CHEESEQUAKE NATURAL AREA
MANAGEMENT PLAN

PREPARED BY:
DIVISION OF PARKS AND FORESTRY
OFFICE OF NATURAL LANDS MANAGEMENT
CN 404
TRENTON, NJ 08625

MAY, 1985

THOMAS H. KEAN
GOVERNOR

ROBERT E. HUGHEY
COMMISSIONER

copy to BF
file only

State of New Jersey
DEPARTMENT OF ENVIRONMENTAL PROTECTION

DIVISION OF PARKS AND FORESTRY
OFFICE OF THE DIRECTOR

PLEASE ADDRESS REPLY TO:
CN 404
TRENTON, N.J. 08625

DIVISION ORDER NO. 28

In accordance with N.J.A.C. 7:2-11.5(a), I hereby adopt as amendments to the Cheesequake Natural Area Management Plan the attached recommendation of the Natural Areas Council.

This amendment shall supplement the current management practices mandated by the Plan and become effective immediately.

12/20/85
DATE

Gregory A. Marshall
Acting Director

At its meeting on November 22, 1985, the Natural Areas Council reviewed a memo from William Vibbert, Superintendent of Cheesequake Park, and a conceptual plan for a change to the adopted management plan for Cheesequake Mr. Vibbert has been directed by the Soil Conservation District to stabilize an erosion problem along a dredge spoil site in the natural area. Diking and draining would solve the erosion problem but the area would revert to Phragmites sp. within several years, presenting reduced environmental value and a fire hazard. Mr. Vibbert has suggested a culvert pipe spillway to create a small pond on the southern portion of the site which would create a transition area at the forest/marsh border and would solve the erosion problem. This pond and transition area would improve the environmental value of the site, particularly for black and wood ducks.

On a motion by Mr. Krauth, seconded by Mr. Moore, the Council recommended revision to the adopted plan to allow the stabilization as proposed.

C. Amount of money in the program:

The Department anticipates that $110,000 will be available for funding Open Lands Management projects in Fiscal Year (FY) 1990, which ends on June 30, 1990.

D. Individuals or organizations who may apply for funding under this program:

Any person, including but not necessarily limited to individuals, corporations, clubs, associations and non-profit organizations, who owns real property in fee simple, may apply for financial assistance under this program.

E. Qualifications needed by an applicant to be considered for the program:

To be eligible for financial assistance under this program, the applicant must meet the following criteria:

1. The applicant must have a fee simple interest in real property; the property must include open space which is not dominated by man-made structures; and the property must be free of any known public health hazards.

2. The applicant must specify a project to be funded. Eligible projects include: installing fences, providing parking areas, installing and building boat or canoe launch areas, planting trees and shrubs for screening, installing litter and trash cans, and constructing and maintaining trails. Liability insurance, legal filing fees and costs of repairing damage due to vandalism may also be considered.

3. The applicant must make the eligible real property available to the public for passive recreational activities. Such activities may include: trail use, water related activities, and other outdoor recreational use.

F. Procedure for potential applicants:

Grants awarded under the Open Lands Management Program are governed by the Open Lands Management rules at N.J.A.C. 7:2-12.

Applications for Open Lands Management grants may be requested from:

Celeste Tracy or Larry Miller
Open Lands Management Program
Office of Natural Lands Management
Division of Parks and Forestry
New Jersey Department of Environmental Protection
CN 404
Trenton, New Jersey 08625-0404
(609) 984-1339

G. Deadline by which applications must be submitted:

Applications for funding during FY 1990 must be submitted by March 15, 1990.

H. Date by which applicant shall be notified or preliminary approval or disapproval:

Within 30 days of receipt, the Department shall evaluate applications for funding under this program and either disapprove or grant preliminary approval of the application.

(a)

DIVISION OF PARKS AND FORESTRY

Natural Areas System
Management Plan for Cheesequake Natural Area

Authority: N.J.S.A. 13:1B-3; 13:1B-15.4 et seq.; 13:1B-15.12a et seq.; and 13:1D-9.

Take notice that in accordance with N.J.A.C. 7:2-11.8 and the recommendation of the Natural Areas Council (Council), Christopher J. Daggett, Commissioner, Department of Environmental Protection, has adopted amendments to the management plan for Cheesequake Natural Area.

The Cheesequake Natural Area, located within Cheesequake State Park in Old Bridge Township, Middlesex County, is a State-owned parcel administered as part of the Natural Areas System by the Department's Division of Parks and Forestry (Division) through Cheesequake State Park. On May 29, 1985, the Department adopted a management plan for the Cheesequake Natural Area. The amendments to this management plan concern access to the existing Nature Center within the Natural Area from a parking area proposed for construction outside the Natural Area.

