LAND USE

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PREPARED FOR THE UNITED STATES DEPARTMENT OF ENERGY

BROOKHAVEN NATIONAL LABORATORY

FUTURE LAND USE PLAN

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Acknowledgments

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The thoughtful suggestions and comments, technical advice, and creative ideas contributed by our stakeholders were instrumental in developing a quality document. We also appreciate the many strong expressions of support we received for our on-going scientific mission.

I would like to specifically acknowledge the outstanding support provided by the Suffolk County Planning Commission which developed an in-depth analysis of the impact of BNL on the economy of Long Island.

It is my hope that the open, lively, and productive dialogue which has characterized this Future Land Use planning process will continue, as together we confront the challenges and take advantage of the many exciting opportunities which lie ahead for Long Island.

N.P. Samios, Director
Brookhaven National Laboratory

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SECTION 1

EXECUTIVE SUMMARY

The U.S. Department of Energy's (DOE) changing mission, coupled with the need to apply appropriate cleanup standards for current and future environmental restoration, prompted the need for a process to determine preferred Future Land Uses for DOE-owned sites. DOE began the "Future Land Use" initiative in 1994 to ensure that its cleanup efforts reflect the surrounding communities' interests in future land use. This process considers current and future missions of DOE's facilities and solicits the concerns of members of the surrounding communities and other affected parties as "stakeholders." Stakeholders' recommendations on future land use will be used in working with regulators, such as the Environmental Protection Agency (EPA) and the states, to identify appropriate methods for environmental remediation and to guide planning for future site development.

This plan presents the results of a study of stakeholder-preferred future land uses for the Brookhaven National Laboratory (BNL), located in central Long Island, New York. The plan gives the Laboratory's view of its future development over the next 20 years, as well as land uses preferred by the community were BNL ever to cease operations as a national laboratory (the post-BNL scenario). BNL established a goal, early on, to involve a broad cross-section of the Long Island community in future land-use planning for the Laboratory site. Over 110 Long Island organizations and key personnel have been involved, many representing large constituencies.

The plan provides an overview of the physical features of the site including its history, topography, geology/ hydrogeology, biological inventory, floodplains, wetlands, climate, and atmosphere. Utility systems and current environmental operations are described including waste management, waste water treatment, hazardous waste management, refuse disposal and ground water management. To complement the physical descriptions of the site, demographics are discussed, including overviews of the surrounding areas, laboratory population, and economic and non-economic impacts.

Discussion of, and proposals for, post-closure future land use appear to be guided by several major drivers:

- Maintaining the economy of Suffolk County
- Protecting and restoring the environment
- Maintaining/protecting the Pine Barrens and open space
- Re-utilizing the Laboratory's infrastructure
- Assessing the status of the Laboratory at the time of postulated closure

Economics

The Future Land Use Plan concludes that BNL presently is a major contributor to the Long Island economy. An economic study titled "The Impact of the Brookhaven National Laboratory (BNL) on the Long Island Economy," performed by the Suffolk County Planning Commission, states:

- "BNL's estimated direct spending of \$423,040,000 during 1995 would cause total Long Island output to increase by more than \$797 million including the initial spending of \$423 million. Long Island earnings would increase by approximately \$329.5 million and more than 13,000 secondary jobs would be created throughout the Long Island economy." In total, the overall ripple effect of BNL spending is an approximate \$1 billion impact on the Long Island economy.
- "The existence of the Brookhaven National Laboratory is clearly vital to Long Island's economic health and that of Suffolk County. BNL's expenditures, even over the course of a single year, have a discernible impact on local economic activity. These expenditures support secondary jobs in a broad array of industries."
- "The financial contributions of the Laboratory are complemented by its efforts to develop state-of-the-art technologies and to transfer these cutting-edge technologies to local industry. Long Island is currently in the throes of a major structural economic transition. It hopes to develop new technologies-based industries to offset job losses in the declining defense sector. The Brookhaven National Laboratory is vital to that effort."

Environment/Pine Barrens

BNL is located in an area where much of the nearby land is preserved in its natural state as parkland. Some areas surrounding the Laboratory have been developed or are planned for future development. Wooded buffer areas form the perimeter of the BNL property and large areas of the site also remain in their natural state. This relatively undisturbed ecosystem contains habitats which include mature white-pine forest, oak/pitch pine mixed upland, seasonally flooded forested wetlands, and open fields. Ecosystem management is an active process at BNL, and has focused

on three activities: monitoring, characterization, and regulatory compliance. Laboratory personnel are active members of the Advisory Committee, Ecology Committee, Land Use Committee, and Protected Land Use Council established under the Long Island Pine Barrens Act of 1993. Among the Laboratory's interests is the management of over 500 hectares of BNL property which is within the Core Preservation Area, delineated by the Pine Barrens Act, although, as federal land, not under its jurisdiction. Additionally, the Peconic River on BNL's property is designated a "scenic river" under New York State's Wild, Scenic, and Recreational Rivers Act and the aquifer underlying BNL is designated a "sole source aquifer" by the EPA. Maintaining the high quality of these environmental resources is a key BNL goal.

Currently, there are twenty-eight "Areas of Concern" (AOCs) for environmental restoration at the BNL site to be addressed through an Interagency Agreement (IAG). The AOCs consist of active facilities, such as the Sewage Treatment Plant (STP), the Hazardous Waste Management Facility (HWMF), and potable wells, and inactive facilities, such as two former landfills, cesspools, and radioactive-waste storage tanks. The AOCs are grouped and prioritized into Operable Units (OUs) and Removal Actions (RAs).

Infrastructure

Development of the Laboratory site has been influenced by the buildings and utilities inherited from the former Camp Upton. The general location and arrangement of the roads, buildings, and utilities are a legacy of the former U.S. Army camp. The physical plant has been upgraded gradually over the last 48 years, but many of the original Army elements are still used and will continue to be accommodated in future planning. The site covers 2,130 hectares, with most of its principal facilities located near the center of the site. The developed area is approximately 670 hectares, of which about 202 hectares were originally developed for Army use. Of the remaining, 81 hectares are occupied by various large specialized research facilities. Outlying facilities occupy about 222 hectares; these include the sewage treatment plant, research agricultural fields, housing, and fire breaks. The balance of the site is largely wooded. At present, there are over 350 buildings in use with a total gross floor area of approximately 340,000 square meters. Permanent buildings constructed since 1947 account for about 75% of the floor space of the Laboratory.

BNL's Master Plan, which looks out 20 years, envisions the potential for future construction in the northeast area of the site to accommodate laboratory buildings to support the Relativistic Heavy Ion Collider (RHIC). Future scientific facilities, which may prove feasible to build over the next 20 years, include a proton linear accelerator or a muon-muon collider, continuing BNL's mission of designing and building state-of-the-art research facilities for the scientific community. BNL's holdings to the east are primarily woodlands and wetlands, and current plans are to leave them in their natural state for the foreseeable future.

Land Use Categories

The DOE Future Land Use process divides land use into six categories; Industrial/Commercial, Residential, Agricultural, Recreational, Native American, and Open Space/Wilderness. Of these six categories, four were considered applicable for the BNL site; Open Space, Industrial/Commercial, Agricultural, and Residential. This plan discusses current land use, projected land use after the 20-year Master Plan period, and postulated land use at an undesignated time if BNL were to close. Maps indicating these uses can be found in Chapters 8, 9, and 10, respectively.

Current Site Land Use

Open space encompasses approximately 75% of the site area, which is mostly in its natural state with the exception of fire breaks, utilities' right of ways, recreation fields, and environmental monitoring wells and stations. This area includes floodplains and wetlands. The industrial/commercial area comprises most of the built-up area of the site including the vast majority of the approximate 350 buildings and other support structures. Included in this area are four national user research facilities--the Alternating Gradient Synchrotron (AGS), the High Flux Beam Reactor (HFBR), the National Synchrotron Light Source (NSLS), and the Scanning Transmission Electron Microscope (STEM). Approximately 28 hectares of agricultural fields are used for growing crops for biological research. The residential area, approximately 69 hectares, includes BNL's housing accommodations, largely inherited from the Army. BNL's housing inventory includes summer cottages, mobile homes, apartments, efficiencies, guest rooms, dormitory rooms, and houses.

Land Use, Master Plan Period

The Laboratory has a coordinated, long-range (20 year) master planning process which identifies future programming and space requirements. Specific scientific initiatives and infrastructure requirements are identified in BNL's Institutional Plan and the Site Development Plan. Specific areas of the site have been designated and are held in reserve for future programmatic and infrastructure development. The planning process addresses the need for new facilities to meet emerging research needs, while making maximum use of existing facilities. Planning is accomplished through meetings, program reviews, interaction with DOE, and suggestions from Laboratory staff, collaborators, and visitors. The BNL site should continue to accommodate the scientific missions of the Laboratory, as currently envisioned, for at least the next twenty years. However, due to the Laboratory's quest for world-changing discoveries, the facilities' needs of forefront basic research cannot be predicted easily. Economics, reliability, quality, and quantity of the existing facilities are taken into account to determine the need for additions and modifications to existing facilities. Facilities required to house proposed and planned scientific initiatives will increase the Laboratory's developed areas.

Open space may be reduced by up to 20% due to the potential construction of scientific machines, such as the linear accelerator, muon-muon collider, or future RHIC experimental support facilities. For the industrial/commercial area, the majority of proposed construction initiatives can be accommodated within the currently developed industrial/commercial area. However, the actual area needed will be contingent upon which initiatives are realized within this period. No expansion is anticipated of the area currently used for agricultural use. The Laboratory anticipates nominal growth in housing on site. The current housing area in the southwest area of the site might be expanded to accommodate this growth; however, areas already cleared may be adequate to accommodate these needs.

Before environmental authorizations are sought, the potential environmental impacts associated with any proposal under consideration are evaluated in accordance with the National Environmental Policy Act (NEPA). The NEPA process also is used to evaluate potential impacts to the environment where there are no other applicable regulations that may govern the ecosystem potentially at risk.

Land Use, Post-BNL Scenario

This "post-BNL" scenario evaluates potential land uses of the site if BNL were to cease operating as a national laboratory. The most critical issue for this scenario would be the timing of the postulated closure and the level of development of the site at that time. The important factors to be considered are the time span for phasing out ongoing operations, the time and resources required for any further remedial actions, and identification of facilities which would be mothballed due to economic considerations. There is no precise method by which we can foresee the level of development of the site at an indeterminate closure time. However, we can make reasonable assumptions based on current knowledge and master planning. At the time of cessation of operations at BNL, the process of evaluating assets would be started.

With the exception of large specific-use research machines, the remainder of the facilities could be turned over to another agency or private sector developers for conventional uses. Considering the use of the remaining facilities, the most appropriate future use would seem to be a continuation of scientific research. However, with modifications (some of which could be major), facilities could be converted to industrial/commercial or light manufacturing uses. Depending on the level of decontamination, decommissioning of the accelerators and reactors may require considerable time. For the post-closure scenario, it is presumed that there may be research machines that remain in a safely mothballed condition until they are removed and/or remediated.

With the exception of some environmental monitoring wells which will be required for several years past the post-closure date, most open space areas would remain as such. Areas in the eastern portion of the RHIC site could be restored to the natural state through a restoration program which also could include the RHIC ring and the agriculture field. Open space areas could be divided into passive and active recreation sites. As to the exact distribution of open areas, current stakeholders' comments have differed and alternate scenarios are discussed. Current and future regulations, such as the current Pine Barrens Act, and stakeholder desires at that time, would likely influence the outcome of land use distribution. For the current industrial/commercial areas, it is expected that similar uses would be sought. Stakeholders' comments indicate that existing outdated structures might have to be torn down and new structures rebuilt to the specifications of the potential users. While several specific suggestions

were made for reusing facilities in the industrial/commercial area, they were all consistent with current land-use classification.

An important consideration for any proposed future use of the site as a non-federal installation would be compliance with the Pine Barrens Act. This Act would regulate future development by non-federal entities in the "Core Preservation Area." The area currently identified as industrial/commercial use lies within the "Compatible Use Area," and thus, could allow required modifications or re-development for the proposed future uses.

The housing facilities might be suitable for continued use. One possibility, suggested by the stakeholders, is to use the existing housing for the elderly.

SECTION 2

DOE FUTURE LAND USE PROCESS

INTRODUCTION

While Brookhaven National Laboratory's (BNL's) basic mission remains unchanged, the U.S. Department of Energy's (DOE) changing mission, coupled with the need to apply appropriate cleanup standards for current and future environmental restoration, have prompted the need for a process to determine preferred Future Land Uses for DOE-owned sites.

