
- Avoiding the removal, disturbance, or compaction of vegetation along stream banks and other shorelines.
- Limiting cleared areas to those required for construction and staging only; selecting the least vulnerable areas for clearing to the extent possible.

520. MINIMIZATION

Minimization involves minimizing the impact by limiting the degree or magnitude of the action and its implementation. Like avoidance techniques, minimization techniques are also often employed very early in the design phase of a project when alternatives are being screened and eliminated. Minimization techniques can also be employed later in the process during the detailed design phase of the selected project. For example, fewer units in a development project, a building that is shorter or takes up less surface area (depending on the resource of concern), shallower dredging, or a parking lot with fewer or smaller parking spaces are all examples of limiting the degree or magnitude of a project to minimize impacts on natural resources. Often, engineering solutions can be employed to redesign a project so that the desired benefits can still be obtained from a project of smaller scale.

530. RESTORATION

Restoration involves rectifying the impact by repairing, rehabilitating, or restoring the affected environment. This type of mitigation generally applies to rectifying short-term construction related impacts, if possible. Examples of such restoration techniques include, but are not limited to: revegetation of denuded surfaces using indigenous plants; placement of appropriate soil that fully meets the requirements of the targeted restoration communities; removal of temporary structures, equipment, and other materials related to construction; and repairing accidental damage incurred during construction.

540. REDUCTION

Reduction techniques involve reducing or eliminating the impact over time by preserving and maintaining the ecological integrity of the site and its surrounding areas to the extent practicable. Reduction techniques can be categorized into short-term or long-term methods. Such techniques include, but are not limited to, the following:

541. Short-term Reduction Techniques

- Use of silt fences, hay bales, mulches, temporary seeding of non-invasive grasses and other covers to limit areas of soil exposure and to stabilize slopes. Sediment and erosion control measures are often required by the City and State but are a frequently overlooked construction component. In all cases, if over five acres of upland construction disturbance are proposed, a "Stormwater Notice of Intent, Transfer, or Termination" form must be filed with the State and regional DEC office citing the location of the site and compliance with any local or municipal erosion and sedimentation control techniques. Guidelines for sediment and erosion control can be found in the book entitled "New York Guidelines for Urban Erosion and Sediment Control."
- Installing temporary drainage systems, including sediment traps, for the duration of construction.
- Limiting the use of chemicals and other potential pollutants for dust control and other construction activities.
- Strict control of the storage, handling, and transport of construction wastes.
- Limiting dewatering to the extent possible; disposing of such waters to maintain the existing drainage system and avoid surface water pollution.
- Incorporating noise or vibration controls in areas containing noise-sensitive species.
- Using environmentally friendly dredging techniques and equipment, such as silt screens, clamshell buckets or hydraulic dredging, no-barge-overflow or shunting, and split-hull barges, where appropriate.
- Monitoring and observance of water quality conditions and standards.
- Employment of fish deterrent systems, if applicable.
- Employing monitoring and maintenance measures to ensure that control devices and

other reduction techniques operate effectively during the period of disturbance.

542. Long-term Reduction Techniques

- Use of indigenous plant material requiring minimal use of supplemental watering, fertilizing, and herbiciding; use of pervious materials (e.g., gravel instead of blacktop) to promote infiltration of stormwater.
- Retention of stormwater on site and its slow re-charge to the ground or overland to surface waters.
- Slope and surface protection, such as physical stabilization, or diversion of drainage around steeply sloped areas, grassed swales, or water-ways.
- Streambank protection, such as physical stabilization.
- Water pollution controls including sediment traps or basins and drain inlet sediment filters.
- Use of pile foundations instead of regrading.
- Provision of tunnels under roadways for wildlife.

550. COMPENSATION

Compensation refers to replacing or substituting for the affected resource. This method of mitigation is often referred to as "compensatory mitigation" and should only be used as a last resort to mitigate for the unavoidable impacts remaining after the first four types of mitigation have been fully employed to the extent practicable.

There are three types of compensatory mitigation: creation, restoration, and acquisition. Creation refers to the creation of the same or similar type of habitat as that which is lost due to the project impacts. The creation of new habitats is recommended in areas of diminutive ecological value. Restoration refers to the improvement of a degraded but still partially functional habitat that is of the same or similar type as the habitat type that will be impacted. Acquisition refers to acquiring a parcel of land of the same or similar habitat type and protecting it from development in the future. Acquisition can also include a restoration component if the acquired property is degraded and can be improved to increase its habitat value. Measurements to ensure the protection of the resulting improved habitat should be undertaken.

All three types of compensatory mitigation should be accompanied by a commitment to monitor to ensure that the goals of the mitigation plan are met and the impacts from the project are fully compensated for. Generally, monitoring is necessary for wetlands or forested areas to determine whether the system that is created or restored will eventually develop the full complement of ecological functions that are intended.

Compensatory mitigation can be either in-kind or out-of-kind. In-kind compensation refers to the creation, restoration, or acquisition of the same habitat type as the disturbed habitat type. Out-of-kind compensation refers to the creation, restoration, or acquisition of a habitat type that is different from the disturbed habitat type. In-kind compensation is preferred over out-of-kind compensation because it results in a more direct replacement of the lost resource. As a result, it is easier to determine that the value of the replaced or restored resource is equivalent to the value of the disturbed or impacted resource. Out-of-kind compensation may be selected on an individual case-by-case basis if in-kind compensation is not feasible. In addition, a combination of in-kind and out-of-kind techniques may be appropriate. In either case, the habitat value gained due to creating, restoring, or acquiring habitat should have as its objective to replace equivalent value lost due to the project impacts.

In addition to the preference for in-kind mitigation, it is also often preferred that mitigation activities take place as close as possible to the projected impacts. The possibility of mitigating for impacts on-site should first be explored. If this is not possible, then mitigation should take place as close as possible to the site. For example, if aquatic impacts are projected to occur as a result of a project, potential mitigation sites should be explored within the same waterbody. If this is not possible, mitigation sites should be selected within the same watershed.

When considering habitat creation as a compensatory mitigation technique, it is important to consider the existing habitat type from which the new habitat type will be created. Like the assessment of impacts of the project, an assessment of impacts of the compensatory mitigation activities must also be performed to ensure that the habitat to be created is not at the expense of another valuable habitat type that has its own ecological value. The objective is for the *net* increase in habitat value to replace the value of the impacted resource due to the project. Therefore, it is usually necessary for habitat creation to take place in existing degraded habitats that are of little to no ecological value. Similarly, when considering habitat restoration, it is important to consider the value of the existing habitat in order to determine the *net* increase in value that will occur from restoration and whether or not this increase will fully compensate for the project impacts.

Much debate exists related to the quantitative evaluation of habitats. Thus, until quantitative methods are developed and validated for urban environments, the determination of habitat value will be largely qualitative. One exception is the valuation of trees on land under the jurisdiction of the New York City Department of Parks and Recreation, for which a quantitative calculation for replacement value of trees has been established. For these impacts, tree compensation using the New York City Department of Parks and Recreation's basal area formula may be required. This entails calculating the basal areas (at breast height) of each tree that will be impacted due to the project, and replacing the total area of each species on a one-to-one ratio. For impacts to other habitats and trees on land not under the jurisdiction of the Department of Parks and Recreation, New York City Department of Environmental Protection or other applicable expert agency may be consulted for guidance.

Another factor that must be considered in weighing the various mitigation techniques is the likelihood for success. Both restoration and creation can entail drastic changes in soil, hydrology, and vegetation. For example, some sites may require denuding and/or revegetating large areas or rechannelizing water courses. The proper soil conditions are essential to the success of a habitat creation or restoration project. When evaluating soils, the U.S. Department of Agriculture (USDA) Northeastern testing procedures, rather than the American Society for Testing and Materials (ASTM) testing procedure, should be used to determine whether existing soil conditions are appropriate for creation or restoration, or whether modified soil conditions are likely to support the intended habitat and its functions. Much debate has focused on the success of wetland creation and restoration efforts. Although these activities may appear to be successful on a gross structural level, the system may take a long time to develop the full complement of ecological functions that a high quality natural area would have or it may never develop such functions. As mentioned previously, it is imperative that long-term monitoring (for at least five years) be an integral component of any compensatory mitigation plan to determine the success of a habitat creation or restoration effort.

