NEW JERSEY WETLANDS ORDER

BASIS AND BACKGROUND

New Jersey Department of Environmental Protection
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BASIS AND BACKGROUND OF NEW JERSEY WETLANDS ORDER

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(Reference: Wetlands Act of 1970 (N.J.S.A. 13:9A-1 et seq.)

1.0 WETLANDS MAPS

1.1. WETLANDS photomaps, bearing a certificate of the Commissioner, Department of Environmental Protection, have been prepared, and are on file pursuant to "The Wetlands Act of 1970" in the offices of those county recording officers where WETLANDS are located.

1.1.1 The ORDER accompanying this BASIS does not apply to those lands upland of the wetland boundary shown on filed photomaps.

1.1.2 Lands shown on filed photomaps below (seaward of) the wetlands boundary are WETLANDS, and the ORDER promulgated by the Commissioner shall be applicable to these lands.

1.1.3 If no wetland boundary is shown on filed photomaps, all lands on the map or maps are WETLAND, and the ORDER promulgated by the Commissioner shall be applicable to such lands.

1.1.4 "The Wetlands Act of 1970" requires that all WETLANDS be inventoried. The inventory appears on all photomaps filed pursuant to the Act.

1.2 Those portions of each filed photomap designated as WETLANDS (below the boundary or the entire map where a boundary is non-existent) meet national map accuracy standards. At this scale, these standards require that 90% of well-defined map features be positioned on maps within 1/30 inch (6.67') of their correct location with respect to basic ground control. Basic ground control refers to previously established government agency surveys. Where control was non-existent, insufficient, or not recoverable, new surveys were performed by a registered surveyor to insure photomap accuracy. Traverses run through panelled ground control points closed within one (1) part in 52,000; this accuracy exceeds "SECOND ORDER" survey requirements.

1.2.1 Within the WETLANDS, major species associations are delineated (inventoried) by 0.013 inch wide lines. At photomap scale (1:2400 or 1"= 200'), these line widths represent 2.5 feet (approximately) on the ground. These "inventory lines" encompass those natural groups (species associations) of plant species occurring as mappable units; also, they have unique tones on aerial-type photographic film. Inventory lines may conform to national map accuracy standards, but the Department does not claim that degree of accuracy for the horizontal placement of lines bounding naturally occurring species groups. These groups, taken together, constitute the WETLANDS INVENTORY.

1.2.1.1 Inspection of filed photomaps shows that WETLANDS inventory lines do abut WETLANDS boundary lines. In these cases, boundary lines are used to close inventory lines.

1.2.1.2 Inventory alphabetical and numerical descriptors are keyed to filed photomap Legends. Alphabetical designators are assigned to plant species occurring in salt water WETLANDS; numerical designators apply to fresh water species. Combinations of alphabetical and numerical designators are indicative of brackish water WETLANDS. Photomap Legend designator order, whether alphabetical or numerical, has no significance. The Department emphasizes that no relationship exists between the alphabetical or numerical order of designators and the nutrient (biological) value of plant species, the value of any given property, or any Department interest in a particular property or area.

1.2.1.3 Filed photomap inventory lines bound naturally occurring species groups whose area either equals or exceeds five (5) acres. Inventories of this size or larger will be useful to those responsible for the preparation of gross marsh productivity estimates; precise marsh productivity data (research) can be generated by intensive, localized field investigation.

If single or multiple species, bounded by an inventory line, in a saline WETLAND are described on filed photomaps by either alphabetical or numerical designators, those species will be present on at least twenty-five (25) percent of the acreage circumscribed by the inventory line. Species of possible minor ecological significance may be present. Such species are not mapped, because they may change rapidly from season to season and may even change in abundance within growing seasons.

In some fresh water WETLANDS, species lines do not fall along any distinct vegetative line. The lines drawn encompass distinct portions of the WETLAND and enclose sparsely-vegetated areas interspersed with considerable open water.