MAKING SOUND ASSUMPTIONS

DOE initiated the "Future Land Use" initiative in 1994 to ensure that its cleanup efforts reflect the surrounding communities' interests in future land use. This process considers current and future missions of DOE's facilities and solicits the concerns of members of the surrounding communities and other affected parties as "stakeholders." Stakeholders' recommendations on future land use will be used in working with regulators, such as the Environmental Protection Agency (EPA) and the states, to identify appropriate environmental remediation methods and to guide planning for development.

Throughout its facilities, the DOE is working with Federal, State, and local governments, Indian tribes, environmental groups, the business community, and individual citizens to identify appropriate and preferred future uses for DOE land. The stakeholders are asked to consider constraints, such as geography, ongoing DOE activities, ecology, economic development, and other factors when defining recommendations for future uses.

At certain sites, DOE's site specific advisory boards, which include diverse stakeholders, are taking the lead in formulating recommendations on future uses for DOE land. At other sites, DOE is using focus groups, public meetings, individual meetings, and other mechanisms to formulate preferred uses. Section 3 outlines the BNL-selected method of involving stakeholders.

As part of this process, several sites are undertaking ecological surveys or studies to identify regions with thriving ecosystems. Because large portions of many DOE's sites have remained undisturbed for over 50 years, rare habitats have been preserved in some areas, and often diverse and rich habitats abound on and off-site as part of an overarching ecosystem.

The DOE also is working with Native American governments to ensure that cultural, religious, and ceremonial resources are preserved. Thousands of archeological finds, including rock paintings, have been discovered on DOE sites. These cultural resources are factored into land use recommendations, and ultimately, into decisions on remedial action.

CRITICAL GUIDE TO CLEANUP DECISIONS

DOE will use the stakeholder's recommendations on future land use as a guide in working with its regulators, such as the EPA and the states, to identify appropriate remedial methods.

Land-use assumptions not only affect costs, but also dictate certain cleanup standards. Proposed future land use designations may affect the level of cleanup at a particular site since cleanup is based on the potential exposure pathways (e.g., soil and groundwater), receptors (e.g., residents and workers), and remediation strategies for a particular scenario. Furthermore, since only certain technologies are available to remediate sites to their pristine conditions, such assumptions indirectly determine the rate of cleanup, the final appearance of the remediated area, and the volume of waste generated by the process.

For instance, because soil excavation is the technique often used to return certain sites to residential standards, massive amounts of slightly contaminated soil may be generated from such cleanups. This soil waste, in turn must be transported, treated, stored, and ultimately, disposed of. Soil removal can require many years to complete and often destroys vegetation and habitats that are present on the land and in the surrounding area.

Because land-use assumptions can have such a profound effect on the cost, rate, type, and impact of cleanups, it is critical that sound assumptions about future uses of these sites are made to guide cleanup decisions.

SECTION 3

STAKEHOLDER PROCESS

STAKEHOLDER INVOLVEMENT AT BNL

BNL established a goal, early on, to involve a broad cross-section of the Long Island community in the Future Land Use planning for the Laboratory site. The Future Land Use Committee wanted to ensure that governmental entities, regulatory agencies, businesses, academia, elected officials, civic organizations, organized labor, environmental groups, and other organizations could contribute their expertise, experience, and knowledge of regional issues to the process. Providing an opportunity for input by the general public, as well as Laboratory employees and visitors was an equally important goal.

As stakeholders were identified and contacted, they were asked to suggest other individuals and organizations which should be participating. Over 110 Long Island organizations and key personnel have been involved to date, many representing large constituencies.

The general public was brought into the process through announced, open meetings held at BNL at which the draft and final draft Future Land Use Plan documents were presented. These meetings were as follows:

- December 1994 Future Land Use Planning Meeting
- March 1995 Future Land Use Workshop
- May 1995 Presentation of Preliminary Draft Plan
- August 1995 (Scheduled) Presentation of Final Draft Plan

All stakeholders were given hard copies of the drafts for review and comment.

The following individuals and organizations were invited to participate as designated stakeholders, a "*" indicates that a representative of the organization attended at least one of the BNL-sponsored Future Land Use meetings, an "M" indicates that the organization invited a BNL representative to meet with their organization to discuss future land use, and a "C" indicates that the organization provided comments to BNL for consideration in the Future Land Use Plan.

TOWN AGENCIES

- Brookhaven Town Economic Development Agency
- *C Brookhaven Town Environmental Protection Agency
- Brookhaven Town Highway Department
- C Brookhaven Town, Department of Planning, Environment & Development
- *C Brookhaven Town Planning Board
- Riverhead Town Planning Board
- Riverhead Town Superintendent of Highways

SUFFOLK COUNTY AGENCIES

- * Suffolk County Cornell Cooperative Extension
- *C Suffolk County Department of Health Services
- * Suffolk County Department of Parks & Recreation
- *C Suffolk County Department of Public Works
- Suffolk County Development Department
- Suffolk County District Attorney
- Suffolk County Division of Historic Services
- *C Suffolk County Planning Board
- * Suffolk County Water Authority

LONG ISLAND

- Environmental Business Association of New York State
- * Long Island Association
- * Long Island Federation of Labor
- *C Long Island Greenbelt Trail Conference
- Long Island Groundwater Institute
- * Long Island Housing Partnership
- *C Long Island Pine Barrens Society
- *C Long Island Pine Barrens Commission
- *C Long Island Regional Planning Board
- C New York State Parks and Recreation Society
- *C The Long Island Nature Conservancy

U.S. FEDERAL GOVERNMENT

- * U.S. Department of Energy - Chicago Operations Office
- *C U.S. Department of Energy - Brookhaven Area Office
- C U.S. Department of Energy - EM5, Future Use Project Office
- U.S. Environmental Protection Agency, Region II, Open Space Council
- Emergency and Remedial Response Division

NEW YORK STATE AGENCIES

- *C NYS Department of Environmental Conservation
- NYS Attorney General
- * NYS Legislative Commission on Long Island Water Resource Needs
- *C NYS Department of Transportation
- C NYS Office of Parks, Recreation and Historic Preservation

BUSINESS/INDUSTRY/UTILITIES

- *C Breslin Reality Development Corporation
- *C Ehasz Giacalone Architects, P.C.
- * Geraghty & Miller
- Lockwood, Kessler & Bartlett, Inc.
- * Long Island Lighting Company
- *C Long Island Rail Road
- New York Power Authority
- * Northrop-Grumman Corporation
- * Wiedersum Associates, P.C.

BUSINESS ASSOCIATIONS

Building & Construction Trades Council of Nassau & Suffolk Counties
Long Island Board of Realtors
Long Island Builders Institute

LOCAL SCHOOL DISTRICTS/COLLEGES/UNIVERSITIES

- Adelphi University
- *C Associated Universities, Inc. Trustees and Officers
- Beth Israel Medical Center
- *C Dowling College
- Hofstra University
- Long Island University
- * Longwood School District
- New York Institute of Technology
- State University of New York at Stony Brook, University Medical Center

- * Suffolk Community College
- * William Floyd School District

SCIENTIFIC GROUPS

- * Cold Spring Harbor Laboratory
- * Long Island Research Institute
- Okeanos Ocean Research Foundation, Inc.
- U.S. Department of Agriculture - Plum Island Animal Disease Center

CIVIC GROUPS

- Affiliated Brookhaven Civic Organizations
- * Brookhaven League of Women Voters
- *C Brookhaven Village Association, Inc.
- * Cancers Cure
- *CM East Yaphank Civic Association
- Group for the South Fork
- Long Island Citizens Advisory Committee for Hazardous Waste
- Manor Park Civic Association
- Manorville Taxpayers Association
- *C Mastic Beach Property Owners Association
- Middle Island Civic Association
- *CM Ridge Civic Association
- Rotary International District 7260 - Middle Island
- Rotary International District 7260 - Riverhead
- *CM Rotary International District 7260 - Rocky Point
- Rotary International District 7260 - Shirley-Mastic
- *C Wading River Civic Association
- Yaphank Taxpayers and Civic Association

ELECTED OFFICIALS

John J. LaMura, Brookhaven Town Supervisor
 Joseph F. Janoski , Supervisor, Town of Riverhead
 Town Councilman Ed Hennessey

Robert J. Gaffney, Suffolk County Executive
 Donald Blydenburgh, Presiding Office of Suffolk County Legislature
 Greg Blass, Suffolk County Legislator
 Nora L. Bredes, Suffolk County Legislator
 Rose Caracappa, Suffolk County Legislator
 Herbert Davis, Suffolk County Legislator
 George Guldi, Suffolk County Legislator

- State Assemblywoman Pat Acampora
- State Assemblyman John L. Behan
- State Assemblyman Richard Brodsky
- State Assemblyman Tom P. DiNapoli
- * State Assemblywoman Debra Mazzeoli
- State Senator Owen Johnson
- State Senator James J. Lack
- * State Senator Kenneth LaValle
- State Senator Caesar Trunzo
- Commissioner John C. Egan, NYS Dept. of Transportation

- U.S. Senator Alphonse D'Amato
- * U.S. Senator Daniel P. Moynihan
- U.S. Congressman Michael Forbes
- Former U.S. Congressman George J. Hochbrueckner

BNL EMPLOYEE GROUPS

- * Alternating Gradient Synchrotron (AGS) Users Group
- * BNL Council
- *C BNL Department Chairpersons/Division Heads
- *C BNL Directorate
- *C BNL Future Land Use Committee
- *C Brookhaven Women In Science (BWIS)
- * High Flux Beam Reactor (HFBR) Users Group
- * International Brotherhood of Electrical Workers Union Local #2230 (IBEW)
- * Long Island Guards Union Local #37 (LIGU)
- * National Synchrotron Light Source (NSLS) Users Group
- * Oil, Chemical & Atomic Workers Union Local #8-431 (OCAW)

SECTION 4

SITE OVERVIEW

HISTORICAL OVERVIEW

On November 1, 1683, "The Great Charter of Liberties and Privileges," signed by James, Duke of York, created the County of Suffolk, New York. The settlement traces its history to 1640, just after the Pilgrims landed at Plymouth. Two groups of English men and women arrived and settled the communities of Southampton and Southold. On December 27, 1686 the Dongan Patent was issued through the colonial Governor Thomas Dongan. This document provides the historic basis for the local Town governments.

Since then, the County's citizenry have developed and protected these lands. Today, Long Islanders are justifiably proud of their roots, and preserve their historic sites and buildings for all to enjoy.

The area of central Suffolk County now occupied by Brookhaven National Laboratory once served the nation in a different capacity. It was the site of Camp Upton, named in honor of Brigadier General Emery Upton. The Camp was active from 1917 until 1920, and again from 1940 until 1946. During World War II, the camp was rebuilt primarily as an induction center for draftees and was later converted into a convalescent and rehabilitation hospital for returning wounded.

Construction of Camp Upton began in the summer of 1917. Plans called for a U-shaped encampment, large enough to house 40,000 troops. The land first was totally cleared of the scrub pines, oak, and tangled undergrowth which dominated the landscape. A rail spur was built, connecting Upton to the Long Island Rail Road on which most of the construction supplies arrived. The recruits who arrived at Upton came from all walks of life. They came from New York, New Jersey, and Connecticut, and represented twenty-five or more ethnic backgrounds. In all, 40,000 people spent some part of their military service at Upton. The camp, completed in 1917, became the nation's 51st largest city and doubled the population of Suffolk County.

Sergeant Irving Berlin was included among these men. While at Upton, he wrote "Yip, Yip, Yaphank," a military musical based on his life at the camp. The show was produced on Broadway, with Berlin's fellow soldiers filling the cast. From this show came one of Berlin's most famous songs, "Oh, How I Hate to Get Up in the Morning."

With the war's end in November 1918, Camp Upton's usefulness was limited. For a time, the camp served as a demobilization site for returning veterans, but eventually the Army decided to close it down, and Camp Upton was deactivated. A public auction in August of 1921 saw everything from stoves to complete structures sold and removed from the Yaphank base. For almost twenty years, the site remained quiet as Upton National Forest. Then, in 1940, the Yaphank wilderness came to life again. The war in Europe and the Pacific generated a drive for military preparation among members of the government. Since the Yaphank land was still available, the decision was made to rebuild the camp.

Sewerage systems were installed to help drain the water that often accumulated on the roads and parade grounds. More and better roads were built. Once war was declared, the camp was filled to capacity with people and machinery and became the 1,222nd induction center. After the war effort moved from the European to the Pacific Theater, the induction center moved to Fort Dix, N.J., and the camp then was expanded and converted into a convalescent and rehabilitation hospital in September, 1944.