Acquisition, the third type of compensatory mitigation, largely eliminates the uncertainty regarding the success of a compensatory mitigation effort, since the habitat, its necessary hydrological and soil characteristics, and its ecological functions often already exist (unless the site to be acquired is degraded, in which case restoration would also be a component of the proposed mitigation plan). However, since this technique neither increases the net acreage of the habitat in question nor does it always increase the value of the habitat (unless restoration is a component), mostly those sites that are in danger of development or degradation in the future should be considered as potential acquisition sites.

The New York/New Jersey Harbor Estuary Program (HEP) Habitat Work Group (HWG) has identified a series of priority wetlands acquisition and restoration sites within the Harbor. Other sources that also contain lists of potential mitigation sites include the New York Open Space Plan and regional or project-specific mitigation plan reports. While these are excellent sources of potential mitigation sites that have already been identified and prioritized, they are not exhaustive lists. Furthermore, these sources may not identify sites that are of the same habitat type as, or in the vicinity of, the impacted habitat. For example, the HEP HWG priority list focuses on wetland systems and therefore would not be applicable for compensatory mitigation for impacts on upland habitats. Therefore, it is necessary at least to attempt to identify appropriate mitigation sites that would provide in-kind mitigation in the vicinity of the impacts, if such potential sites are not already identified in other sources.

560. RESTORATION EXAMPLES

The quality and appropriateness of a particular natural area landscape restoration depends on many factors. The creation and restoration of wetland (fresh and tidal) and upland ecosystems often fail because too little attention was given to some fundamental elements. To help improve the effectiveness of developing a long-term functioning target ecosystem, careful attention to the following is crucial:

1. The proposed site for a restoration project must be capable of supporting the targeted ecosystem (e.g., proposed creation of freshwater wetlands should include sufficient watershed area for proper hydrological conditions).

2. Plant selection for a given restoration should be suitable and capable of thriving under proposed conditions (examples of improper plant selection include: placement of high shade requirement plants in full sun, placement of high moisture plants in dry locations, and placement of drier plants in too moist locations).

3. The soil substrate must be suitable for the targeted ecosystem. The appropriate soil depth is crucial, and a restoration site should have sufficient soil depth for type of vegetation proposed (min. 3' for trees) correct pH, organic matter, nutrients, salinity, etc.). Therefore, soil characteristics including pH, organic matter, nutrients, and salinity should all be considered.

4. Implementation of and adherence to appropriate ecological landscape specifications and the use of effective erosion control measures are crucial in habitat restoration (e.g., seeding or planting only within specified times, use of seed and plant material from local provenance, use of indigenous plant material, and replacement and maintenance of erosion control measures regularly).

5. Appropriate soil nutrient levels that are suitable and capable of supporting the targeted ecosystem should be established (e.g., when planting a plant community with low nutrient requirements, avoid using high fertility soils and applying fertilizers).

6. Selection of a landscape restoration contractor that is experienced with all aspects and requirements of targeted ecosystem (e.g., a contractor that specializes in upland ecosystems may not be the appropriate choice for a wetland restoration. In one instance, an inexperienced contractor expressed concern that plants in a wetland would be "too wet" to survive).

7. Construction fill derived soils should not be used to construct a habitat, as these soils are limited in the plant communities that they can support (they have a high pH, often drain poorly or too much, contain high nutrients, and non-indigenous plants often colonize these soils).

8. Monitoring and follow-up maintenance during the establishment period (3-5 years) are critical to the success of any restoration project (e.g., proper watering, regular removal of invasive weeds, replacement of plant material or seeding at next available season and not at the end of the maintenance period).

The New York City Department of Environmental Protection and the New York City Department of Parks and Recreation undertook an unprecedented varied-landscape restoration project in Idlewild Park (Queens) which provides excellent examples of successful restoration efforts. The examples shown in the figures are specific to the Idlewild project. Restoration efforts for other projects will require unique attention to items including, but not limited to; specifying appropriate ecosystems, construction methods, specifications, and designs. The examples given below are shown for illustrative purposes only. The project restored degraded uplands and wetlands. Descriptions of three of the projects follow below.

561. Upland Restoration

A degraded upland area was restored to an indigenous grassy community (Figure 1). The original substrate was primarily a construction fill derived material. This type of "soil" is extremely limited in the types of plants that it is capable of supporting. Primary plant species typical of this environment are Mugwort (*Artemisia* sp.) and Ragweed (*Ambrosia* sp.). To establish the desired upland coastal dune ecosystem, the construction derived fill material was removed and replaced with up to six feet of clean sand (the required and appropriate substrate for this particular plant community). Sand was placed in an undulating manner to create varied micro-climates throughout site. The focus of the landscape restoration design was to establish appropriate plant communities with associative plants rather than dissimilar individual plants. The tree canopy, tree understory, shrub understory, and herbaceous layer were incorporated into the design. Varied sizes of same species were planted to produce an uneven age plant community. In addition, the use of indigenous plant material produced from a provenance of within 150-mile radius of project significantly reduced overall mortality rate. The establishment of an indigenous warm-season grass and wildflower meadow provided wildlife habitat, greater soil erosion control, increased drought tolerance, and reduced supplemental watering and fertilizing in comparison to conventional cool-season lawn grasses.

562. Wetland Restoration

Both tidal and freshwater wetlands were restored in Idlewild Park (Figures 2 and 3), and the methodology for restoring these wetlands is similar. The correct hydrology is essential in establishing both tidal and freshwater wetlands. All too often, restoration efforts are wasted and the intended project fails because the final grade was off by less than 6". This 6" is the difference between establishing the proper wetland hydrology and creating a moist upland.

A land survey of the proposed restoration site is required to determine the amount of excavation necessary, and in designing the optimal location for the water source (tidal channels for tidal marshes or the inflow of fresh water input for surface water-fed wetlands). In tidal situations, the area should be rough graded down to near the final grade and allowed to settle for several tide cycles (Figure 2). This allows the determination of the high water mark, allows the substrate to expand after inundation and allows the substrate to "bounce up" after the removal of additional weight. Fine tuning to the final grades can be adjusted after a week of uninterrupted tidal cycles. An additional foot below final grade is removed and replaced with one-foot of clean sand prior to planting wetland plugs on one-foot centers.

The following techniques will help to establish a functioning, biologically diverse wetland:

1. Establish gently rising slopes from the center of the wetland and stabilize these slopes with grasses and shrubs (this pertains only to the wetland itself; the area outside of the wetland boundary can have steeper slopes).
2. Plant trees on the wetland boundary for slight shading.
3. Maintain varying sediment depths in order to diversify plant communities.
4. Build isolated islands in the middle of the wetland.
5. Include some open water in the wetland.
6. Add boulders or logs as perching habitat for waterfowl.
7. Provide a properly maintained and functional goose exclusion fence. This is necessary to prevent geese predation until the plants have fully established themselves and have minimized exposed soil.

600. Developing Alternatives

Alternatives that can avoid or minimize impacts to natural resources and avoid the need for mitigation should be given first consideration. Such alternatives can include different sites as well as changes to project layout, design, and density.

700. Regulations and Coordination

710. REGULATIONS AND STANDARDS

There are many specific federal, state, and City rules and regulations governing natural resources. These permits are independent of CEQR, and may require their own environmental review. Typically, the permitting process is undertaken after the CEQR process is completed. However, applicants are encouraged to contact the regulatory agencies as early as possible to be certain the project is permittable and any mitigation aspects are identified. Since many CEQR actions may be affected by permit requirements and conditions, applicants and lead agencies will need to be aware of them. Those most commonly applicable for actions undertaken in New York City are described below.