1.2.1.4 In many areas, filed photomap inventory lines bound a species or species group of less than five (5) acres. The Department does not adhere to the normal five (5) acre guideline in these instances for two reasons:

(1) Ecological [*Zizania aquatica* (Wildrice) areas of less than five (5) acres may be inventoried because of their food value to wildlife.]

(2) Practical (Department field personnel must inspect complex biological areas; easily located reference points aid investigators and contribute to increased efficiency.)

1.2.2 The WETLANDS boundary, above which the promulgated ORDER does not apply and below which the promulgated ORDER does apply, is shown on all applicable filed photomaps by a continuous 0.025 inch wide line. At photomap scale (1:2400), this line width is equivalent to 5.0 feet measured on the ground. This boundary may conform to national map accuracy standards, but the Department does not claim that degree of accuracy (6.67') for its horizontal placement. The horizontal position accuracy of the boundary line does not exceed plus or minus (±) ten (10) feet of the true line position as measured on the ground.

1.2.2.1 The true line position in areas where local relief changes abruptly (from 1.5 to 9.0 feet) is placed at the break in slope. Uplands are dry as compared to WETLANDS. Plant species occurring at this boundary may include: *Spartina patens* (Saltmeadow cordgrass), *Iva frutescens* (Marsh elder), *Panicum virgatum* (Switchgrass), species of *Typha* (Cattail), *Phragmites* (Phragmites or Common reed), and *Baccharis halimifolia* (Groundsel tree); most of these species are tabulated in "The Wetlands Act of 1970." Common dryland species just upland of this boundary may include: Arrowood, Cedar, Pine, and various hardwoods including Oak, Tulip, Poplar, Hickory, Red Maple, Black Gum, and Sweet Gum; none of these species are listed in "The Wetlands Act of 1970."

1.2.2.2 The true line position, in locations where the transition from WETLAND to upland (dry land) is gradual, is placed at intermixed WETLAND plant species and upland (dry land) species junctions. Mixtures of *Juncus gerardi* (Blackgrass), Saltmeadow cordgrass, Marsh elder, Groundsel tree, and Switchgrass border typical upland mixtures of Cedar and hardwoods. In other cases, mixtures of Saltmeadow cordgrass, *Scirpus* (Bulrush), and Cattail species abut upland mixtures of Red Maple, Willow, Alder and hardwoods.

Most of the WETLAND species named are tabulated in "The Wetlands Act of 1970"; none of the upland species named are listed in the Act.

1.2.2.3 The true line position in existing man-disturbed areas (including but not limited to roads, dikes, spoil piles, and occupied or non-occupied bare areas) is drawn to exclude most of these areas from the WETLAND area and thus exclude them from regulation. The Department knowingly has adopted this conservative position. Disturbed WETLANDS are not easily repaired or replaced; their value in the food chain is greatly reduced since most disturbed WETLANDS no longer support, as they once did, the kinds of vegetation listed in "The Wetlands Act of 1970." This does not, however, impair their value as open space or storm and sea buffer areas.

1.2.2.4 The true line position is modified where natural bare ground (salt pans, etc.) or man-deposited spoil crosses an otherwise established portion of the WETLANDS boundary. Line modifications on filed photomaps are made seaward (at the WETLAND edge) of such bare ground or spoil areas.

1.3 Filed photomaps have a 1:2400 (1" = 200'). Each 3.0' by 3.5' photomap (stable plastic to minimize the effects of changes in temperature and humidity) encompasses 6000 feet in the east-west direction and 7000 feet in the north-south direction; the equivalent area is 964.2 acres (1.5065 square miles). Each 1000 foot square corresponds to 22.96 acres on the ground.

1.4 Filed photomaps show the New Jersey State Plane Coordinate, Universal Transverse Mercator, and the Latitude-Longitude grid systems. The New Jersey Grid is basic; computations were made to determine the exact relationship of the other systems to this grid.