The camp again was deemed unneeded once combat in the Pacific ended, and the Second World War drew to a close. It was officially declared surplus on June 30, 1945; however, this time it was not dismantled. Several suggestions were made on how the base and its facilities could be put to the best use. The proposal finally accepted called for the former army camp to be converted into a national research center for the peaceful uses of atomic energy. Barracks were to be used as temporary facilities until permanent structures could be built to house the scientists and their equipment. Thus, in January 1947, Brookhaven National Laboratory was born, and Camp Upton finally completed its military service to the nation.

When Brookhaven National Laboratory opened it was one of three national laboratories, places where federally funded facilities could be built that were beyond the resources of individual

universities. In the late 1940s, this meant nuclear reactors and particle accelerators, although, at that time, forefront accelerators still could be built at universities.

Brookhaven's first generation of these two types of machines were completed in the early 1950s. The Brookhaven Graphite Research Reactor (BGRR) went into operation in 1950, and the Cosmotron, a proton synchrotron that was the first particle accelerator to surpass 1 billion electron volts (GeV) was dedicated in 1952. Completion of each machine had a significant impact upon the Lab, because supporting facilities and experimental equipment had to be built, along with special arrangements for power, security, waste disposal, and so forth. A hot lab, to handle nuclear engineering and chemistry, was built in 1951, and a medical research reactor, completed in 1958, was part of a new medical research facility. Two major, low-power accelerators also served Brookhaven low-energy nuclear physics and irradiation programs: a 3.5 million electron volts (MeV) Van de Graaff accelerator, and a 60-inch cyclotron. Both originally were built by industry but had to undergo major renovations by Brookhaven scientists before they became suitable for research work.

In the 1960s, BNL completed a second generation of large machines. The Alternating Gradient Synchrotron (AGS), a 33 GeV proton accelerator, was finished in 1960, and the High Flux Beam Reactor (HFBR), a research reactor providing thermal neutrons, went into operation in 1965. Again, the new large facilities involved restructuring BNL in terms of support, organization, power, and in other ways. The Brookhaven Linac Isotope Producer (BLIP) was attached to the end of the linear accelerator leading into the AGS, allowing the production of medically useful radionuclides without interfering with AGS work. Another major research facility built during the 1960s was the Tandem Van de Graaff, completed in 1970, that for many years was the world's largest electrostatic accelerator. All these machines have been continually upgraded and are world-class research facilities today.

At the end of the 1960s, Brookhaven underwent a period of major constriction, losing a large fraction of its employees. A large nuclear engineering program, oriented towards developing a liquid metal fuel reactor, was terminated at the end of the decade. During 1966 and 1967 the Laboratory acquired approximately 390 hectares adjacent to the eastern boundary, 82 hectares adjacent to the northern boundary, and 303 hectares adjacent to the southern boundary from

Suffolk County and private land owners. In 1971 the Lab's North Tract, approximately 913 hectares located on the north side of Route 25, was declared surplus Federal property and the majority was transferred to New York State for use as parkland. A small parcel of approximately 18 hectares was acquired by the Shoreham-Wading River School District. Brookhaven pursued the possibility of having a third-generation accelerator from the 1960s onwards. In the mid-1970s, it seemed as though it was about to get one -- ISABELLE, a colliding-beam accelerator. A tunnel was completed early in the next decade, but the project was terminated.

The late 1970s marked the development of a major new user facility at BNL, the National Synchrotron Light Source (NSLS) designed to exploit the use of synchrotron light as a research tool to study matter. Ground was broken in September, 1978, and, in 1982, commissioning began on Vacuum Ultraviolet (VUV) and x-ray storage rings. The NSLS received immediate, enthusiastic support from its user community, which included many major industrial firms, and in 1983, approval was received for expanding the NSLS building and adding several experimental beamlines. Today the NSLS supports over 2,500 users from more than 450 university, industrial, and government institutions on over 80 experimental beamlines.

In addition, the 1980s saw the development of heavy ion capability at the AGS, through the construction of a transfer tunnel connecting the Tandem Van de Graaff accelerators to the AGS and an AGS Booster facility.

In 1991, the Laboratory received approval for the Relativistic Heavy Ion Collider (RHIC). This world-class nuclear physics accelerator builds upon the heavy ion capability developed at the AGS and uses the facilities constructed a decade earlier for the ISABELLE project. The RHIC project is expected to be completed just after the 50th anniversary of the Laboratory's inception and again will change the programs, operations, and services at the Laboratory.

The RHIC ring, 4 km in circumference, is clearly visible from orbiting satellites, meaning that the project literally puts the Laboratory on the map for decades to come. Furthermore, about 17,000 visitors enjoy the Laboratory's Exhibit Center annually, where dynamic exhibits trace the history of Camp Upton and of the Laboratory's research accomplishments.

PHYSICAL CHARACTERISTICS

When founded in 1947, the Laboratory was considered to be located in a rather remote area, with abundant land, vegetation, and water. Laboratory activities have steadily grown, and the nearby off-site population has increased over the years. It has been the policy of the Laboratory to carefully manage the natural resources and achieve an ecologically sound balance between scientific development and environmental stewardship.

The Laboratory is located close to the geographic center of Suffolk County approximately 100 km east of New York City. It consists of 2,130 hectares, most of which is wooded. Additional details concerning current land use can be found in Section 8, "Current Land Use".

TOPOGRAPHY/GEOLOGY/HYDROGEOLOGY

The Laboratory lies in a section of the Oak-Chestnut Forest Region known as the Atlantic Coastal Plain Physiographic Province. The site is on the west rim of the shallow Peconic River watershed, which is bordered by two lines of low hills which extend east and west nearly the full length of Long Island.

The marshy areas in the northern and eastern sections of the site are part of the Peconic River headwaters. The Peconic River both recharges to, and receives water from, the ground water aquifer depending on the current hydrological condition. The site terrain is gently rolling, with elevations varying between 36.6 and 13.3 meters above sea level.

The aquifer beneath BNL is comprised of three water-bearing units: the moraine and outwash deposits, the Magothy Formation, and the Lloyd Sand Member of the Raritan Formation. These units are hydraulically connected and make up a single zone of saturation with varying physical properties extending from a depth of 13.7 m to 357 m below the land surface. Figure 4-1 shows the groundwater flow and recharge system.

As a sole-source aquifer, Long Island's groundwater resources require that a delicate balance is maintained between human use and nature. Suffolk's largest town, Brookhaven, where most of the Laboratory is located, adopted a new master plan in the last decade, based on the Long Island

Comprehensive Wastewater Management Plan, which was the first on Long Island to zone land use to preserve the aquifer.

Figure 4-1: Groundwater Flow

BIOLOGICAL INVENTORY

A Site-wide Biological Inventory was undertaken by the Laboratory from 1993 to 1994 to provide background ecological information for the site. This baseline information will be used for planning and conducting environmental restoration and identifying potential ecological changes.

The Inventory consisted of a literature review to determine the potential species present, and an extensive field study. During the field study, the presence and abundance of fish, amphibians, reptiles, birds, mammals, and plants on the BNL property were assessed. Habitats with the potential to be inhabited by endangered or threatened species received particular emphasis. Other special studies included surveys of nocturnal raptors, breeding birds, and the breeding habitat of the tiger salamander; further, studies were made of the small mammals and organisms living in the sediment in the bottom of the Peconic River and its vegetation. The wetlands were delineated.

During the wildlife survey, two endangered species protected by Federal and/or New York State law were identified. Several other animal and plant species classified as New York State Threatened or Special Concern also were found on site. Fifteen ecological communities were identified on, or adjacent to, the BNL site and were classified according to dominant species, density of vegetation, wildlife present, and the degree of human disturbance.

About 30 species of trees comprise the bulk of the wooded areas, much of it being scrub oak (*Quercus ilicifolia*) and pine (*Pinus rigida*). The development of natural vegetation has been influenced largely by land clearing, fire, flooding, and draining. The present local patterns result primarily from past fires, and most of the vegetation is secondary growth.

The Peconic River, a branch of which originates on the site, is noteworthy because two of its downstream sections are listed by New York State as either "scenic" or "recreational," and are under the jurisdiction of the New York State Department of Environmental Conservation (DEC). BNL's on-site habitat is dominated by pitch pine/oak forest. This community has the greatest number and diversity of wildlife. Because of fire suppression, this community is undergoing succession and is becoming a primarily deciduous forest on the BNL site.

FLOOD PLAINS/WETLANDS

The one-hundred-year floodplains and wetlands encompass approximately 140 hectares of the BNL site, mostly areas bordering the headwaters of Peconic River. The one-hundred-year floodplain maps of the Federal Emergency Management Agency's (FEMA's) National Flood Insurance Program indicate that in the vicinity of Relativistic Heavy Ion Collider (RHIC) the elevation of the one-hundred-year floodplain is approximately 16 meters above mean sea level. Culverts traversing the floodplain in the RHIC area can accommodate exceptional events, such as "one-hundred-year" storms. No other laboratory facility lies in this floodplain or in wetlands.

The existing Hazardous Waste Management Facility (HWMF) is located close to the wetlands. The Laboratory is constructing a new Waste Management Facility (WMF) which will be located approximately 550 meters from the wetlands and 6 meters higher in ground elevation. Waste management activities are scheduled to be relocated to this new facility in FY 97.

CLIMATE / ATMOSPHERE

The daily weather and long-term climate are influenced by the adjacent water masses, the land mass of the adjoining mainland, and the east-west orientation of Long Island. The climate is classified as coastal, being neither entirely continental nor maritime. The Laboratory, like most eastern seaboard areas, can be classified as a well-ventilated area. The prevailing ground level winds are from the southwest during the summer, from the northwest during the winter, and equally from these two directions in the spring and fall.

The Laboratory site lies within a non-attainment area for ozone. This condition focuses concern on all facilities in the region which release volatile organics and oxides of nitrogen to the atmosphere. The New York State Department of Environmental Conservation (DEC) has developed a state Implementation Plan, which supplements their air-emissions regulatory program, to resolve the non-attainment condition. The Laboratory's air emissions are regulated by the DEC and EPA, and Laboratory staff work closely with them to ensure compliance. As part of the routine environmental protection program, extensive monitoring is conducted in and around the BNL site. The results of this program are published yearly in the annual BNL Site Environmental Report.

SITE IMPROVEMENTS

At present, there are over 350 buildings with a total gross floor area of approximately 340,000 m². This includes modular buildings and trailers, permanent buildings constructed since 1947, and buildings inherited from Camp Upton. Figures 4-2 and 4-3 show the buildings and roads for the built-up area of the site. The construction of the major permanent buildings began in 1947, and they account for about 73% of the gross floor area of the Laboratory.

UTILITIES

BNL has several central utility systems, including electric power distribution, steam, chilled water, compressed air, potable water, process (non-potable) water, sanitary water, and storm water. Table 4-1 summarizes the BNL Physical Plant data, including utility systems.