711. Federal Regulations

- *Section 404 of the Federal Clean Water Act: Dredge and Fill.* Section 404 of the Federal Clean Water Act (33 USC 1344, jointly administered by EPA and the U.S. Army Corps of Engineers, or COE) prohibits the discharge of dredged or fill material into the waters of the U.S. (including wetlands) without a permit from the COE. These activities are regulated through Nationwide, Regional General, or Individual Permits.

A.Figure 1
Idlewild Upland Restoration

1. Pre-Restoration

2. Restoration in Progress

3. 2 Years Later

B.Figure 2

Idlewild Tidal Restoration

4. Pre-Restoration

5. Restoration in Progress

6. 2 Years Later

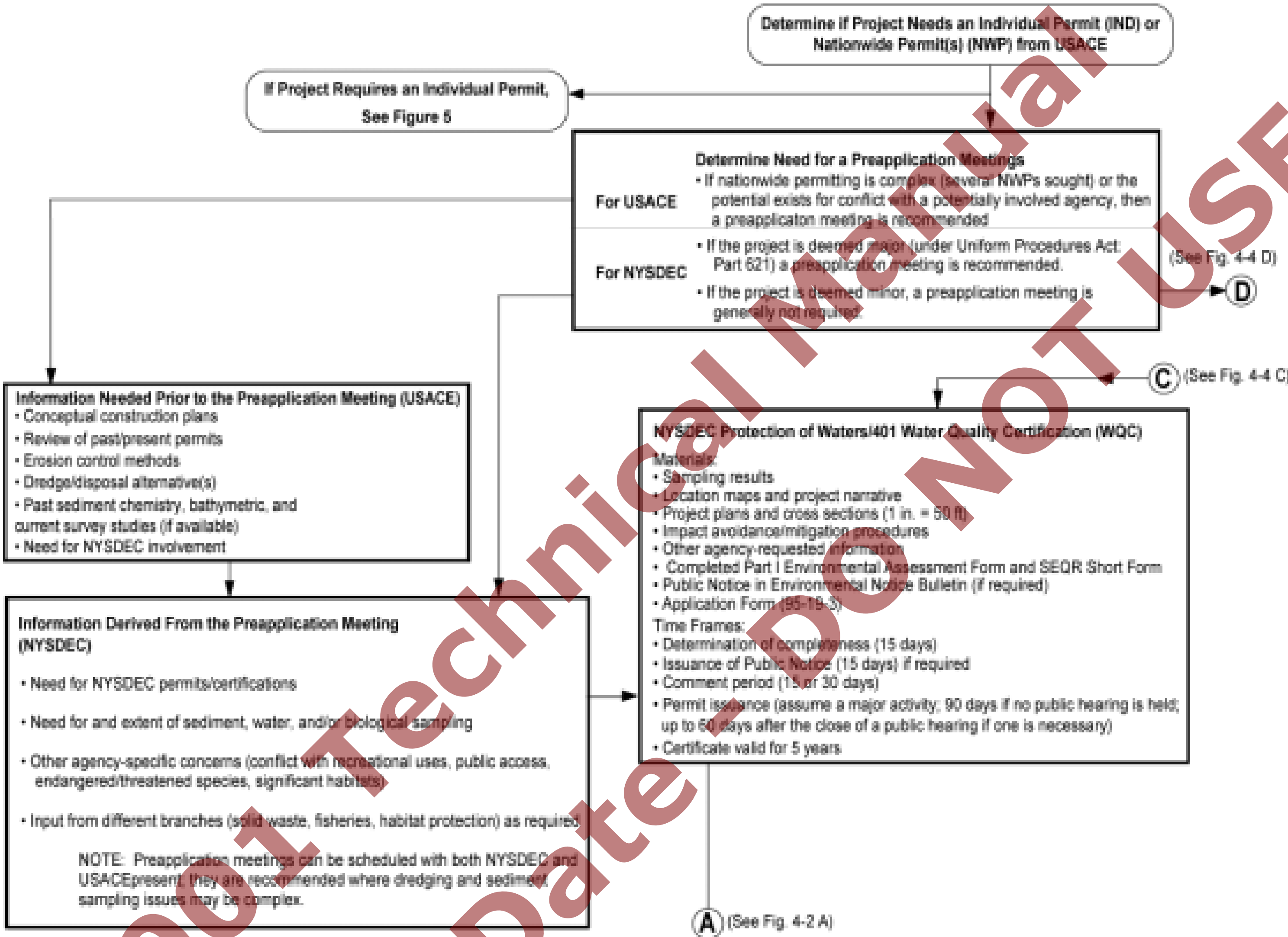
C.Figure 3
Idlewild Freshwater Wetland Restoration

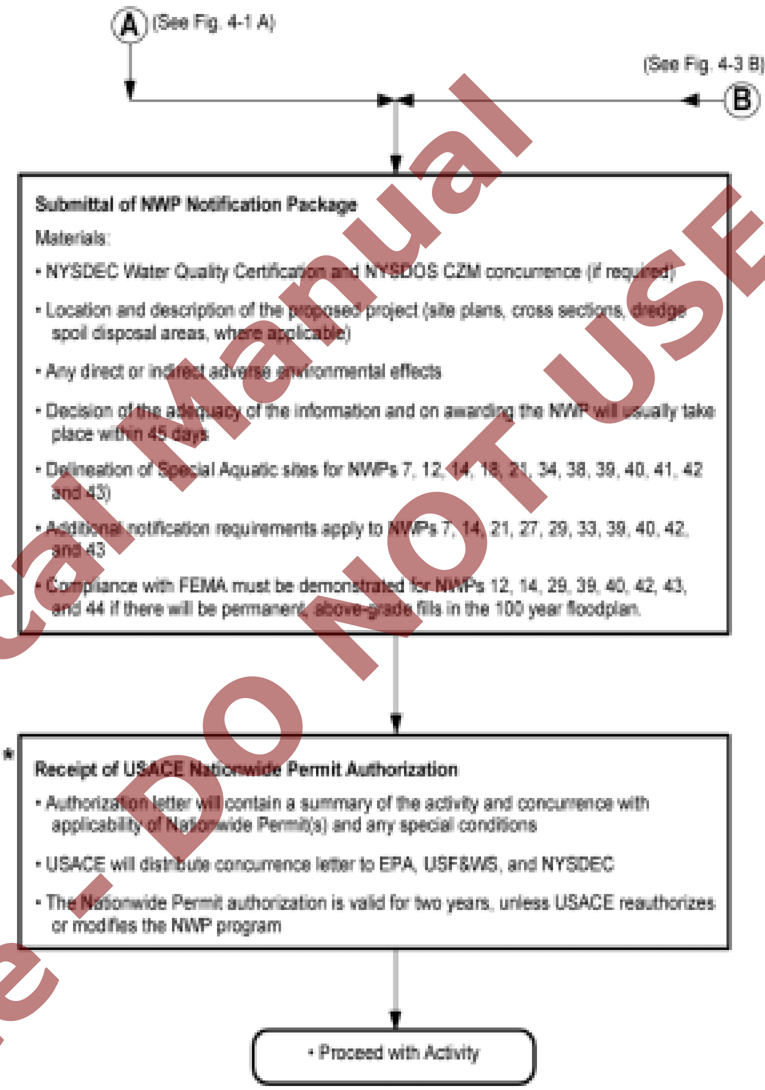
7. Pre-Restoration

8. Restoration in Progress

9. 2 Years Later

Figure 4-1
The USACE Nationwide Permit
and NYSDEC Application Process





LEGEND

Notification is required where a review by the District Engineer (USACE) is necessary to ensure that activities authorized by those NWPs have minimal individual and cumulative adverse effect(s) on the environment.