1.5 The filed photomap indexing system is based on the New Jersey Grid. Grid values in the lower left (southwest) corner – north 280,000 and east 1,776,000 – are noted. Direction and the last three digits of each number are dropped to obtain the photomap index number (280-1776).

1.6 Each filed photomap has primary and secondary names. Secondary names are derived from Geological Survey (U.S.G.S.) 7.5 minute quadrangle sheets; primary names are selected from map-center water bodies, near-center permanent geographic features, or adjoining photomap water bodies or permanent geographic features. The latter kind of photomap titles contain appropriate north, south, east, or west designators.

2.0 THE ESTUARINE ZONE – GENERAL

2.1 New Jersey's estuarine zone, the area between the sea and the land, is unique; it is related to the sea and the land, but it is different from either. The "estuarine zone" is composed of bays, harbors, lagoons, channels, inlets, barrier beaches, sounds, estuaries, WETLANDS (tidal marsh), submerged lands (riparian), tidal portions of many fresh water streams and tributaries, and coastal and inter-tidal areas. Complex physical, chemical, and biological forces act and interact within this zone and create an exceptional but delicately balanced environment.

2.2 Estuaries, those semi-enclosed areas in which the land meets the sea and in which fresh water and salt water mix, are fertile and productive. In New Jersey, WETLANDS adjacent to estuaries yield up to five (5) to six (6) tons of dry organic matter per acre per year. In comparison, the world average wheat production is only 0.5 tons per acre. The sustained high fertility of WETLANDS depends on many natural factors:

(1) The mixing of the waters of different salinities produces efficient vertical mixing that results in nutrient traps. Consequently, valuable nutrients are not swept out to sea but move within the WETLANDS and cycle rapidly between organisms, water, and bottom sediments. (Residence time for phosphorus varies from 0.05 to 200 hours in marsh fauna and flora.)

(2) Tidal flow is essential to continually supply food, chemical nutrients, and oxygen. Waste products may be removed automatically, and clams, oysters, and other sessile organisms need not waste energy coping with purification processes.

(3) In some areas, land drainage from surrounding farmland is rich in minerals and organic material; additional nutrients are added to coastal WETLANDS through runoff from rivers and streams.

2.3 Plant life occurs in all WETLANDS as marsh grasses and algae. These plants grow and die. Decay transforms their tissues into minute fragments of food and vitamin-rich detritus. This detritus is suspended in the water and forms a nutritious "soup" that is carried into tidal creeks, bays, and offshore waters. Nearly all species of sport and commercial fish, shellfish, and other marine creatures in the estuarine zone are dependent on this "soup" for food, directly or indirectly.

2.4 Marsh detritus is transported back and forth by tidal action into sounds and bays and, eventually, to nearshore waters. This "outwelling" of nutrients and materials into the sea is similar in mechanism and magnitude to oceanic upwellings that support valuable fisheries in various parts of the world. Outwelling provides nutritional materials that may support marine life at long distances from our coast. Thus, there is a continuum from the WETLANDS to the open seas. Some fish that never enter or utilize WETLANDS are dependent on the estuarine zone for the continuous enrichment of their oceanic habitat.

2.5 Many aquatic animals feed on WETLAND plants, detritus washed from WETLANDS, and the algae that float in the water and coat marsh and channel surfaces. Other animals, including man, prey on animals that have eaten these plant foods; all, directly or indirectly, derive their energy from WETLAND (estuarine zone) flora.

Estuarine fauna include microscopic animal life, shellfish, crustaceans, fin fish, birds, and mammals. Many of these are permanent residents of WETLANDS and tidal streams; other fauna from the sea spend part of their lives in estuarine zone waters. Oysters, clams, and crabs are among the best known residents of WETLANDS streams and estuarine zone bays.