TABLE 4-1

ORIGIN			STEAM UTILITY (CONT'D)		
Former Camp Upton - WWI & WWII			Use -	272155464	kg/yr
BNL started January 1, 1947			- peak	22	kg/s
Operated by Associated Universities, Inc.			Distribution - supply plus		
			condensate return	18	km
			Pressure -	862	kPa
POPULATION (1994)			WATER UTILITY		
Staff -	3576		Treatment Plant Capacity -	263	L/s
Guests/Visitors -	3500		Wells, 6 @ -	76	L/s
			Storage Tanks, 2 @ -	1152160	L
				3790000	L
WEATHER			Carbon Filters (Wells 10,11,12)	3	
Winter Average -	0.2°	C	Clearwell -	947500	L
Summer Average -	22.2°	C	Distribution System -	72	km
			Pressure-	380 to 480	kPa
SITE			SANITARY UTILITY		
Total -	2153	ha	Waste Water Treatment Facility		
Built-up area -	364	ha	Capacity -	131	L/s
Large machines -	162	ha	Use - summer	52.6	L/s
Farm, housing,			- normal	43.8	L/s
sewage plant, etc. -	81	ha	- expansion	35.1	L/s
Difference in elevations -	24	m	- emergency storage	87.6	L/s
Max ht. above sea level -	37	m	Collection System Piping -	50	km
Bounded by:	West - William Floyd Parkway		CHILLED WATER UTILITY		
	South - Long Island Expressway		Centrifugal chillers, 3 @ -	4400	kW
	East - County Parks		Steam absorption chiller -	4400	kW
	North - Private Land		Three cell cooling tower -	947	L/s
			Distribution Sys - supply&return	10	km
			Buildings served -	6	
BUILDINGS			COMPRESSED AIR UTILITY		
Perm/Temp	315	343184 m2	Compressors, 2 @ -	354	L/s
Trailers	214	8083 m2	Pressure -	862	kPa
			Distribution System -	2.4	km
ROADS & WALKS			TELECOMMUNICATIONS UTILITY		
Roads - paved	47	km	Switch capacity -	9200	lines
- unpaved	23	km	Service - lines	5200	
Sidewalks -	18	km		5350	
Firebreaks -	74	km	- jacks	1200	
Parking Slots -	3950	slots	STORM WATER SYSTEM		
Paved Areas -	34	ha	Recharged to ground		
			SPDES Discharge Points -	7	points
			Collection System -	14	km
RAILROAD			FIRE ALARM SYSTEM		
Tracks -	2.7	km	Propriety System NFPA72 Style 7		
			Capacity -	20000	points
			- in service	3800	
FENCES			SECURITY ALARM SYSTEM		
Various Types -	23	km	Classified		
			WASTE DISPOSAL		
ELECTRIC UTILITY			Putrescibles & Solid Waste -	Town Landfill	
LILCO 69 kV Feeders	2		Hazardous -	On-site management & collection for off-site disposal	
Main Substations-Total	150	kVA			
Distribution Underground -	2.4 & 13.8	kV			
Demand, Maximum	47	MW			
	64	MVA			
Use -	220000	MWh/yr			
STEAM UTILITY					
Boilers 4 @ -	11720	kW			
	11720	kW			
	52750	kW			
	36630	kW			
Fuel -	#6 oil (1%S) and #2 oil				
Feed stocks - oil storage	11370000	L			

ENVIRONMENTAL OVERVIEW

WASTE MANAGEMENT

Waste management operations include minimization, treatment, storage, and disposal. Each of these functions includes one or more of the radioactive, hazardous, mixed, or sanitary waste categories. No hazardous, radioactive, or mixed wastes currently are disposed of on the Brookhaven site. Hazardous and radioactive wastes are shipped off site for disposal at other DOE installations, or at licensed, private disposal facilities. BNL's non-hazardous solid waste is disposed of at the Brookhaven Town landfill.

Waste minimization and pollution includes operations such as recycling, recovery, and materials substitution to reduce the burden on off-site treatment, storage, and disposal facilities. The plan calls for the establishment of working groups within each BNL department and division to evaluate each waste generating process and recommend strategies for reducing waste.

WASTE WATER TREATMENT

Sanitary waste water is collected from BNL facilities and piped to the BNL Sewage Treatment Plant. This plant settles the solids, and chlorinates and filters the waste water before it is discharged to the Peconic River. The Laboratory complies with the DEC regulations for discharging waste water. BNL currently is upgrading the plant to be a state-of-the-art tertiary treatment facility; this upgrade will be completed by 1998.

The Laboratory has two lined holding ponds, each of which can hold about four days of the Laboratory's sewage effluent. The collection system detects and diverts sewage effluent into hold-up ponds if contaminants, in excess of limits, are present in the sanitary system. When waste water is diverted to the hold-up ponds, the contaminants are evaluated to determine the proper treatment methods.

HAZARDOUS WASTE MANAGEMENT

Chemical wastes generated by Laboratory operations are collected and sorted at the Hazardous Waste Management Facility (HWMF) and are prepared for shipment off-site. BNL has begun a phased project to relocate hazardous waste operations to a new, modern facility. The new Waste

Management Facility (WMF), scheduled to begin operation in FY 1997, will provide for safe, more efficient storage, handling, and repackaging of hazardous and radioactive wastes in full compliance with regulatory requirements.

Aqueous wastes with low levels of radioactivity are directed by underground piping or collected in holding tanks and then transported to the Waste Concentration Facility (WCF) where the liquid volume is reduced and radioactive solids are collected. A new filtration process technology is currently used. The purified water from the process is collected in a tank, monitored to ensure that the levels of radioactivity are safe, then the water is evaporated. Radioactive process wastes are packaged then transported off-site for treatment. This operation typically handles 275 to 375 m³ of liquid waste per year.

REFUSE DISPOSAL

In compliance with NYS law, the Laboratory's landfill was closed at the end of 1990. All the Laboratory's non-hazardous, non-recyclable refuse is transported to the Brookhaven Town landfill for disposal. A site-wide recycling program, initiated in November 1990, reduces the amount of refuse sent to the landfill and reduces disposal costs. In addition, the Laboratory is paid for each ton of white paper, computer paper, and cardboard that is recycled.

GROUND AND SURFACE WATER ASSESSMENTS

The aquifer underlying BNL has been designated as a "Sole Source Aquifer" by the EPA. All of Long Island's drinking water supply comes from groundwater. However, there are still gaps in our knowledge of the groundwater hydrogeology beneath the site, and recent studies have focused on increasing our understanding.

Rainwater penetrates the permeable soils readily, with little run off. Precipitation on Long Island averages 114 cm per year, of which 58 cm recharges to replenish the groundwater. Locally, most stream water is derived from groundwater seepage. Groundwater flow in the BNL area is influenced by three rivers (Carmans, Forge, and Peconic). In addition, BNL's activities, such as pumping and recharge, influence the water table locally.

BNL has been studying its underlying aquifer system since the early fifties. The groundwater in the BNL area moves predominantly in a southerly direction to the Great South Bay, while taking a more easterly direction in the Peconic River watershed. Although the primary orientation of groundwater flow is horizontal, the BNL site is situated in a regional recharge zone to the underlying Magothy Aquifer which creates a downward component. Groundwater velocity is estimated to range from 20 to 35 cm per day.

BNL uses, on average, 13,800,000 liters of groundwater per day to meet potable and process water needs. The water is pumped from on-site wells. Approximately 56% of the water pumped is returned to the aquifer through on-site recharge basins; about 16% is discharged into the Peconic River bed. The balance represents unaccounted-for losses through cooling towers (evaporation) and other discharges to storm drains, cesspools, and sanitary system losses.

BNL installed approximately 450 groundwater monitoring wells. They are sampled at frequencies based on their location and function. BNL's monitoring well network is being continuously enhanced by upgrading wells, abandoning outdated ones, and installing new ones. Water from these wells is analyzed for radionuclides (gross alpha, gross beta, tritium and gamma activity), metals, organics, and for other water-quality parameters. In addition, Suffolk County Department of Health Services (SCDHS) currently collects groundwater samples from selected off-site wells and gives BNL split samples for radionuclide analysis. SCDHS also periodically analyzes some off-site groundwater samples for organics and supplies BNL with data. Further details of the groundwater monitoring program are given in the annual BNL Site Environmental Report which is available to the public.

SOIL CONTAMINATION

Surface soils in certain areas of the BNL site have been contaminated by past landfill activities, material storage, research activities, and spills of oil, chemicals, or low-level radioactivity. These areas are being investigated as part of BNL's Environmental Restoration Program described in Section 7.

BNL works very hard to prevent such spills today. However, if an accidental spill occurs, the spill is immediately contained, cleaned up, and reported to the appropriate environmental agencies.

The "Site Map - Known or Suspected Contaminated Soil", Figure 4-4, shows the location of soil that has the potential or is known to be contaminated with chemical compounds and/or low-level radioactivity. Additional information about these areas can be found in the BNL Site Baseline Report which is available to the public.

Figure 4-4: Site Map - Known or Suspected Contaminated Soil

KNOWN OR SUSPECTED CONTAMINATED SOIL MAP
LEGEND
LOW LEVEL RADIOLOGICALLY CONTAMINATED SOIL
CHEMICAL SOIL CONTAMINATION

SECTION 5

BNL MISSION

WHAT WE DO

Brookhaven National Laboratory's missions support the Department of Energy's scientific and technical role in implementing the National Energy Strategy. This strategy "...calls for continued and significant investments in fundamental science and engineering research and in the associated advanced training of scientists and engineers. These investments are seen as preconditions for reaping the practical benefits of energy sciences and technology in the future." The National Energy Strategy further emphasizes that "Forefront research facilities are vital to U.S. leadership in both science and industrial research. However, they can be expensive and may require frequent upgrades to address new problems and challenges. They also must be staffed with scientists, engineers, and technicians who have solid training and who are informed about research progressing worldwide." It is Brookhaven's special competencies in these areas that define our primary missions.

Brookhaven National Laboratory has three primary missions. The first is to conceive, design, build, and operate large, complex research facilities for the benefit of the entire scientific community in a safe and environmentally sound manner. These facilities, such as particle accelerators and colliders, nuclear reactors and synchrotron storage rings, are used for fundamental scientific studies and for both basic and applied research in energy-related physical, life, and environmental sciences.

The second mission is to carry out research in basic science programs which potentially have long-term payoffs. Many of these programs employ the unique facilities mentioned above; others take advantage of the special expertise and ancillary support services and facilities at the Laboratory. The ease of engaging in collaborative efforts with outside users, from universities, industries, and other government laboratories, greatly enhances the effectiveness of the programs and encourages a wide-based use of the special facilities at Brookhaven.

The third mission is to contribute to the technology base of the nation. The Laboratory is engaged in developing new technologies and facilities, and transferring this new knowledge to the commercial sector. Brookhaven is involved in the education of scientists and engineers through a wide variety of cooperative research programs, and has other extensive educational programs covering a broad spectrum of people, reaching from elementary school through university students and faculty.

As a national resource, Brookhaven makes available, when feasible and consistent with its mission, its unique facilities and expertise to state and federal agencies and to the private sector.

NEAR-TERM GOALS

BNL PLANNING ASSUMPTIONS

In developing near-term goals, certain planning assumptions must be made. For BNL, these are the following:

- The nation will continue to have a need for a strong science and technology effort to provide the underlying base for future evolution and growth. This effort will require support for both basic and applied research.
- There will be a continuing need in many fields of science and technology for large, complex research-user facilities which will be designed and operated by the DOE laboratory complex for the entire scientific community, including universities, other governmental agencies, and industry.
- Environment, safety, and health issues (ES&H) will play an increasing role in our society and in the overall operations of the Laboratory. This will result in stronger support for the development of technologies that reduce, rectify, and/or eliminate ES&H problems. Also, it will lead to stronger and more proactive inclusion of ES&H principles in our operations.

- Energy efficiency and alternative energy sources will be a focus of great attention because of their direct bearing on our nation's productivity, competitiveness, and economic well-being.

GENERAL GOALS

The following are the general goals for BNL:

- The Laboratory has the ability to design, build, and operate leading-edge user research facilities. These facilities serve the university and industrial scientific community well in a wide variety of scientific disciplines. It is our goal to use this expertise to operate and improve existing facilities, maintaining them in state-of-the-art capability, and to create, over the next ten years, the next generation of user facilities of greater power and utility. Achieving this goal will allow the Laboratory to maintain the essential world-class research efforts that drive the performance of its facilities. In addition, other research activities will greatly profit from the close proximity of this rich mix of research tools.
- The Laboratory prides itself on the ease with which creative interdisciplinary research can be done. It is our goal to play a major role in providing the underlying science and technology for DOE's missions in basic and applied research, energy and environmental sciences, materials science, and biotechnology.
- As the changing world has fundamentally altered the U.S. posture on nuclear weapons, it is the Laboratory's goal to further develop arms control and nonproliferation technology.
- In environmental, safety, and health issues (ES&H), the Laboratory's goal is to achieve the same level of success as we have achieved in our research endeavors. The Laboratory intends to do this through a structure of effective procedures, by having trained and qualified personnel, and by continually analyzing its ES&H performance.

SPECIFIC GOALS

The specific goals for BNL are as follows:

- The Laboratory will go through a major transition in 1999 when the primary funding program changes from High Energy Physics to Nuclear Physics. This will cause a substantial change in the operating budgets in these two areas. Our goal is to accomplish this transition smoothly and preserve the excellence of both programs, each of which is unique for the nation.
- As a Multi-Program Laboratory, it is the goal of BNL to continue developing new capabilities in basic energy and life sciences.
- It is our goal to obtain operating funds at a level which optimizes use of facilities.
- An important goal is that of public education on the nature of long-term basic research. Commercial applications that may be spun-off from such research take longer to mature in the marketplace and are often only remotely connected to the original task. The Laboratory will use historical experience to defend the critical and fragile nature of basic research.
- Finally, we note that it is a challenge to keep intact the corps of specialized scientists, engineers, and other technical personnel experienced in constructing and operating large technical facilities in the face of drawn-out or delayed construction projects. It is our goal to continue to play a role in the education and training needed to preserve a national capability to build complex facilities to meet scientific, industrial, and national security needs.