The management plan for the Cheesequake Natural Area is hereby amended to allow the Division of Parks and Forestry to create access from the proposed parking area to the existing Nature Center in accordance with the "Nature Center Trail Location Plan" prepared by the Office of Capital Planning and Development. Creation of such access is subject to the following conditions:

1. The Division will rehabilitate the existing Fern Trail.
2. The Division will create a new trail, on grade, connecting the Fern Trail to the Nature Center following contours and in a meandering path.
3. The Division will install appropriate signage to indicate that vehicle access from the new parking area to the Nature Center is limited to vehicles serving handicapped individuals.
4. The Division will pave handicapped parking spaces in the new parking area and either pave a path or install a boardwalk from those spaces to the existing Nature Center ramp.
5. The Division will avoid cutting large diameter trees and dead standing trees during the access project.
6. Division staff will perform the final flagging of the connecting trail and clearing for the access project. Any changes in the trail plan will be reviewed by Division staff.
7. The Department will make a determination of whether the access project requires a wetlands permit for stream crossing. If a wetlands permit is required, the Division will obtain the permit before proceeding with the access project.
8. The Division will post boundary signs along the Natural Area border of the Fern Trail.
9. The Division will close and attempt to revegetate the existing Red Trail which runs between the Nature Center and the Fern Trail.
10. The Division will avoid destroying a population of ground pine which was identified by Council staff during an inspection of the project site.

This notice is published as a matter of public information.

(b)

DIVISION OF WATER RESOURCES

Notice of Receipt of Petition for Rulemaking Areawide Water Quality Management Plans and Associated Permits

Petitioner: Carole Balmer

Take notice that on August 9, 1989, the Department of Environmental Protection (Department) received a petition for rulemaking concerning Areawide Water Quality Management Plans and associated permits. Petitioner requests that the Department amend and repeal the process for review for proposed amendments to Areawide Water Quality Management Plans and associated permits including, but not limited to, stream encroachment permits, (N.J.A.C. 7:13), Freshwater Wetlands (N.J.A.C. 7:7A), Safe Drinking Water Act regulations (N.J.A.C. 7:10), New Jersey Pollutant Discharge Elimination System, (N.J.A.C. 7:14A) and Statewide Water Quality Management Planning (N.J.A.C. 7:15) to include a synopsis of long term anticipated secondary impacts resulting from the approval of granted permits and approvals. The petitioner contends that under the Federal Clean Water Act, 33 U.S.C. §1251, the Department is not in minimal compliance if the aforementioned issues are not addressed and resolved.

The Department will contact the petitioner and request clarification of the petition in accord with the requirements of N.J.A.C. 7:1-1.2, adopted August 7, 1989, at 21 N.J.R. 2302(a). Once the Department receives this clarification, it shall, in accordance with the provisions of N.J.A.C. 1:30-3.6, subsequently mail to the petitioner, and file with the Office of Administrative Law, a notice of action on the petition.

(c)

DIVISION OF WATER RESOURCES

Amendment to the Ocean County Water Quality Management Plan
Public Notice

Take notice that on July 3, 1989, pursuant to the provisions of the Water Quality Planning Act, N.J.S.A. 58:11A-1 et seq., and the "Water Quality Management Planning and Implementation Process" Regulations (N.J.A.C. 7:15-3.4), an amendment to the Ocean County Water Quality Management Plan was adopted by the Department. The Ocean County Utilities Authority's Central (OCUA) Service Area Wastewater Management Plan provides for increasing the planned flows to the Central Plant

Let's protect our earth

DEPARTMENT OF ENVIRONMENTAL PROTECTION
Division of Parks and Forestry
Office of Natural Lands Management
CN 404 Trenton New Jersey 08625
(609) 984-1339
FAX (609) 984-1427

MEMORANDUM

To: Gregory A. Marshall, Director
Division of Parks and Forestry

From: Thomas F. Hampton, Administrator
Office of Natural Lands Management

Date: May 10, 1991

Subject: Proposal to modify the boundary of Cheesequake Natural Area

At a meeting of April 10, 1991, the ONLM submitted the enclosed boundary change proposal for the Cheesequake Natural Area to the Natural Areas Council. This proposal was prepared cooperatively by ONLM and Superintendent Paul Sedor. The proposed boundary change recommends the addition of several areas that were either recently acquired or were recommended for addition in the adopted management plan for Cheesequake, and the deletion of the hazardous Perrine Site which is now being fenced to prevent public entry. Adoption of the proposed boundary change will result in a net addition of about 5.4 acres to the natural area.

In response to the proposal, the Council recommended approval of the boundary change (minutes attached). In accordance with Council-approved procedures for modification of a natural area boundary, this recommendation is being forwarded to you for final approval.

T.F.H.

Enclosure

c: Richard Barker
Paul Sedor

I hereby approve the boundary change for the Cheesequake Natural Area as approved by the Natural Areas Council and as depicted on the attached map.

Date: 5/14/91

Gregory A. Marshall, Director
Division of Parks and Forestry

NATURAL AREAS SYSTEM BOUNDARY CHANGE PROPOSAL

CHEESEQUAKE NATURAL AREA
March 25, 1991

Applicant

Paul Sedor, Superintendent
Cheesequake State Park
Matawan, NJ 07747

Office of Natural Lands Management
Division of Parks and Forestry
CN 404
Trenton, NJ 08625

Natural Area

Cheesequake Natural Area
Old Bridge Township; Middlesex County (map attached)

Relationship of Applicant to Natural Area

Proposal is being jointly submitted by the Administering Agency for the natural area, which has primary responsibility for managing the area in accordance with the adopted management plan, and the Natural Areas Program staff.