Menhaden, Fluke (Summer Flounder), and Weakfish are among the commercially important fin fish that live in these waters as young Diadromous fish. On the other hand, Anadromous fish such as Shad and Eels may remain in estuarine areas for considerable periods of time during their migration from the sea to fresh water streams. Finally, many kinds of commercial and sport fishes are directly dependent on estuarine zone waters for their number and well-being.

2.6 WETLANDS vegetation responds sharply to interactions of salinity (soil and water), moisture, elevation, and tides. Elevation plays a major role in determining WETLAND plant community composition, because elevation determines the extent to which each community will be inundated by high tides. New Jersey's WETLANDS vary in plant species composition, and that variation depends, primarily, on the amount of salt in tidal waters. Based on observed species composition variations, the WETLANDS of New Jersey may be classified, broadly, as follows:

(A) SALINE WETLANDS, found along the ocean shores of New Jersey, are characterized by very low species diversity. Many zones contain only a single species and occur over large areas.

The most abundant plant species occurring within the reach of daily tidal flow is *Spartina alterniflora* (Saltmarsh cordgrass or Smooth cordgrass). It grows virtually without competition in this region and is an excellent indicator of the extent to which a given marsh is inundated by the sea. Above the level of daily tides, one may find isolated, low vigor, stands of Saltmarsh cordgrass, but the dominant species is Saltmeadow cordgrass. *Distichlis spicata* (Saltgrass or Seashore saltgrass) may be a constituent of some high marsh communities, but Saltmeadow cordgrass is known to grow almost exclusively above areas where frequent (daily) tidal inundation occurs.

(B) BRACKISH WATER WETLANDS are quite similar to saline marshes; however, they do contain some plant species characteristic of fresh water marshes. These WETLANDS are common along estuaries and tributaries where incoming tidal waters are still saline. Saltmarsh cordgrass is common in areas with tidal inundation, and Saltmeadow cordgrass is common in marshes above the high water line.

(B1) Some BRACKISH WATER WETLANDS contain lower amounts of salt in their soils when compared to TYPE B WETLANDS. In these marshes, plant species composition changes and becomes more diverse. Salinity is often too low to support Saltmarsh cordgrass and Saltmeadow cordgrass. *Spartina cynosuroides* (Big cordgrass) as well as species of Bulrush and Cattail are common. Two species are indicative of tide lines in these WETLANDS – Big cordgrass grows in high marsh; Cattail is found in lower marsh. Cattail is a good low marsh indicator when combined with field observation.

(C) In FRESH WATER WETLANDS, species diversity increases. Cattail, *Peltandra virginica* (Arrow-arum), *Pontederia cordata* (Pickerel-weed), *Nuphar* sp. (Yellow waterlily), and Wildrice are common. These species may grow below high water lines or wherever soil is water-saturated. Phragmites is common within these WETLANDS.

3.0 WETLANDS — A PHYSICAL BARRIER

3.1 The sea can be either friendly or hostile. It may, on any one day, be calm and beautiful or terrifying and destructive. High waters, winds, and waves can damage or destroy property in WETLAND or upland and can, with time, cause substantial mainland erosion.

3.2 The force (energy) of the sea is often underestimated; a four-foot high ten-second wave contains 33 foot-tons of energy, and an eight-foot wave of the same period generates 131 foot-tons of energy. Waves transmit a portion of their energy to any fixed barrier (homes or other structures) placed so as to arrest wave motion. If barriers are weak, structures will be either severely damaged or completely destroyed.

3.3 WETLANDS, physically, act as a buffer between the sea and land; they help protect man. They absorb a portion of wind and storm wave energies, and they provide large storage areas for flood and storm waters. These functions, in turn, reduce mainland erosion rates and lessen social and economic hardships caused by upland flooding and high winds.

3.4 WETLANDS are dynamic and everchanging. Storms and winds may rip their turf and, for a time, alter natural drainage and contour; but the marsh is resilient – it survives and adjusts to new combinations of physical forces.