SECTION 6

SITE DEMOGRAPHICS

REGIONAL OVERVIEW

Long Island is about 195 km long and 25 to 40 km wide. At its west end, Long Island is separated from Staten Island by the Narrows, from New Jersey by Upper New York Bay, and from Manhattan Island by the East River. On the north, Long Island Sound separates it from mainland Connecticut. The eastern end of Long Island splits into two peninsulas, the "forks," 50 to 65 km in length, and, on the south, barrier beaches shelter almost three-fourths of Long Island's south shore from the ocean. Long Island's shape and location contributed significantly to its past development and will be important in the future.

Approximately 6.7 million people live on Long Island; more than half live in Brooklyn and Queens. Of the remainder, 1.29 million live in Nassau County and 1.32 million in Suffolk County. Figure 6.1 shows the resident population within an 80 km radius of BNL. Since 1940, the population of the five western towns of Suffolk County (Babylon, Brookhaven, Huntington, Islip, and Smithtown) has increased from 0.15 million to 1.2 million.

Local governments and planning commissions are making strong efforts to channel growth in an orderly fashion. Various master plans have been commissioned and implemented. Park and farm lands are being purchased by local government to preserve the rural character of the Island. Zoning ordinances have been enacted to safeguard the groundwater by controlling population density.

Long Island's development into a high-technology area is aided by its geographic location and demographics. Long Island's well-educated population has provided the necessary workforce for its high-tech industry and institutions.

Figure 6-2: Land use patterns in the vicinity of the site.

Parklands, airports, and recreational and educational facilities account for about 32% of the local area; another 30% is undeveloped woodland or farms. The remaining 38% consists of areas developed or zoned for business, industry, or residential use. The area surrounding the Laboratory is still lightly settled (Figure 6-2). Proposals have been presented to the Town of Brookhaven for a planned industrial park, a shopping mall, and housing developments adjacent to the Laboratory. BNL reviews local government master plans and significant proposed development actions to assess the potential impact on the Laboratory.

LABORATORY POPULATION

The Laboratory has a total staff of approximately 3,500 regular employees. This breaks down as follows: 21% scientific personnel, 16% engineering personnel, 12% management and administrative personnel, 12% other professional personnel, 13% technicians, and 26% which includes bargaining unit employees, and all others. The scientific personnel at the Laboratory include specialists in a variety of physical and life science disciplines, reflective of the multi-disciplined research at the Laboratory. Table 6-1 summarizes the actual population and the personnel forecast based on the BNL Institutional Plan FY 1995 - FY 2000.

ECONOMIC IMPACT

With its total budget of nearly \$450 million, BNL has a significant impact on the local economy. The "ripple-effect" of the BNL budget, which considers the secondary effects of BNL spending, appears as an approximate \$1 billion contribution to the Long Island economy. As a potentially affected stakeholder, the Suffolk County Executive authorized the Suffolk County Planning Commission to undertake the study "Impact of BNL on the Long Island Economy." The report was completed and transmitted to BNL in June 1995. At the request of Suffolk County, the study was conducted by the Chief Economist of the Long Island Regional Planning Board (LIRPB). The analysis was based on the input-output model of the Long Island economy, known as the RIMS II model, commissioned and purchased by LIRPB and prepared by the Bureau of Economic Analysis of the U.S. Commerce Department. The model demonstrates the impact of BNL expenditures on L.I. output, earnings, and employment. Table 6.2 summarizes the economic findings. In addition

Table 6-1
BNL POPULATION TRENDS

FY	FTE EMPLOYEES	GUESTS ¹	FTE + GUESTS
1985	2,700	2,000	4,700
1986	2,695	2,000	4,695
1987	2,783	2,000	4,783
1988	2,740	2,000	4,740
1989	2,831	2,000	4,831
1990	2,770	2,000	4,770
1991	3,384	2,500	5,884
1992	3,443	2,500	5,943
1993	3,484	3,000	6,484
1994	3,417	3,000	6,417
1995	3,399 ²	3,200	6,599
1996	3,420 ²	3,200	6,620
1997	3,448 ²	3,300	6,748
1998	3,542 ²	3,400	6,942
1999	3,467 ²	3,500	6,967
2000	3,507 ²	3,500	7,007

1. Guest population estimates. FTE - Full-time equivalent person years
2. Estimate from the Institutional Plan FY 1995 - FY 2000.

to the economic contributions made by the BNL budget, calculated by the model, the study recognizes other economic benefits are derived from Cooperative Research and Development Agreement (CRADA) spending by both BNL (effects included in Table 6-2) and the industrial partner. The following are several key issues, as stated in the study:

- "The existence of the Brookhaven National Laboratory is clearly vital to Long Island's economic health and that of Suffolk County. BNL's expenditures, even over the course of a single year, have a discernible impact on local economic activity. These expenditures support secondary jobs in a broad array of industries."
- "The model does not fully capture BNL's influence on the Long Island economy. For example, as of 1994, there were 884 BNL retirees living on Long Island. Even at a modest

annual retirement of \$35,000 each, these retirees could inject almost \$31 million into the Long Island economy."

- "As of 1994, BNL's payrolls accounted for 27% of total Suffolk County payrolls in business services." (*Business services is a general industry category used by the economic model and includes research and testing laboratories, advertising, credit reporting, data processing, and personnel supply services.*)

Table 6-2
BNL ECONOMIC IMPACT

IMPACT PERIOD	INCREASES (IN MILLION \$) TO		INCREASE IN EMPLOYMENT
	OUTPUT	EARNINGS	
Total impact of BNL Spending of \$3.64 billion for 1984-1995	6,834	2,864	115,322
Total impact of BNL Spending of \$423.0 million in 1995	797	330	13,287

Figure 6-3, BNL Budget 1984-1995, and Figure 6-4, Procurement from L.I. Firms, represent part of the data used by the economic model to determine the economic effects of the BNL budget on the L.I. economy.

OTHER IMPACTS

In addition to the contribution BNL makes to the local economy, BNL has many other interactions with local industry, educational and scientific institutions, and surrounding communities. These types of contributions are also recognized in the Suffolk County Planning Commission study "Impact of BNL on the Long Island Economy". As an example, the conclusion of the study states the following:

Figure 6 - 3: BNL Budget, 1984 - 1995

Figure 6 - 4: Procurement from L. I. Firms 1990 - 1994

"The financial contributions of the Laboratory are complemented by its efforts to develop state-of-the-art technologies and to transfer these cutting-edge technologies to local industry. Long Island is currently in the throes of a major structural economic transition. It hopes to develop new technologies-based industries to offset job losses in the declining defense sector. The Brookhaven National Laboratory is vital to that effort."

Examples of non-direct economic impacts include the following areas:

Technology Transfer, including:

- Technical support for industry through personnel exchanges;
- Sponsorship of technical conferences;
- Small business development through cooperation with the N.Y. State Small Business Development Center;
- Participation with the Long Island Forum for Technology (LIFT).

Science and Math Education Support programs coordinated through the BNL Science Education Center and the Public Affairs Office, including:

- School District and Community College Technical Assistance;
- General Student Programs;
- Teacher Enhancement Program;
- Science and Technology Education to Minorities;

- Science Center/Science Museum Program, including open summer tours;
- Programs for Undergraduate, Graduate, and Postdoctoral Students and Faculty.

SECTION 7

ENVIRONMENTAL MANAGEMENT

OVERVIEW

BNL is located in an area where much of the nearby land is preserved in its natural state as parkland. Some areas surrounding the Laboratory have been developed or are planned for future development. Wooded buffer areas along the perimeter of the BNL property and several other large areas of the site remain in their natural state. This relatively undisturbed ecosystem contains such habitats as a mature white pine forest, an oak/pitch pine mixed upland, seasonally flooded forested wetlands, and open fields.

BNL's ecosystem management of these lands has focused on three activities: monitoring, characterization, and regulatory compliance. Monitoring includes annual sampling of the terrestrial and aquatic flora and fauna on-site and down wind-stream; monitoring of on-site emissions and effluents to the environment; and management of emissions and effluents based upon data feedback. Major characterization efforts have included a detailed vegetative species mapping, based on phytosociological relationships, along the Peconic River Corridor, completed in 1982; vegetative community mapping in 1993; wetland delineation with photo verification in 1994; and a site-wide biological inventory completed in 1994. This work was complemented by detailed analyses of the environmental matrices for metals, organics, and radioactivity. The results of this analysis are documented in the BNL Annual Site Environmental Report, which is available to the public.

Regulatory compliance involves updating and obtaining permits for hazardous waste storage areas, treated and untreated liquid, air discharges to the environment, and actions in or near wetland habitats. At present, BNL maintains, or is in the process of obtaining, over 90 separate regulatory authorizations. Before environmental authorizations are sought, the potential environmental impacts associated with any proposal under consideration are evaluated in accordance with the National Environmental Policy Act (NEPA). The NEPA process also is used to evaluate potential

impacts to the environment where no other applicable regulations may exist that govern the ecosystem potentially at risk.

Ecosystem management is an active process at BNL. Laboratory personnel are active members of the Advisory Committee, Ecology Committee, Land Use Committee, and Protected Land Use Council, established under the Long Island Pine Barrens Act of 1993. In addition, BNL personnel participate in the Peconic Estuary Reserve Program. Among the Laboratory's interests is the management of over 500 hectares of BNL property which is within the Core Preservation Area, delineated by the Pine Barrens Act. Additionally, the Peconic River on BNL's property is designated a "scenic river" under New York State's Wild, Scenic, and Recreational Rivers Act. The aquifer underlying BNL is designated a "sole source aquifer" by the U. S. Environmental Protection Agency. Maintaining the high quality of these environments is as important to the BNL mission as are its scientific accomplishments. To take a major step toward completing this mission, BNL is developing a wildlife management plan expected to be available for public comment by the fall of 1995. Additionally, the Laboratory is weighing a proposal to the Department of Energy that would designate portions of BNL as a National Environmental Research Park.

PINE BARRENS ACT

The Long Island Pine Barrens Protection Act of 1993 (the Act) amended Article 57 of the Environmental Conservation Law of the State of New York by requiring that a comprehensive management plan be developed for approximately 40,500 hectares covering parts of the towns of Brookhaven, Riverhead, Southampton, and portions of two villages in Suffolk County. The plan must be approved within specific timetables by the three affected towns. The Pine Barrens Commission has completed a draft management plan for the Long Island Pine Barrens (LIPB).

The Act defined the overall Central Pine Barrens Zone, and two types of areas within that Zone, the Core Preservation Area, and Compatible Growth Area. Within the Core Preservation Area, the principal goal is to preserve its natural state. Development, construction, and other activities therefore are limited or prohibited. Development, construction and other activities within both areas is governed by NEPA.

While it is the position of DOE that the Act confers no jurisdiction to the State of New York over the BNL site, DOE and BNL have been providing technical support to the Pine Barrens Commission. In addition, the Laboratory has agreed to utilize the Long Island Pine Barrens Management Plan as a guide in site development and future use planning for the BNL site.

The Long Island Pine Barrens Management Plan has categorized areas of the BNL site as Core Preservation Area and Compatible Growth Areas. The Compatible Growth Area encompasses primarily the central portion of the site where most of the buildings and structures currently exist.

ENVIRONMENTAL PERMITTING

Brookhaven National Laboratory extensively monitors the environment in and around the BNL site. This environmental program is required by DOE policy and various environmental permits. It is an effort to assess and minimize the impact of Laboratory operations on the environment and to demonstrate compliance with applicable environmental laws. The results of this program are published yearly in the annual BNL Site Environmental Report.

There are a variety of processes and facilities at BNL which operate under special conditions of permits and licenses issued by either the New York State Department of Environmental Conservation (DEC) or the U.S. Environmental Protection Agency (EPA). Most of these are Certificates to Operate, issued by the DEC, for air-emission sources from processes such as welding, machining, degreasing, painting, blueprint machines, and industrial boilers. The majority of these sources are considered to be minor air emission sources; however, there are four boilers at the BNL Central Steam Facility (CSF) which the DEC considers to be major sources. The Laboratory also has authorization from EPA to operate seven facilities which emit low levels of radionuclides (within permitted requirements) to the atmosphere.