Notification for NWPs 5, 7, 13, 17, 21, 26, 29, and 33 is required. Notification must be completed by the Applicant and consists of the following:

- Name, address, and phone number of the applicant.
- Location, description, and purpose of the project, direct and indirect or adverse environmental effects, and other permits/approvals needed or necessary to conduct the proposed activity.
- USACE will determine the need to contact other agencies (USF&WS, NMFS, and OPRHP) for site-specific information and will initiate the contacts if deemed necessary.
- Applicant must file a Nationwide Permit Compliance Certification and Report Form within 30 days of completing the activity.

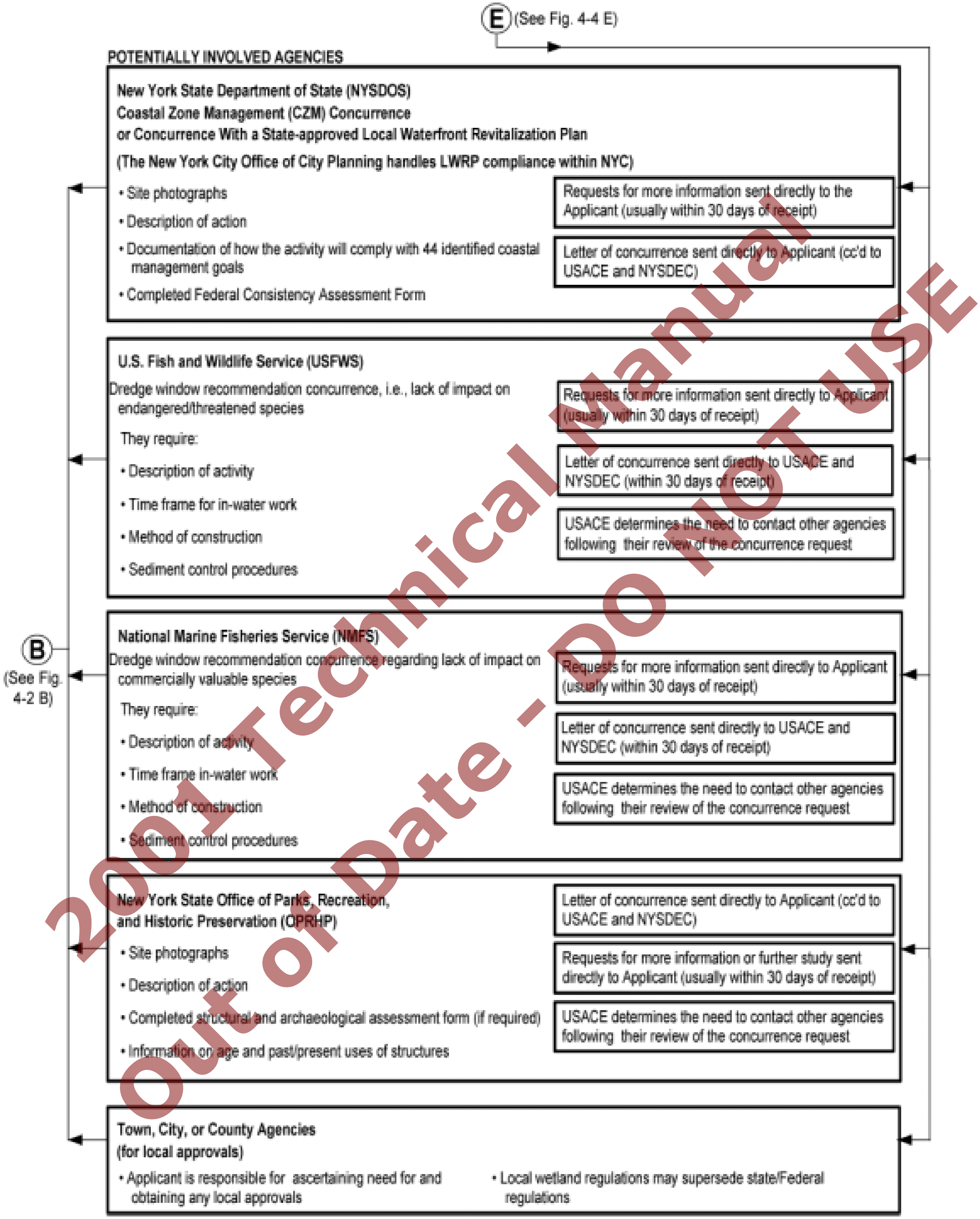
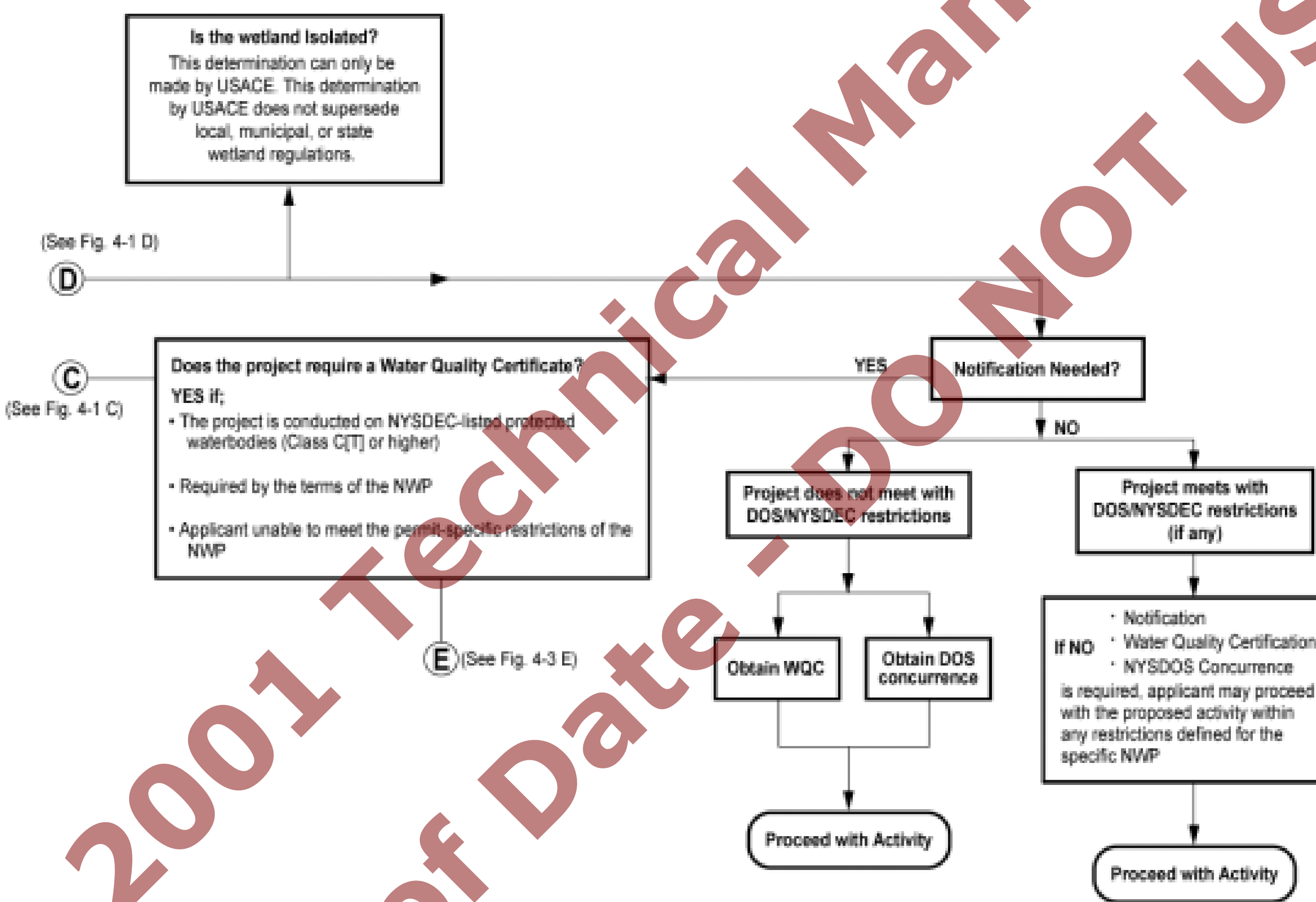
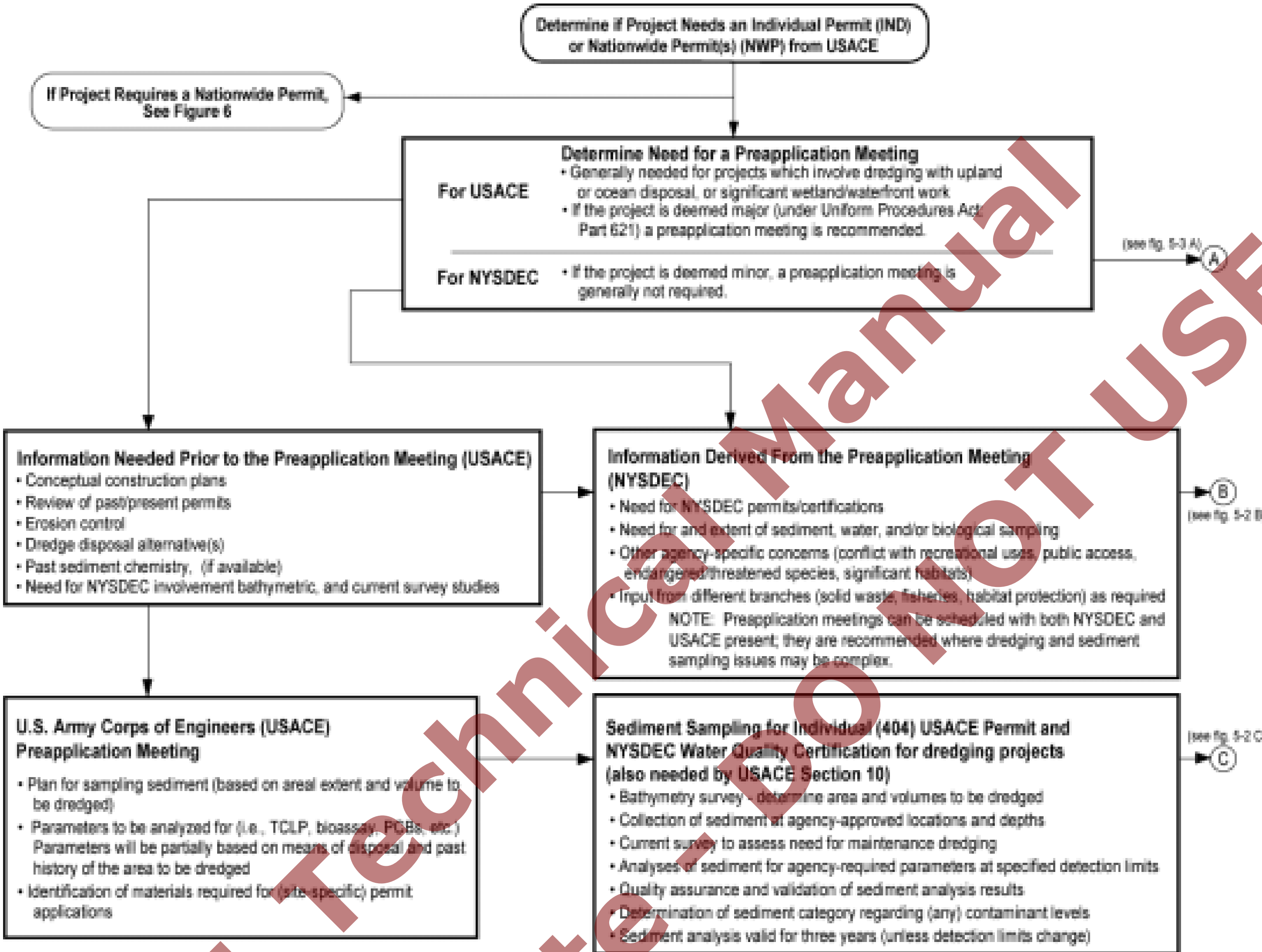