3.5 Filling WETLANDS may reduce their capacity to store storm or flood waters. Non-storable storm waters could infringe on neighboring marshes or uplands and cause extensive damage which otherwise may not have occurred.

3.6 Developments in WETLANDS are particularly vulnerable to wave and water damage because of their proximity to the sea. Ocean County storm record observations taken in the general vicinity of Mystic Islands, west of Tuckerton, show that Mystic Islands is subject to periodic flooding (Mystic Islands is between 2.1 and 2.5 feet above mean sea level*):

DATE	YEAR	WATER HEIGHTS ABOVE MEAN SEA LEVEL (FT.)
1/26	1932	8.1
9/16	1935	7.3
11/17	1935	8.5
9/30	1943	7.2
10/20	1943	7.7
9/14	1944	11.6 (hurricane)
11/25	1952	9.95
11/7	1953	8.1
1/23	1966	7.0 (At Radio Road Bridge)

*Excerpted from a topographic survey submitted by the Mystic Islands Surveyor.

3.7 In March, 1962, "Tuckerton Beach and Mystic Islands, located to the west of Beach Haven, were flooded by high tides in Great Bay, and sustained major damages. These communities are relatively new developments, and are comprised almost exclusively of vacation homes. A total of 617 homes in Tuckerton Beach and 154 in Mystic Islands suffered flood damage."

3.8 The material in quotes was copied verbatim from page 4-10 Post Flood Report (Corps of Engineers) – March 1962 Storm. These data and the Ocean County information prove that WETLANDS flooding and major damage to WETLAND-located structures actually occur.

3.9 Those who live in structures built on WETLANDS are gambling; major floods will continue to occur, and subsequent property damage costs will be proportional to the severity of the flooding. (No one can guarantee a tranquil and non-hazardous WETLAND environment.)

3.10 The WETLAND ORDER is, in part, designed to protect the public safety and preserve and enhance public welfare. With WETLANDS flooding data a matter of the public record, it would be indefensible for the Department of Environmental Protection to make public a less stringent ORDER.

4.0 WETLANDS AND WATERFOWL

4.1 The WETLANDS constitute an ecosystem. Each plant species or species association is not individualistic or self-sustaining; species interact and are interdependent. This holds true also for the animal life (snails, amphipods, worms, and insects) of the marshes which depend on the plant life. The larger and more evident animals at the top of the intricate food chain are dependent upon the productivity of the WETLANDS for their survival. Man can easily destroy the delicate balance of the WETLANDS, triggering changes which infringe upon and decimate waterfowl populations.

4.2 The WETLANDS support wintering, migratory, and summer breeding waterfowl. Brant winter in its brackish bays and adjacent areas; Ducks and Geese migrating along the Atlantic Flyway feed in the WETLANDS. The Mallard and the Black Duck breed in the WETLANDS and even remain in small numbers through the winter. Waterfowl productivity could be seriously depleted if the WETLANDS and their vegetative cover were destroyed or seriously encroached upon by man. During heavy wintertime freezes, certain food organisms of the WETLANDS are inaccessible to fowl, and the birds must forage for food wherever it can be found. Encroachment lessens their chance for survival.

5.0 WETLANDS — OTHER BIRDS

5.1 Productive WETLANDS not only maintain waterfowl but also support a variety of bird life which winters, migrates, and breeds here. Passerine birds such as Marsh Wrens, Seaside and Sharp-tailed Sparrows, and Red-winged Blackbirds breed in the marsh. The Tree Swallow, in late August, eats marsh insects and by feeding performs a valuable function to man.

5.2 Shorebirds are represented by Skimmers, Rails, and Oystercatchers. The Dunlin spends the winter in the WETLANDS, while most Clapper Rails arrive here in late April, having wintered in the marshes from South Carolina to northern Florida.