The BNL CSF supplies steam for heating and cooling to all major areas of the Laboratory through an underground distribution system. The BNL Major Petroleum Facility (MPF) is the storage area for the fuels used at the CSF and operates under a license issued by the DEC. All major petroleum facilities are required to install groundwater monitoring wells. The license has general stipulations which include regularly testing groundwater monitoring wells for floating and dissolved products.

Tests for floating products are done monthly by BNL; however, testing for dissolved products is carried out twice a year and must to be analyzed by a DEC certified laboratory. An additional condition of the license is that the Laboratory must prepare and periodically update a Spill Prevention, Control, and Countermeasures (SPCC) Plan. This document describes the methods, mechanisms, and equipment available to address and control a spill at this facility.

Brookhaven National Laboratory operates its own Sewage Treatment Plant (STP) which typically receives approximately 4,000,000 liters per day of sanitary and process waste waters discharged from BNL operations. The effluent from this plant discharges to the Peconic River and is regulated by a State Pollutant Discharge Elimination System (SPDES) Permit issued by the DEC. This permit specifies monitoring requirements, the results from which are compared to effluent limitations and are reported monthly to the DEC.

Low-level radioactive, hazardous, and mixed wastes generated at BNL are transported to the onsite Hazardous Waste Management Facility (HWMF) for processing, storage, packaging, and preparation before offsite disposal. The HWMF has areas dedicated to the safe storage of each type of waste. In addition, all documentation on waste tracking is maintained at the HWMF. This facility operates under a Permit issued by the DEC. The Laboratory will shortly begin constructing a new state-of-the art Waste Management Facility (WMF).

In addition, the Laboratory currently has approximately 225 storage tanks (facilities) registered with the Suffolk County Department of Health Services (SCDHS). Eighteen of them, used primarily to store water-treatment chemicals, also are registered with the DEC under their Hazardous Substance Bulk Storage requirements.

RCRA/CERCLA ACTIVITIES

Brookhaven National Laboratory was included on the EPA's National Priorities List in November 1989. This is a list of hazardous waste sites that are considered high priority for investigation and cleanup, as appropriate, under the federal Superfund Program officially known as the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

In 1991, BNL established the Office of Environmental Restoration to oversee the Laboratory's

Superfund activities. Its responsibility is to manage the remediation of areas of known contamination, as well as identify, mitigate, and remediate other areas of potential contamination.

An Interagency Agreement (IAG) was negotiated and signed in February 1992 by the DOE, EPA, and the DEC. The IAG insures compliance with CERCLA, the corrective action requirement of the Resource Conservation and Recovery Act (RCRA), the National Environmental Policy Act (NEPA), as well as the corresponding New York State regulations. In particular, the IAG is intended to insure that environmental impacts associated with past and present activities at BNL are thoroughly investigated so that appropriate actions for cleaning up the site can be formulated, assessed, and implemented.

ENVIRONMENTAL RESTORATION ACTIVITIES

There are currently twenty-eight "Areas of Concern" (AOCs) at the BNL site to be addressed through an IAG. The AOCs consist of active facilities, such as the Sewage Treatment Plant (STP), the Hazardous Waste Management Facility (HWMF), and potable wells; and inactive facilities, such as two former landfills, cesspools, and radioactive waste storage tanks. The AOCs are grouped and prioritized into Operable Units (OUs, Figure 7-1) and Removal Actions (RAs). Based on the current program baseline, project cleanup activities are expected to extend to the year 2013. However, this schedule could be affected by changes in the funding profile and the scope of specific remediation actions selected as a result of the ongoing Remedial Investigation/Feasibility Study (RI/FS) process.

BNL and Suffolk County Department of Health Services established an intensive groundwater monitoring program that regularly collects samples from selected on-site monitoring wells and off-site residential wells. Since 1985, concentrations of tritium off-site have been below state drinking-water standards.

Removal Actions

Removal Actions (RAs) have the highest priority in environmental restoration. Two former RAs have been closed-out; six others are in varying stages of completion. Current RAs include:

- Removal of three above-ground ("D" Waste) and thirteen underground storage tanks

- containing radioactive and hazardous wastes (RAs I and II);
- Decontamination of cesspools at twenty-four Laboratory buildings (RA III);
- Treatment of groundwater associated with an earlier Spray Aeration Project in the southern portion of the site (RA V);
- Cleanup of former landfills and associated disposal areas within Operable Unit I (RA VI);
- Remediation of soils and/or groundwater contaminated with volatile organic compounds (VOCs) (RA VIII).

Operable Units

Restoration activities at each of the five OUs are governed by a regulatory process dictated by the IAG. The process involves characterizing and evaluating potential environmental problems, selecting and implementing a remediation strategy, and follow-up environmental monitoring. All the OUs currently are in the characterization/evaluation phase. Over four hundred monitoring wells are now in place to monitor possible groundwater contamination and the effectiveness of cleanup activities.

Operable Unit I/VI, which encompasses the southeastern quarter of BNL, consists of several AOCs ranging from waste disposal areas to accidental spill areas. The HWMF has been contaminated with both low-level radioactive material and hazardous materials as a result of accidental spills and past operations. The older landfill area was used by both the U.S. Army and BNL as a waste disposal area for most of this century. This area also includes disposal areas for chemical bottles, glassware, and other laboratory wastes. Low-level volatile organic chemicals and tritium concentrations (below drinking water standards) have been detected in wells off-site. These concentrations have been attributed, in part, to releases from the HWMF and the second landfill area. No organic compounds have been detected in the groundwater at the Upland Recharge area. However, ethylene dibromide (EDB) has been found at levels above NYS Drinking Water Standards downgradient from this OU, indicating that groundwater contamination may have occurred as the result of an Upland Recharge Experiment in the mid- to late-1970s.

Operable Unit II/VII encompasses the central or core area of BNL. It consists of various areas where low-level radioactive materials are or were handled and stored. Facilities associated with OU II/VII include the Waste Concentration Facility, scrapyards for steel from the Alternating

Gradient Synchrotron (AGS), a former test area adjacent to the Low Mass Criticality Facility, and various areas where soil is contaminated with low levels of radioactivity.

Operable Unit III focuses on known or suspected groundwater contamination from waste disposal, accidental spills, and past routine releases in areas not included in the other OUs. Past practices may have resulted in groundwater contamination by organic materials in the vicinity of the Paint Shop, near the Physics Department, and at the former site of a chemistry laboratory. Accidental spills and leaks of low-level radioactive materials have occurred near Building 830, in a wetland area north of the Linear Accelerator, and at the former firehouse location. Spills of oils and solvents have contaminated soils in the vicinity of the heavy machine shop. Past storage of hazardous or low-level radioactive materials in drums and above-ground and underground storage tanks may have resulted in accidental releases to soils in several BNL locations. Some BNL supply wells have shown low concentrations of organic compounds. Carbon filtration systems have been installed on several of these wells, which remain in service, to remove these compounds. Four wells have been taken out of service.

Operable Unit IV is located in the east-central portion of BNL. It includes the Central Steam Facility, where fuel spills have occurred, and the Reclamation Facility (Building 650 sump and outfall)), a radiological decontamination area. Soil and groundwater at the spill areas were found to be contaminated with Volatile Organic Compounds (VOC's). Soil in the Building 650 sump and outfall areas were found to be radiologically contaminated.

Operable Unit V encompasses the northeastern portion of BNL. It focuses on the Sewage Treatment Plant, which is currently being upgraded. After primary treatment (clarifying and filtering), the STP discharges into an intermittent stream which forms the headwaters of the Peconic River. There also is a Satellite Disposal Area which was used to dispose of unknown chemicals and leaking gas cylinders in the 1960s. Low-level tritium concentrations have been detected in wells offsite which may be due to releases from the STP.

 

LEGEND

OU I/VI		Waste Management Areas, Landfills, and Upland Recharge
OU II/VII		Alternating Gradient Synchrotron Scrapyard and Aerial Survey
		Cesspools, Storage Tanks, Dry Wells (may be multiples)
OU III		Potable and Supply Wells and Spills
OU IV		Central Steam Facility
OU V		Sewage Treatment Plant

Figure 7-1: Operable Units

SECTION 8

CURRENT LAND USES

The current Laboratory site development has been influenced by the buildings and utilities inherited from the former Camp Upton. The general location and arrangement of the roads, buildings, and utilities are a legacy of the former army base. The physical plant has been gradually upgraded over the last 48 years, but many of the original Army elements are still in use and will continue to be accommodated in future planning.

To the north and west of BNL, the area is largely wooded, privately owned, and zoned for residential development. Within the Laboratory, there are no plans to further develop land in the west area of the BNL site. The area between Upton Road, William Floyd Parkway, and Princeton Avenue is planned to be kept as a buffer zone with forest and grassy areas. Currently, the anticipated expansion of major Laboratory buildings is to the north. BNL's holdings to the east are primarily woodlands and wetlands and plans are to leave them in their natural state for the foreseeable future.

The site covers 2,130 hectares, with most of its principal facilities located near the center of the site. The developed area is approximately 670 hectares of which about 202 hectares were originally developed for Army use. Of the remaining, 81 hectares are occupied by various large specialized research facilities. Outlying facilities occupy about 222 hectares; these include the sewage treatment plant, research agricultural fields, housing, and fire breaks. The balance of the site is largely wooded.

At present, there are over 350 buildings in use with a total gross floor area of approximately 340,000 square meters. Permanent buildings constructed since 1947 account for about 75% of the floor space of the Laboratory. There is a 50-50 mix of concrete-block masonry and wood structures, which either will continue to be used, be demolished, or be modified for other functions. An additional 5%, approximately 16,550 m², is comprised of World War II wood structures and wood frame postwar additions, which currently are being used for housing. Other building uses

include the following:

- High-bay industrial type facilities with overhead cranes;
- Research laboratories including biomedical, chemical, physics, and laser;
- Offices;
- Light manufacturing, including machine shops and craft shops;
- Commercial facilities, including a library, post office, bank, and gas station; and
- Recreational facilities, including tennis courts, swimming pool, and gymnasium.

The total road system consists of 46 km of paved roads and 23 km of dirt and gravel roads. There are 95 paved service areas and parking lots of various capacities with a total area of over 33.5 hectares.

The NYS Office of Parks, Recreation & Historical Preservation surveyed the site for historically significant areas. Three areas of the site were recommended for preservation (Figure 8-1); the old Graphite Reactor Building; the old Cosmotron enclosure (Building 902); and a small area of World War I trenches (approximately 30 meters by 30 meters). The laboratory will consult with this office for any future proposals that will affect these three area.

The DOE Future Land Use process categorizes current land use into the following categories:

- Industrial/commercial - e.g., research and development facilities, offices, manufacturing plants, rail yards, staging areas, power plants, utility systems, and waste management facilities;
- Residential - e.g., permanent and temporary housing, dormitories;
- Agricultural - e.g., farming, grazing, and aquaculture;
- Recreational - including passive and active uses;
- Native American - including traditional, cultural, and religious uses;
- Open space/wilderness - including protected wildlife and critical habitats, scenic vistas.

Of these potential six categories, four were considered applicable for the BNL site; open space, industrial/commercial, agricultural, and residential. Figure 8-2 shows the current land uses of the BNL site "zoned" into these four categories..

Figure 8-1: Historically Significant Sites

Open Space

Open space encompasses approximately 75% of the site area, which is mostly in its natural state with the exception of fire breaks, utilities' right of ways, recreation fields, and environmental monitoring wells and stations. This area includes floodplains and wetlands. These floodplain areas border the headwaters of the Peconic River in the northern area of the site, while the wetlands are predominantly in the eastern section of the site. The Laboratory facilities, with the exception of portions of the RHIC ring, do not encroach on the one-hundred-year floodplains or wetlands. Some 30 species of mammals and 180 species of birds have been recorded in the open spaces. The open space surrounding the developed central area of the site forms a buffer zone for the industrial/commercial land use areas.

Industrial/Commercial

The four designated national user facilities--the Alternating Gradient Synchrotron (AGS), National Synchrotron Light Source (NSLS), Scanning Transmission Electron Microscope (STEM), and the High Flux Beam Reactor (HFBR) serve the scientific user community from both the United States and abroad and are currently the centerpieces of the industrial/commercial land use area. The Relativistic Heavy Ion Collider (RHIC), now under construction, will be an additional unique national user facility within this land use category. Approximately 3 hectares of Laboratory site is leased to the U.S. Department of Commerce for the NEXRAD weather radar facilities. These facilities are part of a National Weather Forecasting Network operated by the National Oceanic and Atmospheric Administration (NOAA). Other facilities housing nine scientific departments, four scientific support divisions, and thirteen support divisions are also within this industrial/commercial area. With the exception of the Sewage Treatment Plant and the Hazardous Waste Management Facility (to be relocated), the industrial/commercial facilities form the developed central area of the site.