Extent and Reason for Proposed Boundary Change

Adoption of the proposed boundary change will result in a net addition of approximately 5.4 acres to the natural area, as summarized below:

Additions (see attached map)

A.	4.996 ac	This recent acquisition will provide a buffer to the rapidly developing Route 34, add additional forested land to the natural area, and make the natural area boundary contiguous with the State Park boundary.
B.	22.448 ac	To provide a buffer to the rapidly developing Route 34, add additional forested land to the natural area, and make the natural area boundary contiguous with the State Park boundary.
C.	5.002 ac	Recommended in adopted management plan as potential future addition to natural area, site contains salt marsh habitat and potential habitat for rare plant species, and would make the natural area boundary contiguous with the State Park boundary.

D.	4.0 ac	Recommended in adopted management plan as potential future addition to natural area, site contains salt marsh habitat and potential habitat for rare plant species, and would make the natural area boundary contiguous with the State Park boundary.
E.	15.23 ac	Recommended in adopted management plan as potential future addition to natural area, site supports wooded and salt marsh habitat, provides buffer to the natural area, and would make the natural area boundary contiguous with the State Park boundary.
F.	2.634 ac	Provides additional salt marsh habitat, and would make the natural area boundary contiguous with the State Park boundary.
	54.31 ac	Total acreage of proposed additions

Deletions (see attached map)

G.	48.9 ac	To remove a site determined by the Division of Hazardous Site Management (HSM) to pose an immediate environmental hazard to the public because of dumped hazardous materials, and to be fenced and signed by HSM to prevent public entry
	48.9 ac	Total acreage of proposed deletions

Description of Land Proposed for Addition/Deletion

Additions

Parcels proposed for addition collectively contain coastal salt marsh habitat or upland habitat of varying age from young woodlot to relatively mature forest.

Deletions

Parcel proposed for deletion contains salt marsh habitat, a man-made freshwater pond created by clay mining, dredge spoils originating from Hooks Creek Lake, and disturbed habitat devoid of vegetation due to soil infertility or supporting early successional species. Soil, water and biota sampling within this site in 1990 revealed the presence of substances hazardous to the public.