E (See Fig. 4-4 E)
POTENTIALLY INVOLVED AGENCIES
New York State Department of State (NYSDOS)
Coastal Zone Management (CZM) Concurrence
or Concurrence With a State-approved Local Waterfront Revitalization Plan
(The New York City Office of City Planning handles LWRP compliance within NYC)
• Site photographs
• Description of action
• Documentation of how the activity will comply with 44 identified coastal management goals
• Completed Federal Consistency Assessment Form
Requests for more information sent directly to the Applicant (usually within 30 days of receipt)
Letter of concurrence sent directly to Applicant (cc'd to USACE and NYSDEC)
U.S. Fish and Wildlife Service (USFWS)
Dredge window recommendation concurrence, i.e., lack of impact on endangered/threatened species
They require:
• Description of activity
• Time frame for in-water work
• Method of construction
• Sediment control procedures
Requests for more information sent directly to Applicant (usually within 30 days of receipt)
Letter of concurrence sent directly to USACE and NYSDEC (within 30 days of receipt)
USACE determines the need to contact other agencies following their review of the concurrence request
B
(See Fig. 4-2 B)
National Marine Fisheries Service (NMFS)
Dredge window recommendation concurrence regarding lack of impact on commercially valuable species
They require:
• Description of activity
• Time frame in-water work
• Method of construction
• Sediment control procedures
Requests for more information sent directly to Applicant (usually within 30 days of receipt)
Letter of concurrence sent directly to USACE and NYSDEC (within 30 days of receipt)
USACE determines the need to contact other agencies following their review of the concurrence request
New York State Office of Parks, Recreation, and Historic Preservation (OPRHP)
• Site photographs
• Description of action
• Completed structural and archaeological assessment form (if required)
• Information on age and past/present uses of structures
Letter of concurrence sent directly to Applicant (cc'd to USACE and NYSDEC)
Requests for more information or further study sent directly to Applicant (usually within 30 days of receipt)
USACE determines the need to contact other agencies following their review of the concurrence request
Town, City, or County Agencies
(for local approvals)
• Applicant is responsible for ascertaining need for and obtaining any local approvals
• Local wetland regulations may supersede state/Federal regulations