The majority of the Laboratory's buildings are located in the industrial/commercial area. At present, 62 wooden buildings and over 225 trailers provide temporary space. These trailers and wooden buildings are planned to be replaced in the future by permanent facilities. Permanent buildings have a total floor area of about 255,000 m² and an average age of 25 years. The existing facilities of the site's core area can broadly be characterized into four functional zones: support services, research machines, physical sciences laboratories, and life sciences laboratories. This functional layout was influenced by the layout of the basic infrastructure, utilities, and other services.

Figure 8-2: Current Land Use Map

The initial infrastructure and utility systems supporting the industrial/commercial functions were installed by the United States Army as part of Camp Upton. Since 1947, the Laboratory has made extensive additions and has modernized the systems to meet the needs of the expanding and changing research programs. The utility systems consist of steam, chilled water, compressed air, potable and process water, sanitary and storm wastewater, electric power, and telecommunications.

Agricultural

Approximately 28 hectares of the site are used for growing crops for biological research. Currently, these fields are used for growing corn; however, other crops have been grown in the past and are likely to be grown in the future. They are located in the eastern area of the site and are surrounded by natural vegetation and open space.

Residential

The Laboratory faces increasing demands to accommodate both U.S. and foreign users, visitors, and other staff with temporary appointments at the Laboratory. The housing inventory, largely inherited from the Army, is composed of summer cottages, mobile homes, apartments, efficiencies, guest rooms, dormitory rooms, and houses. Approximately 69 hectares are designated for this purpose. The 19 buildings used for apartments, four dormitory structures and the guest rooms building are Army buildings converted for residential use. The bulk of this residential area lies in the southwest segment of the site. A natural growth of scrub oak and pine surrounds the residential complex which consists of the apartment area, cottages, efficiencies, and BNL's child care facility. The growth in research and education programs and conference activity continues to increase the need for additional housing and conference facilities.

SECTION 9

FUTURE LAND USES

BNL MASTER PLAN

The Laboratory has in place a coordinated, long-range (20 year) planning process which identifies future programming and space requirements. Scientific initiatives and infrastructure requirements are identified in the BNL Institutional Plan and the BNL Site Development Plan. Specific areas of the site have been designated and are held in reserve for future programmatic and infrastructure development initiatives. Planning efforts aim to optimize the physical plant to support the needs of BNL as a forefront scientific research institution. The planning process addresses the need for new facilities to meet emerging research needs while making maximum use of existing facilities and assets. Planning for future land use is accomplished through meetings, program reviews, interaction with DOE, and contributions from Laboratory staff, collaborators, and visitors.

The Laboratory will continue to fulfill its mission of constructing and operating large experimental facilities that encourage the participation and support of the outside user communities (scientists and engineers from the United States and abroad) to maintain U.S.'s pre-eminence in basic research. The planned research facilities, when built, will substantially increase the number of visitors and users.

It is BNL policy to minimize the generation of hazardous and radioactive waste and potential impacts of associated operations on the environment. The Laboratory complies with all applicable Federal, State, and local laws; however, activities which occurred in the 1940s, 1950s and 1960s created several areas of environmental concern that are being addressed. The process of systematically identifying and characterizing these areas for remedial actions is ongoing and is described further in Section 7. These actions, which are part of the overall Environmental Restoration program, will be influenced by the proposed future land uses for the site. On-going and planned activities in the area of Environmental Safety and Health (ES&H) are prioritized and documented in the Laboratory's ES&H 5-Year Plan. This plan includes activities and resource requirements needed to ensure the safety and health of BNL's workers and the public and

minimize the environmental impact of Laboratory operations. It has also been the Laboratory's policy to minimize the impact of development on the environment. The Laboratory's planning efforts also consider the goals of the Pine Barrens Plan, the Special Groundwater Protection Plan, and the L.I. Comprehensive Wastewater Management Plan.

The Laboratory plans to preserve as much area as possible in its natural state while carrying out its mission to support the Department of Energy through leading-edge user research facilities, research and technology development, educational efforts, and industrial involvement. Several stakeholders have suggested that the Laboratory increase its efforts in the areas of environmental and ecological research. Present open areas including those areas contained in the wetlands and within the floodplain may provide ideal areas for such research.

The BNL site will continue to accommodate the scientific missions of the Laboratory as currently envisioned for at least the next twenty years. However, due to the Laboratory's quest for world-changing discoveries, the outcome of on-going basic research can not be predicted. The future development of the site is based on the continued need for large, complex research user facilities in a variety of fields of science and technology. The Laboratory must continue to improve existing facilities to maintain state-of-the-art capability and is planning to create, during the next decade, the next generation of user facilities of even greater scientific capability and utility.

Economics, reliability, quality, and quantity of the existing assets are taken into account to determine the need for additional facilities and to revitalize existing assets. Facilities required to house proposed and planned scientific initiatives will increase the Laboratory's developed areas.

With the commissioning of the Relativistic Heavy Ion Collider (RHIC), the Laboratory will be starting an exciting program of exploring new frontiers of fundamental matter. Brookhaven intends to be the premier nuclear physics facility into the first decade of the next century and continue as a leader in nuclear physics research through expansion of the current nuclear physics research program. The infrastructure must support the new research initiatives. Rehabilitation of most utilities and some increases in plant capacity are planned. The extension of utilities and roads into the planned research facilities in the northern and southern portions of the site is anticipated.

Figures 9-1 and 9-2 represent two possible Laboratory's growth scenarios over the next 20 years. Again, areas have been "zoned" as industrial/commercial, open space, agricultural, and residential, in accordance with the DOE guidance. There is a strong probability that this land use plan will have to be modified as the proposed research initiatives are further refined and new ones are initiated.

Open Space

Open space, which includes the undeveloped area may be reduced by up to 20% due to construction of proposed scientific machines including future RHIC experimental support facilities. BNL is studying and has conceptualized two significant scientific projects which, if ever built, would reduce open space. The two projects are a linear accelerator (Figure 9-1) and a muon-muon collider (Figure 9-2) for which BNL is now studying the scientific feasibility. No construction funding has been yet requested for either project. BNL is currently seeking funding for the Long Base Neutrino Oscillation Experiment. This project includes the construction of two 4550 m³ tanks and support structures which will each take up approximately 1 hectare of currently undeveloped area in the northeast portion of the site. All remaining undeveloped areas are planned to remain in their natural state with the exception of additional environmental monitoring wells on the site perimeter. The floodplain areas are not likely to be affected, unless these areas are required in support of one of the larger conceptualized accelerators or colliders. In the unlikely event that the floodplain area must be encroached, provisions to minimize impacts and accommodate exceptional events such as a "One-Hundred-Year" storm will be made.

Several stakeholders have indicated that some BNL open space could be used for long and short term ecological research. While BNL does not have or expect any funding for this type of research, nor have they set aside any specific areas, BNL would consider proposals from recognized external organizations to perform such research. However, such proposals would have to be fully funded and would be subject to validation by the BNL peer review process.

Industrial/Commercial

In the Industrial/Commercial Land Use category, totaling 805 hectares, specific areas are held in reserve for future programmatic and site development initiatives. Details on these areas are provided in the Site Development Plan. In general, the areas to the north and northeast of the central developed area may be developed to contain future major machines. The Laboratory plans

to establish individual "program-centered" departmental and divisional complexes. The majority of these complexes will be accommodated in the currently developed area containing the industrial/commercial facilities. However, the actual area needed will be contingent upon which proposed initiatives are realized within this time period.

By the turn of the century, RHIC will be operating as the fifth major national user facility at BNL and the center for BNL accelerator activity. New proposals for additional experiments, equipment, and facilities to extend the physics capabilities, will be presented to DOE. It is anticipated that additional industrial/commercial type facilities will be required for these new endeavors. The site area east of the RHIC ring is designated for this future program expansion.

Several undeveloped areas of the site may be used to accommodate a linear accelerator or a muon-muon collider. The Laboratory continually studies the feasibility of constructing scientific machines which would push the energy frontier beyond what is available in existing particle physics facilities. Similar work designing higher energy linear electron-positron colliders is underway at BNL, Stanford Linear Accelerator (SLAC) in California, and in Japan, Europe, and Russia. If these types of machines were built in the United States, Brookhaven would be a candidate location. The accelerator or collider would be built in a tunnel, possibly using bored tunnel construction, so as to minimize the impact at the surface. The areas considered for locating the accelerator or collider and associated facilities are included in the maps depicting the expanded area of Industrial/Commercial Land Use.

Agriculture

The approximate 28 hectares currently used for growing crops for biological research will most likely remain as agricultural fields for use by the BNL Biology Department. However, no expansion of this use is anticipated.

Residential

New initiatives and major activities in scientific research, technology development, and knowledge transfer will bring many additional visitors, collaborators, students, and industrial users to the site. Housing is a valuable asset for our success in accommodating the user community for short periods of time. The Laboratory anticipates nominal growth in the housing inventory on site. The

current housing area in the southwest area of the site might be expanded to accommodate this growth. Adjacent cleared areas appear adequate to accommodate this need.

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Figure 9-1: Future Land Use Map, BNL Master Plan 2014 - Alternate "A", Linear Accelerator

Figure 9-2: Future Land Use Map, BNL Master Plan 2014 - Alternate "B", Muon-Muon Collider

SECTION 10

FUTURE LAND USES

POST-CLOSURE

The overwhelming response of the stakeholders (see Section 3 for list) has been that BNL should remain an operating national laboratory. The community-at-large has stated its strong support for BNL and its sense of BNL's importance to the local communities, Long Island, and the nation. This "post-closure" scenario evaluates possible potential land uses of the site if BNL were to cease operating as a national laboratory.

The most critical issue for the "post-BNL" evaluation would be the timing of the postulated closure and the level of development of the site at that time. BNL continues to work toward furthering scientific knowledge, improving existing facilities, and creating next-generation user facilities. The important factors to be considered are the time span for winding down ongoing operations, time and resources required for any further remedial actions, and for identification of facilities which would be mothballed due to economic considerations. There is no precise method by which we can foresee the level of development of the site at the indeterminate closure time. However, reasonable assumptions can be made based on our current knowledge and master planning.

When operations cease at BNL, the process of evaluating assets will be initiated. With the exception of large specific-use research machines, the remainder of the facilities could be turned over to another agency or to private sector developers for conventional uses. Considering the historic use of the remaining facilities, the most appropriate future use would seem to be a continuation of scientific research. However, with modifications (some of which could be major), facilities could be converted to industrial/commercial or light manufacturing uses.

For continued scientific use, the large research machines, due to their uniqueness and high operating costs, would have to be "adopted" by an industry- or university-sponsored consortium. Depending on the desired level of decommissioning and decontamination, cost-effective

remediation technology for accelerators and reactors may not be available. For the post-closure scenario, it is presumed that there may be research machines that remain inactive after closure. These machines would be safely mothballed until technology is developed to economically remove and/or remediate them. Mothballing the reactors might require that some support structures are left in place, and that some level of protection is provided.

The RHIC/AGS Complex, proposed linear accelerator, and proposed muon-muon collider would be the most significant machines affecting future real-estate use. The RHIC/AGS rings with their significant tunnels and earth and concrete shielding could be left intact. Vegetation would grow over the tunnels, allowing this area to return to its natural state. The proposed colliders, which if built with bored-tunnel construction, might have had only minimal impact on surface habitation. Thus, mothballing these facilities in place would not have any significant adverse effect on the surface vegetation or groundwater. However, based on the level of remaining activation and contamination, some physical protection might have to be provided.

Figure 10-1 depicts BNL's initial vision of Future Land Use (post-closure) of the BNL site as modified to reflect stakeholder input. Again, land use areas are "zoned" as Open Space; Industrial/Commercial; Recreational; and Residential.

Open Space

With the exception of some environmental monitoring wells which would be required for several years past the post-closure date, the open space areas would remain as such. The eastern portion of the RHIC site, developed to support the RHIC programs, could be restored to its natural state through a restoration program. This program also could include the RHIC ring and the agriculture field. (Much of the wooded area of the BNL site was reforested after World War I during the Great Depression.)

Open space areas could be used for passive recreation, environmental studies, hiking or greenbelt trails, limited recreation, canoeing the navigable portions of the Peconic River, or preserved as ecologically sensitive areas. These areas also could serve as areas to study reforestation.