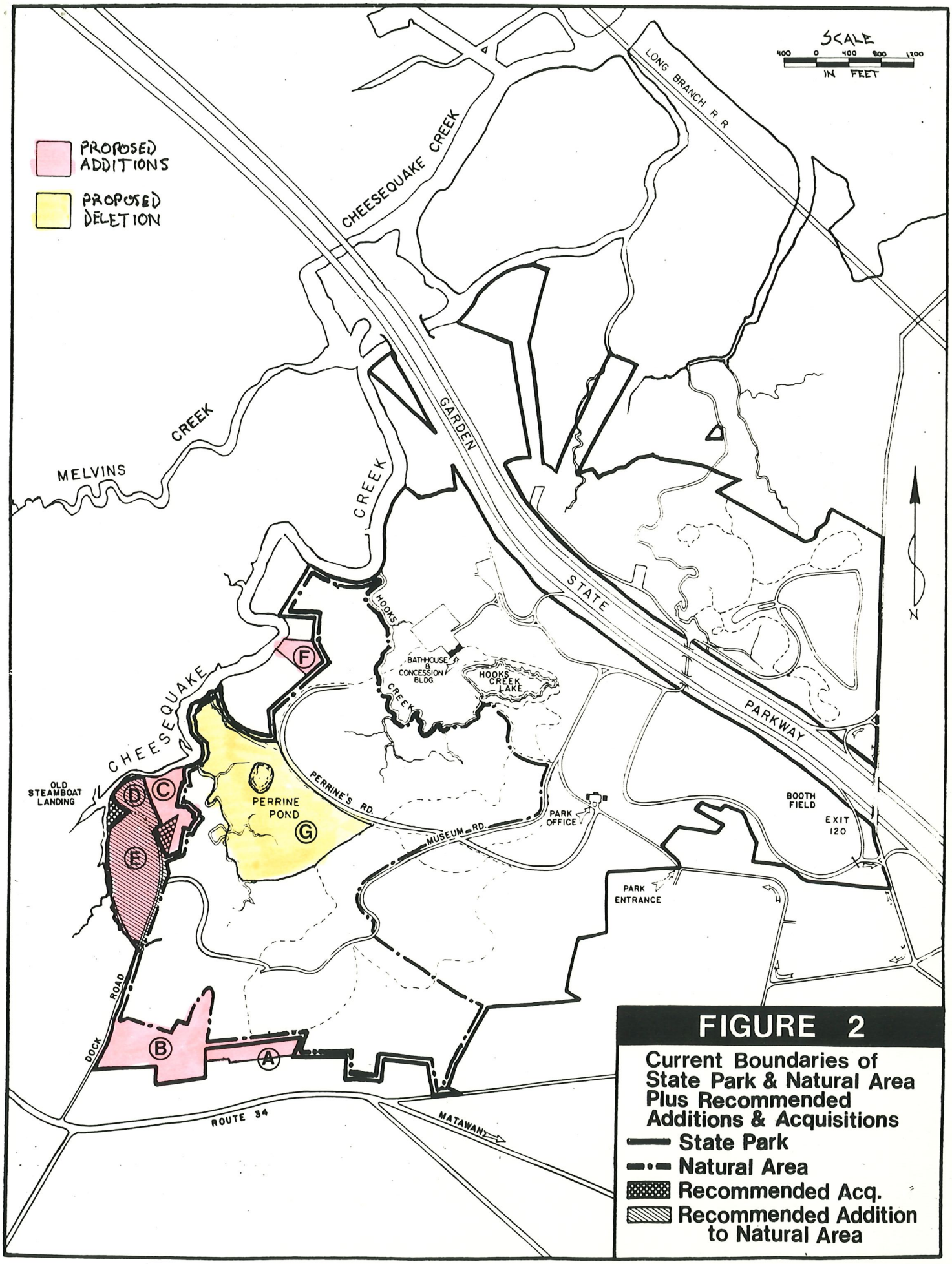

FIGURE 2

Current Boundaries of State Park & Natural Area Plus Recommended Additions & Acquisitions

- State Park
- Natural Area
- Recommended Acq.
- Recommended Addition to Natural Area

ABSTRACT

The Cheesequake Natural Area, a portion of Cheesequake State Park, became incorporated into the Natural Areas System in 1978. The Natural Area is located in Middlesex County, Old Bridge Township, and is within the Inner Coastal Plain physiographic province. This portion of Cheesequake State Park was designated to the System because it contains salt marsh and associated transition zones and provides habitat for flora and fauna of both northern and southern New Jersey affinities. In addition, this report will also show that the Natural Area supports a diversity of threatened/endangered species of both plants and wildlife.

This management plan has been developed pursuant to N.J.A.C. 7:2-11.5 which mandates that management plans be prepared for all areas designated to the Natural Areas System. Management will be aimed at prescribing uses and practices that will be allowed and implemented in order to maintain and, if possible, enhance the natural features which the site contains.

The following general management techniques are recommended in this plan. Chapter III contains detailed information on issues and prescribed management techniques and should be referred to for additional information.

Classification

Cheesequake is to be designated a Class II Natural Area for two reasons: (1) the natural features present are not so sensitive that their use should be restricted for ecological research and study, and (2) management techniques can be designed to protect the areas' sensitive features while also allowing for their careful observation. No recreational activities are prescribed in the management plan.

Boundaries

The area of the State Park west of Dock Road shall become part of the designated natural area because of its significance as potential habitat for rare New Jersey plant and animal species.

Acquisition along Dock Road is suggested in order to eliminte current dumping problems and effectuate a continuous border for the natural area.

Trails

A proposed trail looping through portions of both salt marsh and upland shall be constructed under the supervision of the Park Superintendent.

No additional roads or trails will be constructed within the natural area.

Threatened Plant Species

The Office of Natural Lands Management (ONLM) will appraise the Park Superintendent and park personnel of all known locations of threatened plant species.

The Park Superintendent will coordinate with ONLM concerning any planned activity or use which may negatively effect threatened plant populations.

Endangered/Threatened Wildlife Species

The Park Superintendent will coordinate with ONLM concerning any planned activity or use which may negatively affect endangered/threatened wildlife species. The need for nesting structures for avian species shall be determined by the Park Superintendent and coordinated with ONLM prior to construction.

External Features

The State Division of Waste Management will coordinate the closure of Global Landfill which, if properly conducted, should reduce or eliminate all potential negative impacts of the landfill on the natural area.

Gypsy Moth Control

As a general rule, there shall be no Gypsy Moth controls within the natural area.

The Park Superintendent, however, upon finding a significant potential Gypsy Moth threat, may request an emergency meeting of the Natural Areas Council to solicit their approval of control measures.

Mosquito Control

No physical manipulation of the marshes to control mosquito populations will be permitted.

The Park Superintendent shall submit a report to ONLM and the Natural Areas Council each year indicating the mosquito control measures used over the year, the success of these measures, and measures proposed for use in the subsequent year.

Non-conforming Uses

The Park Service must insure cleanup of all materials dumped in the Perrine site (both toxic and non-toxic) within five years of adoption of this plan.

The Park Superintendent shall be responsible for revegetation of all denuded areas within the Perrine site, using native vegetation whenever possible, within seven years of plan adoption.

All structural remains of the former nature center shall be removed within two years of plan adoption.

Posting Boundaries of the Natural Area

Signs will be placed at all entrance points and along all bordering roads and trails indicating to users that they are entering the natural area.

Procedures for Conducting Research

Procedures for persons who wish to conduct research within the natural area as outlined in the Administrative Code shall be adhered to. Research proposals shall be reviewed by the Park Superintendent and ONLM.

Research Goals

ONLM will cooperate with the Park Superintendent in compiling lists of mammals and herptiles supported within the natural area.

Several research proposals are outlined which could aid significantly in determining future management stragegies within the natural area.

Public Participation and Education

Procedures are suggested to aid in involving local interested individuals in an on-going inventory of resources within the natural area.