5.3 The most common summer Gull of the WETLANDS is the Laughing Gull, while the most common of the winter is the Herring Gull. The Common Tern, Least Tern, and occasionally the Gull-billed Tern breed on the exposed sand flats. The Forster's Tern is present in the salt marsh in small numbers.

5.4 Wading birds such as Herons, Egrets, and Glossy Ibis breed in colonies in the marshes and on its edges. Along with Coots, Bitterns, and Gallinules, these birds depend entirely upon the WETLANDS for their food.

6.0 WETLANDS AND PESTICIDES

6.1 Pesticides are used in WETLANDS to control mosquito populations. Pesticides have been misused: Department studies show that persistent pesticides and their metabolites — DDT, DDE, and DDD — are present in WETLANDS vegetation. Through biological magnification, these pesticides have become concentrated in fish, fur-bearing animals, waterfowl, crabs and birds.

6.2 Persistent pesticide use can result in long-term detrimental environmental effects. Evidence exists to indicate that certain pesticides have caused immediate and long-term fish and wildlife mortality.

6.3 The ORDER prohibits the use of persistent pesticides in WETLANDS and all pesticides where there are significant stands of high vigor Saltmarsh cordgrass, *Scirpus americanus* (Common threesquare) or *Scirpus Olneyi* (Olney threesquare), Wildrice, and Cattail. These areas are flooded twice daily by the tides. Flooding prevents mosquito production and makes such regions of high value to fish, shellfish, and wildlife.

6.4 The Department takes the position that pesticides should be applied in WETLANDS only when absolutely necessary. If non-persistent pesticides are applied to the marsh, the following guidelines may be used to minimize unwanted and unwarranted environmental impact and maximize control effectiveness at lower public cost:

6.4.1 Determine the proper pesticide to be used.

6.4.2 Determine the correct dosage rate and adhere to it.

6.4.3 Establish the criteria for and locate all heavy breeding centers.

6.4.4 Apply the proper pesticide at the right dosage only to the heavy breeding areas at the right time.

7.0 WETLANDS — THEIR PRODUCTIVITY AND BENEFIT TO MAN

7.1 Department of Interior statistics for 1967 indicate that New Jersey's commercial coastal fisheries landed 117 million pounds of seafood having a dockside value of $10 million. About 3,000 fishermen were employed either full or part time on boats and on the shore. Approximately 2,000 other persons were employed full-time in seafood wholesaling and in processing plants. The value of processed products has been estimated to be near $30 million.

About two-thirds of the commercial fish catch on the Atlantic Coast is believed to be WETLANDS (estuarine)-dependent (McHugh 1966). Department of Environmental Protection studies in the Great Bay-Mullica River estuary tend to confirm that many finfish species, at some stage in their life cycle, utilize estuarine waters. At Cape Horn, Great Bay, thirty-one species of fish were taken over a year's time; the Bay Anchovy was most abundant, Silversides were second, and other seined species included the Silver Perch, Northern Pipefish, Northern Puffer, Winter Flounder, Red Hake, and Black Sea Bass. The fisheries yield from the U.S. Atlantic Continental Shelf has been estimated to be equivalent to about 535 pounds per acre of estuary (Stroud). Loss of estuarine habitat could cause substantial losses of fisheries products to those dependent on high sustained yields for their economic well-being.

7.2 Reliable sports fishing statistics for the New Jersey Coast are not available. Recent estimates, however, indicate that nearly one million sportsmen fish in coastal waters each year and catch at least 10 million pounds of fish. Creel census results in the Great Bay-Mullica River estuary show that nearly one million fish are taken each year by sports fishermen. The contribution to the State's economy by these sportsmen is substantial even though quantitative data are unavailable. Boat and motor sales, charters, rentals, licenses, fishing equipment, bait, travel, motel, marina costs, and food expenditures for these services and supplies are all related to the attractiveness of the tidal WETLANDS and bays.