Figure 10-1: Future Land Use Map, Post-Closure Scenario

Industrial/Commercial

The core area will have usable facilities which might be suitable for offices, and chemistry, biology, clinical, electronic, and applied-sciences laboratories. The infrastructure supporting these facilities will sustain their continued use. However, past experience from similar situations on Long Island indicates that there may be only marginal outside interest in BNL's facilities, due to the decline of manufacturing on Long Island. This situation was demonstrated with the closing of the Mitchell Field in Uniondale, the Fairchild Aviation facility in Farmingdale, and more recently, with the on-going conversion of the Grumman Calverton and Bethpage sites. From this past experience, various stakeholders suggested that existing outdated structures might have to be torn down and new structures rebuilt to the specifications of the potential users.

An important consideration for any proposed future use of the site as a non-federal installation would be compliance with the Pine Barrens Act. This Act would regulate future development by non-federal entities in the "Core Preservation Area." The area currently identified as industrial/commercial use lies within the "Compatible Use Area" and thus, could allow required modifications or re-development for the proposed future uses. In addition, rights asserted by local Town governments through the Dongan Patent may impact future land uses.

The following are suggestions for industrial/commercial reuses of the BNL site, all of which are generally compatible with the general land use categorization:

- As a bulk-freight transfer station using the current BNL rail siding;
- As a site for a Suffolk County Police substation which might be needed if the proposed commercial development on William Floyd Parkway is built;
- As a connection road between Route 25 and North Street (near the Long Island Expressway) via a new north/south roadway along the BNL eastern fire break and the LILCO right-of-way. (This would have some impact on current open space).

Educational institutions, such as the State University of New York at Stony Brook, may have an interest in taking over all or part of the industrial/commercial complex. The general consensus of the participants in the Future Land Use process is that this type of land use would be appropriate. Other suggested educational/cultural/governmental related future uses, all of which are consistent

with the general land use categorization are:

- To establish a museum complex like the Smithsonian or the Science Museum in Chicago to promote tourism in the area. Discussion included the possibility of the L.I. Museum of Science using this site for expansion to the east end of Long Island.
- To use BNL facilities for educational research. There is the possibility of expanding New York City university campuses to Long Island locations or making this a graduate center for a consortium of schools. The resources of various colleges and universities that would like to expand campuses on Eastern Long Island could be combined on site.
- To reuse parts of the site for on-site housing for local colleges that do not have room for expansion.
- To make the site a cultural/educational center where senior citizens and interested individuals could attend retreats, take continuing education courses, and tour Long Island attractions.
- To privatize the research facilities so that corporations pay to use equipment, such as a biomedical research facility, or a "Cold Spring Harbor Laboratory East."
- To maintain the boundaries and make the site a small village, so that control is kept locally and the site is not broken up into smaller parcels.
- To possibly re-use the site for a Town of Brookhaven "Town Center."
- To reuse facilities such as the firing range, tactical training facility, swimming pool, and other areas by federal and local law enforcement agencies for firearms qualification, emergency services, SCUBA, and crowd control training.

Recreational

The areas indicated, totaling approximately 145 hectares, should be largely in their natural state with the exception of the land which might be developed for the proposed linear accelerator or muon-muon collider facilities. The area to the south will be easily accessible from two major highways--the Long Island Expressway bordering on the south, and the William Floyd Parkway on the west. Portions of this area could be used for active recreation, such as a golf course or hiking trails. The area shown to the North is shown in response to some stakeholder desires to provide an active recreation area to support neighboring residential areas. The area indicated in the south east quadrant of the site consists of a current site active recreational area (not currently classified

as recreation as it is not open to the public) and former landfill areas. There is precedent on Long Island to convert these types of areas to public use active recreation areas. However, some stakeholders insist that current undeveloped areas remain for conservation or passive recreational use with no expansion to active uses. As these are conflicting views, environmental concerns will have to be weighed against conflicting desires by the authority having control of the site at that time.

Residential

Based on an assessment of the suitability for continued use, future uses for the housing facilities could be sought. One possible reuse, suggested by stakeholders, is to re-use the existing housing for the elderly. This type of re-use could be supported by the continued use of a portion of the existing medical facilities which are located in the proposed Industrial/Commercial area.

APPENDIX A

LIST OF ACRONYMS

AGS	Alternating Gradient Synchrotron
AOC	Area of Concern
BGRR	Brookhaven Graphite Research Reactor
BLIP	Brookhaven Linac Isotope Producer
BNL	Brookhaven National Laboratory
BWIS	Brookhaven Women In Science
CAAA	Clean Air Act Amendments of 1990
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CRADA	Cooperative Research and Development Agreement
CSF	BNL Central Steam Facility
DEC	New York State Department of Environmental Conservation
DOE	U.S. Department of Energy
EDB	Ethylene Dibromide
EPA	U.S. Environmental Protection Agency
ES&H	Environment, Safety, and Health
FEMA	Federal Emergency Management Agency
HFBR	High Flux Beam Reactor
HWMF	Hazardous Waste Management Facility
IAG	Interagency Agreement
IBEW	International Brotherhood of Electrical Workers Union Local #2230
LIFT	Long Island Forum for Technology
LIGU	Long Island Guards Union Local #37
LIPB	Long Island Pine Barrens
LIRPB	Long Island Regional Planning Board
MPF	BNL Major Petroleum Facility
NEPA	National Environmental Policy Act
NOAA	National Oceanic and Atmospheric Administration
NSLS	National Synchrotron Light Source
OCAW	Oil, Chemical & Atomic Workers Union Local #8-431
OU	Operable Unit
RA	Removal Action
RCRA	Resource Conservation and Recovery Act
RHIC	Relativistic Heavy Ion Collider
SCDHS	Suffolk County Department of Health Services
SLAC	Stanford Linear Accelerator
SPCC	Spill Prevention, Control, and Countermeasures Plan
SPDES	State Pollutant Discharge Elimination System
STEM	Scanning Transmission Electron Microscope
STP	Sewage Treatment Plant
VOCs	Volatile Organic Compounds
VUV	Vacuum Ultraviolet
WCF	Waste Concentration Facility
WMF	Waste Management Facility

APPENDIX B

SUMMARY OF STAKEHOLDER COMMENTS

The following represents significant comments by stakeholders extracted from both written comments and those made at various meetings during the Future Land Use process. Comments are categorized into general comments and comments pertaining to the four Land Use categories used in the plan which are applicable to BNL. Where similar comments were made by multiple stakeholders, they were grouped together.

General

- Rocky Point Rotary
BNL should consider input from small business to balance input from other interest groups.
- NYS Office of Parks, Recreation and Historic Preservation
The BNL site should be surveyed (post-BNL) for historically significant facilities.
- Central Pine Barrens Advisory Committee
Town of Brookhaven, Department of Planning, Environment & Development
A site-specific advisory board should be established.
- Brookhaven Village Association, Inc
BNL land should be retained in federal ownership to avoid shorter term trends as exhibited by local government.
- Town of Brookhaven, Department of Planning, Environment & Development
Add reference to the Dongan Patent of 1686.

Open Space

- Town of Brookhaven, Department of Planning, Environment & Development
BNL should develop performance standards to ensure the protection of wildlife, vegetation, cultural and historical resources. BNL should conform to local land use regulations, including those of the Town of Brookhaven.

BNL should incorporate recommendations from local Land Use Plans into the BNL Land Use Plan.

BNL should create zoning/land use categories which reflect the types of categories generally used by municipal planners.

BNL should conform to Article 57 - Long Island Pine Barrens Act

BNL should consider restoring or re-creating some wildlife habitats or significant vegetational communities or wetlands areas which may have been damaged or destroyed by past Laboratory activities.

BNL should preserve ecologically sensitive lands in the Core Area and Compatible Growth Areas, including wetlands areas, significant habitat areas, and locations containing either federal or state endangered, threatened, and special-concern species.

BNL should make a stronger commitment to designating parts of the site as long-term ecological research areas.

- Wading River Civic Association
Ridge Civic Association
Future Land Use Workshop, Working Group on Environmental & Ecological Preservation
Civic Association Roundtable Meeting
Post-BNL, as much land as possible should be donated to the Pine Barrens Preserve and/or used as an ecology park.
- Central Pine Barrens Advisory Committee
Civic Association Roundtable Meeting
BNL should designate a portion of the site as a National Environmental Research Park.
- East Yaphank Civic Association
Future Land Use Workshop, Working Group on Environmental & Ecological Preservation
Town of Brookhaven, Department of Planning, Environment & Development
Long Island Regional Planning Board
NYS Department of Environmental Conservation
The primary use of underdeveloped areas should be for conservation and passive recreation.
- Future Land Use Workshop, Working Group on Environmental & Ecological Preservation
The proposed Linear Accelerator would be a threat to sensitive areas of the BNL site.

Future development at the Laboratory should try to minimize the fragmentation of sensitive areas.

Areas to the eastern portion of the BNL site including the Peconic River headwaters are particularly ecologically sensitive.
- Long Island Regional Planning Board
NYS Department of Environmental Conservation
Undeveloped portions of the property should be turned over to the State of N.Y. or Suffolk County and retained as part of the Pine Barrens Comprehensive Planning effort.
- Pine Barrens Commission
The Nature Conservancy, Long Island Chapter
BNL should retain the integrity of open spaces, especially the undeveloped areas including the northeast and southwest portions of the site.

- Central Pine Barrens Advisory Committee
All spaces designated for open space should have specific uses designated.
- Civic Association Roundtable Meeting
Post-BNL, the eastern portion of the site should be used as parkland since it adjoins existing parkland.

BNL should maintain undeveloped areas consistent with designated Pine Barrens Core Areas.

Commercial/Industrial

- Ridge Civic Association
Wading River Civic Association
Mastic Beach Property Owners Association, Inc.
NYS Department of Environmental Conservation
Post-BNL, a portion of the site should be developed as a college or university.
- Future Land Use Workshop, Working Group on Scientific / Academic Focus
Possible future uses of the BNL site (post-BNL) include a museum complex, a graduate education center, a cultural/education center, or reuse by local government a "Town Center".

Post-BNL research facilities could be privatized.

- Future Land Use Workshop, Industrial/Commercial Working Group
Past experience has indicated that reuse of facilities without either major renovation, demolition and reconstruction would be unlikely.

Reuse post-BNL site and existing facilities as a Technology Park.

- Future Land Use Workshop, Working Group on Utilities and Transportation
A possible post-BNL use would be as a bulk freight transfer station facility.

A north/south access road on the BNL east firebreak should be considered. *(Note, objections to this were made by The Nature Conservancy as impacting ecologically sensitive land, and the N.Y.S. Department of Transportation noted that off-site road improvements also would be required in concert with this proposal).*

- Brookhaven Village Association, Inc
Post-BNL, reuse buildings and facilities as a federal complex.
- NYS Department of Transportation
Proposed *(based on preliminary draft plan)* future uses would not overstress existing transportation systems.

Road and interchange changes would have to be implemented (external to BNL) to support the proposed bulk-freight transfer station and north/south access road.

- Civic Association Roundtable Meeting
Utilization of the central core area of the site as a university campus, perhaps in conjunction with the newly developed Dowling College National Aviation and Transportation Center Campus.

The Laboratory's Sewage Treatment Plant could be used by surrounding communities to replace cesspools.

Post-BNL, some of the WW II structures could be restored to their original appearance and developed as a Camp Upton historical park/museum site.

Recreation

- Wading River Civic Association
Future Land Use Workshop, Working Group on Environmental & Ecological Preservation
NYS Department of Environmental Conservation
Ridge Civic Association
Mastic Beach Property Owners Association, Inc.
Civic Association Roundtable Meeting
Post-BNL, existing recreational facilities including gym, pool, ballfields, and tennis courts could be maintained for public use..
- BNL Employees
The area comprising the former landfill, interim landfill, glasshole, and animal/chemical hole could be reused as a golf course.
- Civic Association Roundtable Meeting
BNL should develop of some form of historical trail with appropriate markings. Buildings with historical significance should be marked and the history described.

Residential

- Future Land Use Workshop, Industrial/Commercial Working Group
Post-BNL, housing could be reused for the elderly, supported by medical facilities.
- Future Land Use Workshop, Working Group on Utilities and Transportation
The housing facilities could serve as dormitories to support Dowling College's National Aviation and Transportation Center.
- Brookhaven Village Association, Inc.
BNL should be zoned as A5 and A10 (5 and 10 acre residential) to follow the Long Island Regional Planning Board's recommendations for Special Groundwater Protection.