ACKNOWLEDGEMENTS

The Office of Natural Lands Management expresses its sincere gratitude to the following persons for their invaluable contributions towards the completion of this document: The Natural Areas Council (Thomas J. Gilmore - Chairperson, Thomas F. Hampton, Ronald B. Krauth, David F. Moore, Thomas O. Niederer, Kathryn A. Porter, George Schindler), Dr. Betty B. Knorr, Roderic F. Schmidt and David B. Snyder. Thanks are also extended to those persons of the Divisions of the Department of Environmental Protection who reviewed and made contributions to this management plan. Finally, special thanks are reserved for William C. Vibbert, Superintendent of Cheesequake State Park, whose past and current careful management practices provided a solid basis for the development of this plan.

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LIST OF FIGURES

INTRODUCTION

The following is a management plan for the Cheesequake Natural Area, a portion of Cheesequake State Park. Management refers to a set of prescribed uses and practices that will be allowed and implemented in order to maintain and, if possible, enhance the natural features which the site contains.

The creation of the Natural Areas System was mandated under the Natural Areas System Act of 1976 (N.J.S.A. 13:1B-15.12a et seq.). The portion of Cheesequake State Park that the plan will address was officially designated as a Natural Area (i.e., part of the Natural Areas System) in the 1978 Administrative Code (N.J.A.C. 7:2-11.1 et seq.) which also defines a "Natural Area" as "an area of land or water which has retained its natural character, although not necessarily completely undisturbed, or having rare or vanishing species of plant and animal life or having similar features of interest which are worthy of preservation for the use of present and future residents of the State." Cheesequake Marsh was designated to the System because it demonstrates "a salt marsh habitat and associated transition zones" and "provides habitat for flora and fauna of both northern and southern New Jersey" (N.J.A.C. 7:2-11.22E, E-1). The Administrative Code mandates the preparation and maintenance of a management plan for each area designated to the System, and generally dictates what each plan should include.

Cheesequake State Park is administered by the New Jersey Department of Environmental Protection, Division of Parks and Forestry, and the natural area shall continue to be administered and managed by this division pursuant to N.J.A.C. 7.2-11.22E, E-1.

Cheesequake State Park is located within Middlesex County, Old Bridge Township, and is in the Inner Coastal Plain physiographic province. Figure 1 shows the location of Cheesequake State Park on the South Amboy N.J.-N.Y. U.S.G.S. Quadrangle. The State Park is in close proximity to the New York-New Jersey Metropolitan Area and major transportation routes.

Collier (1977) indicates that the Cheesequake marsh area (an area greater than the natural area and the boundaries of the Park itself) has experienced much use since its settlement. During the 19th Century the economy of the area was primarily based on agriculture, and local produce was shipped from a steamboat landing, formerly at the terminus of Dock Road, to New York markets. The marsh used to be a food source providing fish, shellfish, waterfowl and turtles to the local population. Some trapping for muskrat still occurs within the marsh area. The farming of salt hay from the marshes for fodder, stable bedding, rope and various other uses was a major industry during the first half of the century. However, this industry has been sharply curtailed for economic reasons and because of ditching operations for mosquito control. Sand and clay mining once occurred in the area, and an abandoned clay quarry exists within the boundaries of the park as Perrine Pond. In 1938, 734.4 acres of the marsh and uplands became incorporated into Cheesequake State Park. The Garden State Parkway was constructed in 1954 which resulted in considerable loss of forested

PARKS AND FORESTRY ADMINISTERED PROPERTIES

DEP, Division of Parks and Forestry

Date Prepared: 7/17/84 Revision:

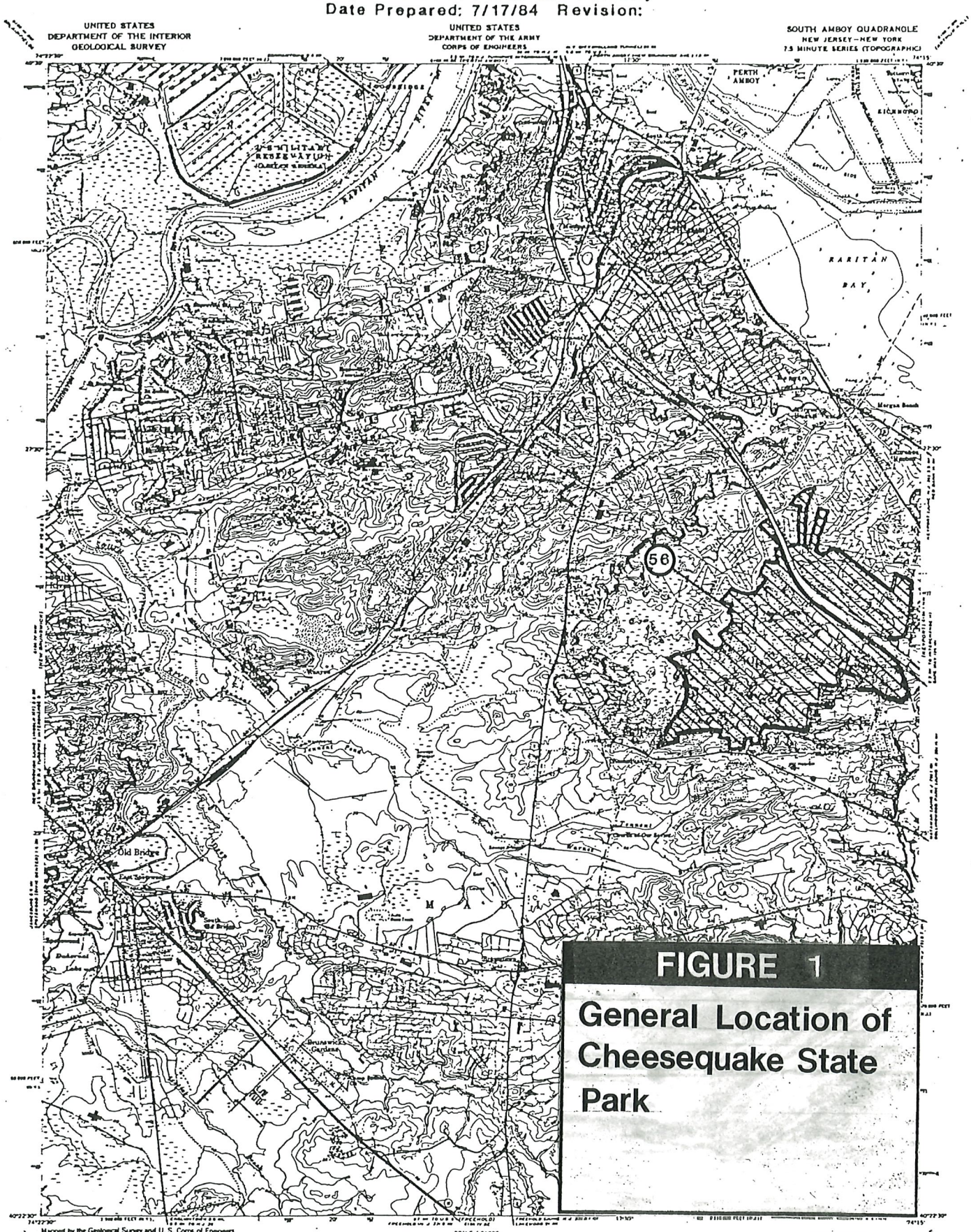


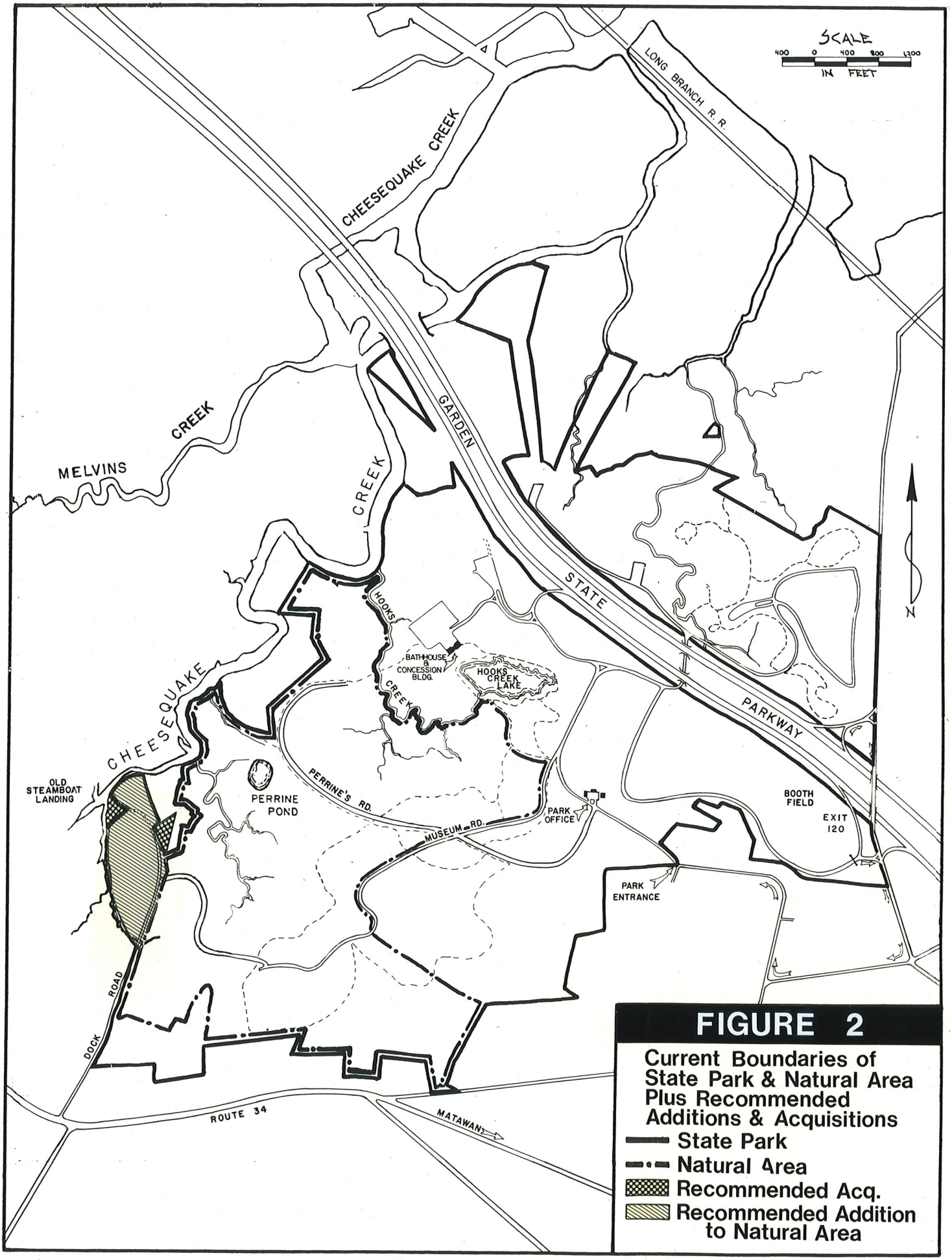
FIGURE 1

General Location of Cheesequake State Park

56 CHEESEQUAKE STATE PARK

land as well as loss of land used for roadway fill. Parkway construction also resulted in rerouting of Cheesequake Creek approximately one-quarter mile north of its former location. By this time the area had generally lost its agricultural quality. Global Landfill began operation in 1969 and a sewer project in Cheesequake State Park was completed in 1976. Land use surrounding Cheesequake is now mostly residential-industrial: housing developments occur at several locations and Global Landfill (recently closed) is obstrusively apparent across Cheesequake Creek. Due to its open nature, proximity between major metropolitan areas and the Jersey shore, and accessibility by major transportation routes, Old Bridge Township has experienced rapid population growth within the past 30 years (Dames and Moore, 1975).

Figure 2 shows the current boundaries of the State Park and Natural Area. The natural area, which lies entirely south of the Garden State Parkway, comprises approximately 450 acres which is 45 percent of the total acreage of Cheesequake State Park (now 1001 acres).


SCALE
400 0 400 800 1200
IN FEET
LONG BRANCH R. R.
CHEESEQUAKE CREEK
MELVINS CREEK
GARDEN STATE PARKWAY
N
HOOKS CREEK
BATHHOUSE & CONCESSION BLDG.
HOOKS CREEK LAKE
CHEESEQUAKE CREEK
OLD STEAMBOAT LANDING
PERRINE POND
PERRINE'S RD.
MUSEUM RD.
PARK OFFICE
BOOTH FIELD
EXIT 120
PARK ENTRANCE
DOCK ROAD
ROUTE 34
MATAWAN
FIGURE 2
Current Boundaries of State Park & Natural Area Plus Recommended Additions & Acquisitions
State Park
Natural Area
Recommended Acq.
Recommended Addition to Natural Area

SITE DESCRIPTION

Topography and Geology

Cheesequake lies within the Inner Coastal Plain physiographic province. Although the marsh itself is near sea level, penninsulas of upland protrude into the wetlands producing marsh embankments. Within the upland portions of the natural area the terrain is characterized by numerous ridges and sometimes steep slopes. The highest positions in the landscape occur at the southern boundary of the State Park and natural area (adjacent to Route 34) which attains a height of 100-130 feet above mean sea level.