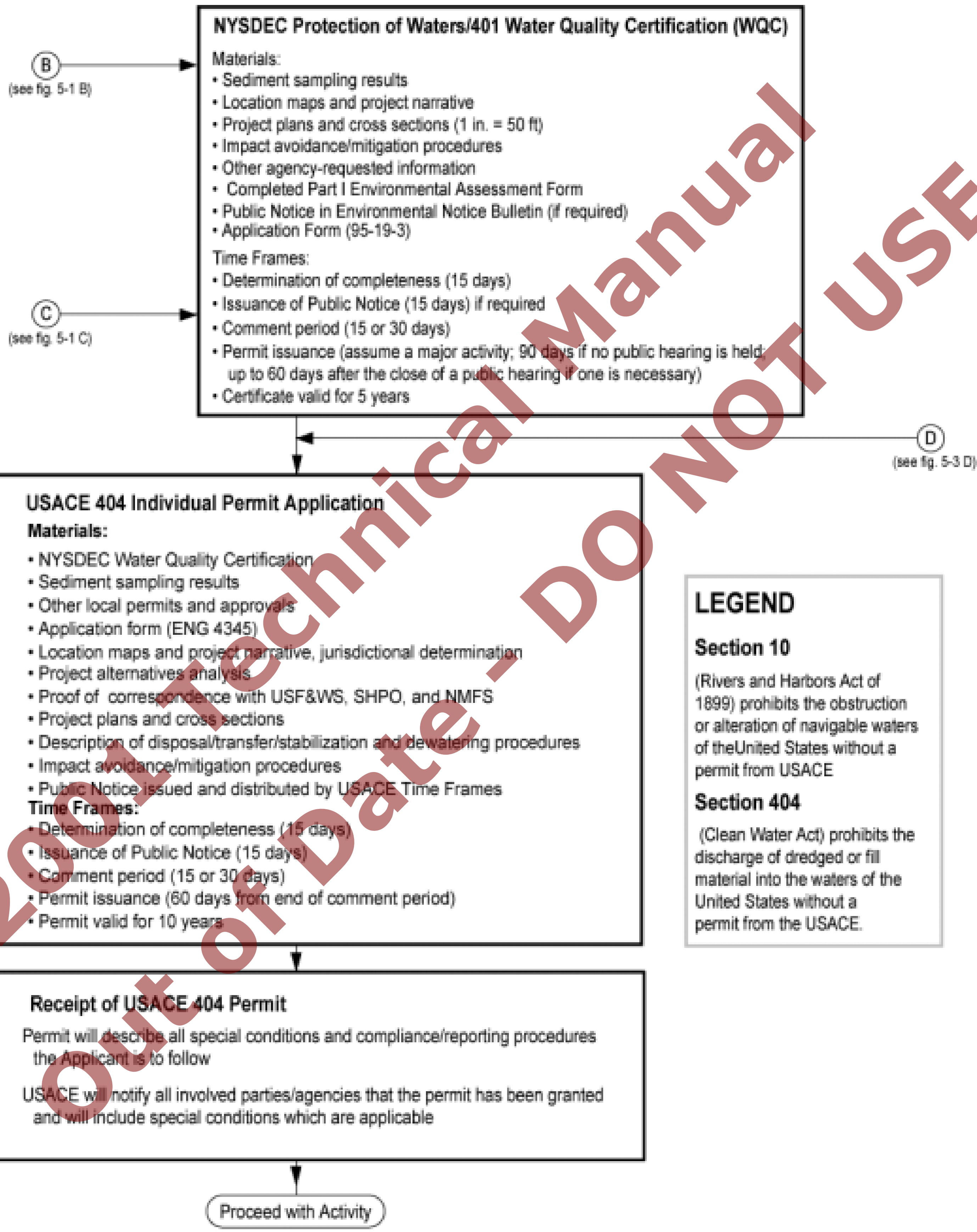
Figure 4-4
The USACE Nationwide Permit
and NYSDEC Application Process




Determine if Project Needs an Individual Permit (IND) or Nationwide Permit(s) (NWP) from USACE
If Project Requires a Nationwide Permit, See Figure 6
Determine Need for a Preapplication Meeting
For USACE
• Generally needed for projects which involve dredging with upland or ocean disposal, or significant wetland/waterfront work
• If the project is deemed major (under Uniform Procedures Act Part 621) a preapplication meeting is recommended.
For NYSDEC
• If the project is deemed minor, a preapplication meeting is generally not required.
(see fig. 5-3 A)
A
Information Needed Prior to the Preapplication Meeting (USACE)
• Conceptual construction plans
• Review of past/present permits
• Erosion control
• Dredge disposal alternative(s)
• Past sediment chemistry, (if available)
• Need for NYSDEC involvement bathymetric, and current survey studies
Information Derived From the Preapplication Meeting (NYSDEC)
• Need for NYSDEC permits/certifications
• Need for and extent of sediment, water, and/or biological sampling
• Other agency-specific concerns (conflict with recreational uses, public access, endangered/threatened species, significant habitats)
• Input from different branches (solid waste, fisheries, habitat protection) as required
NOTE: Preapplication meetings can be scheduled with both NYSDEC and USACE present; they are recommended where dredging and sediment sampling issues may be complex.
B
(see fig. 5-2 B)
U.S. Army Corps of Engineers (USACE) Preapplication Meeting
• Plan for sampling sediment (based on areal extent and volume to be dredged)
• Parameters to be analyzed for (i.e., TCLP, bioassay, PCBs, etc.) Parameters will be partially based on means of disposal and past history of the area to be dredged
• Identification of materials required for (site-specific) permit applications
Sediment Sampling for Individual (404) USACE Permit and NYSDEC Water Quality Certification for dredging projects (also needed by USACE Section 10)
• Bathymetry survey - determine area and volumes to be dredged
• Collection of sediment at agency-approved locations and depths
• Current survey to assess need for maintenance dredging
• Analyses of sediment for agency-required parameters at specified detection limits
• Quality assurance and validation of sediment analysis results
• Determination of sediment category regarding (any) contaminant levels
• Sediment analysis valid for three years (unless detection limits change)
(see fig. 5-2 C)
C

4:Figure 5-2

The USACE Individual Permit and NYSDEC Application Process



(see fig. 5-1 A) A

POTENTIALLY INVOLVED AGENCIES

New York State Department of State (NYSDOS) Coastal Zone Management (CZM) Concurrence or Concurrence With a State-approved Local Waterfront Revitalization Plan

(The City of New York Office of City Planning handles LWRP compliance within NYC)

- Site photographs
- Description of action
- Documentation of how the activity will comply with 44 identified coastal management goals
- Completed Federal Consistency Assessment Form

Requests for more information sent directly to the Applicant (usually within 30 days of receipt)

Letter of concurrence sent directly to Applicant (cc'd to USACE and NYSDEC)

U.S. Fish and Wildlife Service (USFWS)

Dredge window recommendation concurrence, i.e., lack of impact on endangered/threatened species

They require:

- Description of activity
- Time frame for dredging
- Method of dredging
- Sediment control procedures

Requests for more information sent directly to Applicant (usually within 30 days of receipt)

Letter of concurrence sent directly to USACE and NYSDEC (within 30 days of receipt)

National Marine Fisheries Service (NMFS)

Dredge window recommendation concurrence regarding lack of impact on commercially valuable species

They require:

- Description of activity
- Time frame for in-water work
- Method of construction
- Sediment control procedures

Requests for more information sent directly to Applicant (usually within 30 days of receipt)

Letter of concurrence sent directly to USACE and NYSDEC (within 30 days of receipt)

D (see fig. 5-2 D)

New York State Office of Parks, Recreation, and Historic Preservation (SHPO)

- Site photographs
- Description of action
- Completed structural and archaeological assessment form (if required)
- Information on age and past/present uses of structures

Letter of concurrence sent directly to Applicant (cc'd to USACE and NYSDEC)

Requests for more information or further study sent directly to Applicant (usually within 30 days of receipt)

Town, City, or County Agencies (for local approvals)

- Applicant is responsible for ascertaining need for and obtaining any local approvals
- Local wetland regulations may supersede state/Federal regulations

1. Nationwide Permits. Nationwide Permits (NWPs) are general permits designed to regulate certain activities that the COE has already found to have minimal environmental impacts (Figure 4). Approvals under the Nationwide Program are typically granted via a letter of concurrence within 45 days. The 43 Nationwide Permits, found at 33 CFR Part 330, are intended to apply throughout the entire country. However, the New York District of COE has developed some regionally specific conditions and the DEC has cited specific conditions, which, if not met, require that a 401 Water Quality Certification be obtained for the project. DEC has denied several of the Nationwide Permits (NWP #'s 15, 16, 17, 21, 29, and 34), and a Water Quality Certification is required whenever an Applicant proposes to invoke one of these six NWPs. The Applicant must verify that it can meet the terms and conditions of the NWP, and file notifications to the COE as necessary. Examples of activities covered under Nationwide Permits include maintenance of currently serviceable structures or fill (provided that there is no change in use of these structures); temporary recreational structures; and removal of wrecked, abandoned, or disabled vessels. As stated previously, the NWP terms and conditions have been modified by DEC and the Department of State (NYSDOS) to deny or modify conditions related to specific activities to fulfill these agencies' responsibilities under 401 Water Quality Certification (DEC) and Coastal Zone Management (NYSDOS).

2. Regional General Permits. In addition to the 43 Nationwide permits, the COE has also issued many general permits on a regional, rather than nationwide, basis to authorize minor activities without the need for individual processing.