7.3 In addition to commercial and sports fishing, estuaries (WETLANDS) are used for other multi-purpose activities. Studies conducted by the Department of Environmental Protection indicate that about 129,000 man-days of use was made of the Great Bay-Mullica River estuarine zone in one year. Those uses included fishing, boating, shell fishing, bathing, hunting, water skiing, and the harder-to-document kinds of activities such as sightseeing and scientific research. All of these uses are important to man — they contribute to the enhancement of the quality of life as well as to his economic and social well-being.

8.0 ORDER — RATIONALE

8.1 The concept of balance is central to the ORDER. The ORDER recognizes that destruction eliminates choice. Therefore, it is designed to take into account effects of any project on the WETLANDS' environment before a project is allowed to proceed. The balance sought to be injected is not a balance between developed and underdeveloped pieces of WETLAND, for nowhere do the criteria exist to strike an accurate balance in this way. The balance of this ORDER is a mental or internalized balance in which the adverse effects of development are weighed before the fact, rather than after.

9.0 CONCLUSIONS

9.1 WETLANDS are ecosystems and are integral to larger estuarine zone ecosystems. WETLANDS support plant species and species communities which are in dynamic but delicate balance. The biophysical environment determines that balance. This complex environment is subject to and is shaped by those natural, physical, chemical, and geological principles governing the tides, ocean currents, coastline slope, climate, river flows, and sedimentation patterns. The object of the proposed order is to control man's impact on this complex environment and on the WETLANDS themselves so that these vital lands can continue to serve man and nature.

9.2 Principal sections of this BASIS have shown that WETLANDS have multiple beneficial uses: They act as a buffer against flood, wind, and wave damage; they serve as a waterfowl, bird, and wildlife habitat; and, they accumulate, store and provide essential nutrients which make the estuary a rich and very productive area. (Estuaries provide the food serving as the base of the food chain for the larval stages of many marine forms during this critical part of their life cycles.)

9.3 A great deal of other significant information about WETLANDS is known. The processes described below may be critical to the long-term well-being and safety of man:

9.3.1 WETLANDS play a most significant geological role as sediment accretors (Niering). Geologists have indicated that sediments which do not form marsh complexes go instead into channels, harbors, or tidal creeks and accentuate silting problems (Sanders and Ellis). Marsh build-up processes occur over 4000 year spans (Redfield); man destroys WETLANDS in one day.

9.3.2 WETLANDS play an important role in the cycling of nitrogen in natural ecosystems (Delwiche). Nitrogen oxides may accumulate in our waters, and nitrate concentrations above 45 milligrams per liter renders those waters unfit for human consumption (U.S.P.H.S.). Such waters, when drunk, can cause methemoglobinemia which usually results in brain damage. WETLANDS are an essential ecosystem; they denitrify toxic nitrogen-oxygen compounds and can act as efficient guardians of the public health (Nickerson).

9.3.3 WETLANDS improve water quality by reoxygenating the water and absorbing nitrates and phosphates (McCormick and Patrick); also, marsh vegetation reduces organic load. Tinicum marsh vegetation studies indicated a daily reduction of approximately 7.7 tons of BOD, 4.9 tons of $P\text{-}PO_4$, and 4.3 tons $N\text{-}NH_3$ (McCormick). WETLANDS help prevent serious public health problems.

9.4 The WETLANDS ecosystem is delicately balanced. Seemingly minor physical alterations could stress this delicately balanced system and cause severe damage to the kinds and abundance of plant and animal species inhabiting the WETLANDS. In addition, significant alteration could affect ultimately the health, welfare, and safety of man. All of the facts are not yet known. The Department's WETLANDS ORDER has been, therefore, conservatively drawn. The ORDER is based on known scientific fact and sound ecological practice. It leaves an adequate margin of safety for protection from miscalculation and extreme natural variation. It takes into account known beneficial and detrimental effects, and it allows for multiple WETLANDS use.