The area consists geologically of Cretaceous sands and clays which, in turn, overly metamorphic rocks of Precambrian age (Dames and Moore, 1975; Collier, 1977). Most of the Cretaceous material consists of Magothy Sands and Magothy, Merchantville and Woodbury Clays; Magothy being the oldest and Woodbury the youngest sediments (Dames and Moore, 1975). A detailed description of the geology of the Park is provided by Scudder (1955).

Soils

The following information on soil series was obtained from the Interim Soil Survey Report for Middlesex County, New Jersey (U.S. Department of Agriculture, 1978). The salt marsh zones within the natural area consist of tidal marsh soils which are flat and flooded twice daily by the normal tides. These constantly saturated soils are composed of silt sized material and are generally high in organic matter (5-20% or greater). Inland of the marsh in the western portion of the area is Alluvial land which is nearly level flood plain containing loamy alluvial deposits from Cheesequake Creek and its tributaries, and has a seasonal high water table near the surface all year. The remaining upland portions of the natural area are predominantly composed of soils of the Keyport and Klej Series. Keyport sandy loam ranging in slope from 2-15% overlies large portions of the uplands. These are deep moderately well drained soils having a moderately fine or fine textured subsoil. The highest positions in the landscape near the southern border of the natural area support Klej sandy loam soils of 2-5% slope. These are deep moderately well to poorly drained soils which experience rapid permeability, the water table sometimes dropping to below five feet in the summer. Some additional soils which occur on small portions of the natural area include Hammonton loamy sand and soils of excavated clay pits.

Soil composition and the nature of the terrain of lands adjacent to Cheesequake Marsh result in a high erosion potential (Collier, 1977). Significant erosion of the uplands is apparent, particularly in late winter and early spring, resulting in alluvial deposits which extend over the marsh.