3. Individual Permits. Actions that involve activities in the water but that are not covered by Nationwide or Regional General Permits require Individual Permits (see Figure 5). Applications for individual permits require extensive documentation, including environmental review under NEPA regulations and discussion of alternatives considered to avoid or minimize significant adverse impacts to wetlands or waters. Mitigation for significant adverse impacts is also required. A 401 Water Quality Certification from DEC is a typical component of an Individual Permit.

- *Section 10 of the Rivers and Harbors Act of 1899 (33 USC 403).* Section 10 requires a permit for construction of structures on or affecting navigable waters of the U.S. For the permit to be issued, the action must not obstruct or alter navigable waters, present a significant adverse effect on the aquatic environment, or result in violations of water quality criteria. As for Section 404 of the Clean Water Act, these activities can be authorized by Nationwide, Regional General, or Individual Permits, described above.

- *Section 401 of the Clean Water Act (33 USC 1341).* Section 401 requires a Water Quality Certificate to be issued for all discharge activities within the waters of the U.S. (including wetlands). In New York State, this certificate is issued by DEC. This certification requires evidence that the project will not cause a violation of water quality standards. This certification is required for Individual Permits issued by the COE (see above); it has already been issued for some of the Nationwide and Regional General Permits (see Figure 3).

- *Section 402 of the Clean Water Act: National Pollutant Discharge Elimination System (NPDES) Program (33 USC 1342).* Under the NPDES program, any point source discharge and stormwater discharges associated with industrial activities and municipal separate storm sewer systems require a permit. The State of New York is authorized to administer the NPDES program under its own State program (see the discussion of SPDES, below).

- *Flood Insurance Acts.* The National Flood Insurance Act of 1968 (42 USC 4001) and the Flood Disaster Protection Act of 1973 (Public Law 93-234). These acts designate coastal high hazard areas and floodways and make federal flood insurance available to buildings and structures within those areas that are constructed so as to minimize danger to human lives, in accordance with federal guidelines.

- *Essential Fish Habitat (EFH).* Portions of the New York Harbor waterways are listed by the National Marine Fisheries Service (NMFS) as essential for one or more life stages of commercially and/or recreationally important fishes. This designation can limit, typically via the permitting process, the types and timing of in-water work. Early coordination with NMFS as part of the CEQR process can identify potential constraints on work schedules (environmental windows) or the need for additional habitat protection techniques, such as silt curtains or environmentally friendly dredging techniques.

- *Endangered Species Act.* As part of the 1974 Endangered Species Act (50 CFR 17), several categories of federal protection were established by the Department of the Interior, Fish and Wildlife Service. Species can be considered endangered (in danger of extinction throughout all or a significant portion of its range) or threatened (likely to be become endangered within the foreseeable future). Plants and animals listed in the Federal Register as endangered or threatened are protected by federal law: it is illegal to pick, damage, or destroy any protected plants on property not owned by the individual, or to hunt, import, export, or possess protected animals. The Fish and Wildlife Service also lists candidates for designation as endangered or threatened species. Although listed candidates are not subject to legal protection, their status may be relevant to a CEQR assessment.

712. State Regulations

- *Freshwater Wetlands Protection Program*—Article 24 of the New York State Environmental Conservation Law (ECL); implementing regulations 6 NYCRR, Parts 662-665. To implement the State policy to preserve, protect, and conserve freshwater wetlands, and to regulate the use and development of such wetlands, DEC created the Freshwater Wetlands Protection Program, which protects freshwater wetlands of 12.4 acres or larger. Smaller wetlands can also be protected if the Commissioner of DEC has determined that they have unusual local importance. All of the protected wetlands are identified on maps prepared by the DEC.

  The Freshwater Wetlands Act provides for the regulation of activities in freshwater wetlands and adjacent areas. Adjacent areas are the areas outside the wetlands that extend 100 feet from the wetland boundary. Permits are required for most activities within the wetlands and adjacent areas.

- *Tidal Wetlands Protection Program*—ECL Article 25; 6 NYCRR Parts 660 and 661. To implement the State policy to preserve and protect tidal wetlands, DEC created the Tidal Wetlands Protection Program, which regulates all tidal wetlands identified on maps prepared by the DEC and adjacent areas. For New York City, adjacent areas generally include the area within 150 feet of the most landward boundary of the tidal wetland, with certain exceptions. Roadways (built prior to August 20, 1977), railroad lines, bulkheads, and a ten foot rise in elevation are examples of physical conditions that can limit the extent of the buffer or adjacent area (6 NYCRR Part 661.4). Permits are required for most activities within tidal wetlands and adjacent areas.

- *Classification of Waters*—Article 6 of the New York State Public Health Law; 6 NYCRR Part 800. Under this program, the State Water Pollution Control Board adopts and assigns classifications and standards on the basis of the existing or expected best usage of the State's waters.

- *Use and Protection of Waters Program*—Article 15, ECL Title 5; 6 NYCRR Part 608. The Protection of Waters Program regulates the following types of activities:

  1. Disturbance of the bed or banks of a protected stream or other watercourse (those classified as AA, A, B, or C; lower classifications are not regulated under the Protection of Waters Program).
  2. Construction and maintenance of dams or artificial obstructions in or across a natural stream or watercourse.
  3. Excavation and/or filling in navigable waters, including adjacent marshes and wetlands. This includes conducting any activity that may result in any discharge or runoff into navigable waters. Any work in the water, even if undertaken under a Nationwide Permit (see the federal regulations, above), requires a Protection of Waters permit.

- *State Pollutant Discharge Elimination System (SPDES) Program*—Water Pollution Control Act (ECL Article 17); 6 NYCRR Parts 750-757.

The SPDES Program is designed to regulate the discharge of pollutants into New York waters and to maintain the highest quality of water possible, consistent with public health and enjoyment of the resource, protection and propagation of fish and wildlife, and industrial development in the state. SPDES permits are required for construction or use of an outlet or discharge pipe (referred to as "point sources") of wastewater discharging into the surface waters or groundwaters of the State; or construction or operation of disposal systems, such as sewage treatment plants, or subsurface systems with a usage of 1,000 gallons per day or more.

- *Endangered and Threatened Species Program*—ECL Articles 9 and 11; 6 NYCRR Parts 182 and 193. Similar to the federal protections, DEC maintains a list of plant and animal species that are protected. Plants listed in 6 NYCRR Part 193 and animals listed in 6 NYCRR Part 182 or 6 NYCRR Parts 182 and 193 are protected by State law: it is illegal to pick, damage, or destroy any protected plants on property not owned by the individual, to apply any defoliant or herbicide, or to carry these plants away without the owner's consent; it is also illegal to hunt, import, export, or possess protected animals.

  Plants are divided into the following categories:

  1. Endangered—in danger of extinction within the state and requiring remedial action to prevent such extinction.
  2. Threatened—likely to become endangered in the state in the foreseeable future.
  3. Exploitably vulnerable—likely to become threatened in a significant part of their range in the state if causal factors continue unchecked.
  4. Rare—those with from 20 to 35 extant sites or 3,000 to 5,000 individuals statewide.

  Animals are divided into similar categories:

  1. Endangered—in danger of extinction within the state and requiring remedial action to prevent such extinction.
  2. Threatened—likely to become endangered in the state in the foreseeable future.
  3. Special Concern—Species for which a documented concern exists for their continued welfare in New York. These species do not receive legal protection, however.

- In addition to animal species protected by the state's endangered and threatened species program (above), other species are also fully or partially protected by law. Fully protected species may not be hunted, pursued, or harassed in any way at any time, except by special permit. Partially protected species are hunted in season, with bag limits and using specified procedures.

- *Coastal Management Program (CMP).* The CMP established 44 policies that are applicable to development and use proposals in the state's coastal area and allowed local municipalities to enact their own local waterfront revitalization programs to implement these and other applicable policies. New York City's Waterfront Revitalization Program was established under the CMP (see discussion below).