Surface Hydrology and Water Quality

The Cheesequake area derives its groundwater supply primarily from Old Bridge Sand and Farrington Sand of the Raritan Formation aquifer (Collier, 1977). Of lesser significance is the aquifer of the Magothy Formation.

Cheesequake State Park lies within the Atlantic Coastal Drainage Basin, Matawan Sub-basin and Cheesequake Creek Watershed. Many small intermittent streams may be observed throughout the uplands, particularly during late winter and spring. Tributaries which drain the natural area and feed Cheesequake Creek include Hooks Creek and Landing Creek. Cheesequake Creek, which is approximately 100 feet in width, drains into Raritan Bay. Construction of the Garden State Parkway in 1954 resulted in a relocation of the main channel of Cheesequake Creek approximately one-quarter mile north of its original location. The old channel was filled with roadfill, creating a dead-end waterway.

Water quality analysis of Cheesequake Creek and its tributaries is not currently available. Because of tidal action, one might expect that potentially contaminating leachate from nearby Global Landfill would be distributed throughout the entire marsh system. However, preliminary sampling of the waterways in the vicinity of Global indicates that the aquatic biota is not being impacted significantly by chemical effluents (N.J. Department of Environmental Protection, 1984). This study will be discussed further in this chapter under Features of Potential Impact.

Vegetation

The vegetation of Cheesequake Natural Area, although not undisturbed, is particularly significant in providing a striking example of vegetation zonation along a gradient from coastal salt marsh to upland forest. Unlike most salt marsh systems, the transition from salt marsh to upland is very abrupt. Additionally, Cheesequake represents a unique transition zone, displaying a diversity of plant species and community types characteristic of both northern and southern New Jersey. Existing habitat types and vegetation community structure is the result of a specific history of climate and sea level change that has been extensively studied by Rosenwinkel (1964). His studies indicate that while the upland vegetation has changed little over time, lowland vegetation has been dramatically altered by the continuous rise in sea level resulting from glacial retreat which began approximately 16,000 years ago. The rise in sea level has caused lowland vegetation and dead organic matter to gradually move landward and become deposited over sands and clays. Rosenwinkel's (1964) data indicates that Atlantic White Cedar (Chamaecyparis thyoides) forests first appeared approximately 1800 years before present (B.P.) and later became quite extensive. Subsequent increases in water level resulted in the development of Cyperaceae marshes and salt grass marshes, and the cedar forests eventually became fragmented and reduced in size as they appear at present. Pollen analysis indicates that Indians founded a settlement on the uplands adjacent to the marsh about 380 B.P. and by about 100 B.P. much of the upland had been cleared by the white man. Indian artifacts are known to be abundant in the Cheesequake uplands, particularly in the Gordon Field area

(William C. Vibbert, Cheesequake State Park Superintendent, personal communication).

A comprehensive, and unpublished, list of the vascular flora of Cheesequake State Park (Appendix A) was compiled shortly after the park's incorporation. Although the principal author of the list is Lewis E. Hand, others who contributed to it include J.A. Small, H.N. Moldenke and A.J. Alexander. All authors are well known for their botanical collections throughout New Jersey. The date of completion of the list is not known but files of the Park Office indicate that it probably was compiled about 1940. The Park has changed considerably since that time: area has increased from 734 to 1001 acres; the Garden State Parkway bisected the Park in 1954. However, David B. Snyder (personal communication) who has done extensive botanical work at Cheesequake feels that this list is still accurate and may be applied for the natural area. Habitats for most of the species on the list still exist in the natural area. However, the age of the list and the fact that it refers to a much larger area than the designated natural area must be considered. At approximately the same time that the vascular list was compiled, lists of lichens, algae and fungi were also made (Appendix B). The original authors of the lichen and algae lists are unknown (perhaps also compiled by Hand et al.), but collectors who contributed to the list of fungi include F.R. Lewis, H.N. Moldenke, G.G. Nearing and J.A. Small. Again, the age and scope of these lists should be noted. Nonetheless, this extensive database makes Cheesequake one of the most studied parks in New Jersey with regard to flora and provides a valuable reference source for all future collections.

The vegetative community types within the natural area are depicted in Figure 3. Community types include coastal salt marsh, freshwater marsh and swamp, white cedar swamp, pine-oak forest, oak-hardwood forest and a small bog. In addition, the natural area contains an unusual mature stand of white pine. It is important to note that Fig. 3 indicates only general locations of these community types. It was not possible to cover-type using aerial photographs so only approximate boundaries could be drawn. Also, it was not possible to field check the entire area. Particularly noteworthy is that considerable variation exists within the oak-hardwood forest type, both in age, structure and species composition. The gradient from marsh to upland results in a gradual change in the forest making it impossible to delineate distinct types on the map. The general location of only the more mature oak forest is indicated. Finally, vegetation within the Perrine site (to be discussed later in this report) is not mapped because of the disturbed nature of the area.

The following brief description of communities and their more common flora is arranged along a general hypothetical transect from marsh to upland. Community composition was determined by Robert J. Cartica during field visits in fall 1983 and early spring 1984.