- *Coastal Erosion Hazard Areas Act*—ECL Article 34; 6 NYCRR Part 505. Under this Act, DEC established a Coastal Erosion Hazards Area, identified on maps. Activities in this area are regulated to minimize or prevent damage or destruction to structures, buildings, property, natural protective features, and other natural resources, and to protect human life. Permits are required for most activities in a designated Coastal Erosion Hazard Area.

- *Flood Hazard Areas*—ECL Article 36; 6 NYCRR Part 500. A permit is required for any development within the federally designated flood hazard areas.

- *New York Natural Heritage Program.* The Natural Heritage Program is administered by the DEC and is intended to identify all natural and artificial ecological communities and rare species that represent the full array of ecological and biotic diversity in New York State. The program focuses on the status and distribution of rare plant and animal species and valuable natural communities because they are most at risk of elimination in the State and globally. All of the habitats and species listed in the program are given a ranking indicating their rarity both globally and in the state. Although the Natural Heritage Program rankings do not provide legal protection, they can be used for assessment of an action's impacts on rare species and recommended environmental studies for the CEQR and permitting process.

- *Significant Coastal Fish and Wildlife Habitats*—Waterfront Revitalization and Coastal Resources Act (Executive Law of New York, Article 42). Under this program, DEC recommends for designation by the Department of State areas it considers significant coastal fish and wildlife habitats. These are habitats that are essential to the survival of a large portion of a particular fish and wildlife population; that support populations of protected species; that support fish and wildlife populations that have significant commercial, recreational, or educational value; and/or that are types not commonly found in the state or region.

- *Critical Environmental Areas*—6 NYCRR Part 617. 14 (g). A state or local agency may designate a specific geographic area as having exceptional or unique characteristics that make the area environmentally important. The impairment of the environmental characteristics of a critical environmental area is one of the criteria for determining the significance of an action Part 617.7 (c) (1) (iii).

713. New York City Regulations

- *Waterfront Revitalization Program (WRP).* The City's WRP also established a Coastal Zone, within which all discretionary waterfront actions must be reviewed for consistency with coastal zone policies. This program is administered by the New York City Department of City Planning. This is discussed in detail in Chapter 3K of this Manual.

- *Local Law 33 of 1988.* This law requires that all habitable space be built at an elevation at or above the 100-year flood level.

- *New York City Zoning Resolution.* The Zoning Resolution includes several districts with special zoning designed to preserve unique natural features. These include the Special Natural Area Districts (Staten Island, Queens and the Bronx), the Special Hillsides Preservation District (Staten Island), and the Special South Richmond Development District (Staten Island).

- *197-a Plans and Other Planning Initiatives.* Other plans and public policy can also include regulations to protect natural resources.

714. Public Policies

- *No Net Increase in Nitrogen.* New York, New Jersey, and Connecticut have agreed to keep the level of nitrogen discharged into the waters that affect Long Island Sound at or below 1990 levels, to avoid the negative effects that can result from excess nitrogen. This is important in areas of the Bronx and Queens that border the Sound or the Upper East River, which directly affects the Sound.

720. APPLICABLE COORDINATION

When an action is subject to any of the regulations listed above, coordination with the appropriate regulatory agency will be required.

730. LOCATION OF INFORMATION

731. Regulatory Agencies

- U.S. Army Corps of Engineers
  Department of the Army
  ATTN: Chief, Regulatory Branch
  New York District, Corps of Engineers
  26 Federal Plaza, Jacob K. Javits Building
  New York, NY 10278-0090
  Phone: 212-264-6730 or 0182

- U.S. Environmental Protection Agency—Region 2
  26 Federal Plaza, Room 837
  New York, NY 10278-0090
  Phone: 212-637-3000

- U.S. Fish and Wildlife Service
  300 Westgate Center Drive
  Hadley, MA 01035
  Phone: 413-253-8200
  National Wetlands Inventory
  Endangered Species Program

- National Park Service
  Gateway National Recreation Area
  Headquarters, Building 69, Floyd Bennett Field
  Brooklyn, NY 11234
  Phone: 718-354-4520

- National Marine Fisheries Service in New York
  50 Maple Avenue
  Patchogue, NY 11772
  Phone: 631-289-8361
  For endangered, threatened, special concern marine species.

- New York State Department of Environmental Conservation
  700 Troy-Schenectady Road
  Latham, NY 12110-2400
  Phone: 518-783-3932
  Division of Fish and Wildlife, Information Services
  New York Natural Heritage Program
  Significant Habitat Unit

- New York State Department of Environmental Conservation
  Regional Office, Region 2
  Hunters Point Plaza
  47-40 21st Street
  Long Island City, NY 11101-5407
  Phone: 718-482-4900

- New York State Department of Environmental Conservation
  Regional Office, Region 1
  SUNY Campus, Building 40
  Stony Brook, NY 11794-2356
  Phone: 631-444-0280

- Federal Emergency Management Agency
  26 Federal Plaza
  New York, NY 10278-0090
  Phone: 212-225-7229
  Floodplain maps

- New York City Department of Environmental Protection
  59-17 Junction Boulevard
  Elmhurst, Queens, NY 11373
  Phone: 718-337-4357

- New York City Department of Parks and Recreation
  The Arsenal, Central Park
  New York, NY 10021
  Phone: 212-360-8111

732. Other Sources

- New York City Department of City Planning Bookstore
  22 Reade Street
  New York, NY 10007-1216
  Phone: 212-720-3667 or 3668
  Citywide planning and zoning information and maps

- U.S. Department of Agriculture
  Soil Conservation Service
  P.O. Box 2890
  Washington, D.C. 20013
  Phone: 202-720-7327
  Information on soil types

- Hudson River Foundation for Environmental Research
  40 West 20th Street
  New York, NY 10011
  Phone: 212-924-8290

- Society for Ecological Restoration
  1955 West Grant Road #150
  Tucson, Arizona 85745

- Lady Bird Johnson Wildflower Center
  4801 La Crosse Avenue
  Austin, Texas 78739-1702
  (512) 292-4200

- Queens College Library
  65-30 Kissena Boulevard
  Flushing, NY 11367
  Phone: 718-997-3700

- Rutgers University
  Department of Ecology, Evolution and Natural Resources
  14 College Farm Road
  Rutgers, The State University of New Jersey
  (732) 932-9631

- Hagstrom Map Co., Inc.
  46-35 54th Road
  Maspeth, NY 11378
  Phone: 718-784-0055
  U.S.G.S. topographical maps, nautical charts

800. References

Gysel, L.W. and L.J. Lyon. 1980. Habitat analysis and evaluation. Pages 305-327 *in* Schemnitz, S.D., ed. Willdife Management Techniques Manual. The Wildlife Soc. Washington, D.C.

Hecht, J. 2001. Personal Communication. June 13, 2001.

Seber, G.A.F. 1973. Estimation of Animal Abundance and Related Parameters. Griffin, London. 506 pp.

Shannon, C.E. and W. Weaver. 1949. The Mathematical Theory of Communication. The University of Illinois Press, Urbana, IL.

Smith, M.H., R.H. Gardner, J.B. Gentry, D.W. Kaufman, and M.J. O'Farrell. 1975. Density estimation of small animal populations. Pages 25-53 *in* Golley, F.B., K. Petrusewicz, and L. Ruszkowski, eds. Small Mammals: Their Production and Populaiton Dynamics. Int. Biol. Prog. 5, Cambridge Univ. Press, London.

U. S. Fish and Wildlife. 1997. Significant Habitats and Habitat Complexes of the New York Bight Watershed. Coastal Ecosystems Program. Charlestown, RI.

Water Environment Research Federation (WERF). 2001. Assessment of Availability and Use of Water Quality Models. Project No.: WERF0010. February, 2001.

Weiner, N. (1948). Cybernetics, or Control and Communication in the Animal and the Machine. The M.I.T. Press, Cambridge, MA.