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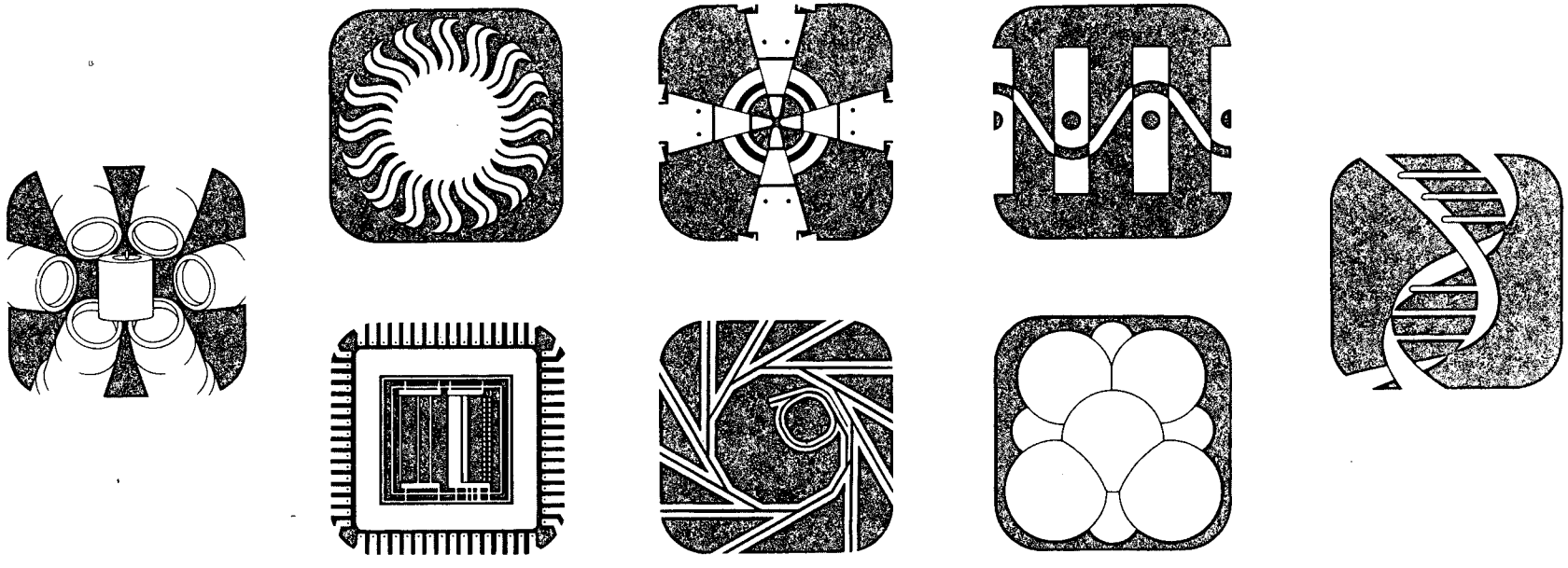
LAWRENCE BERKELEY LABORATORY

LONG RANGE DEVELOPMENT PLAN



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Prepared by
Office for Planning and Development

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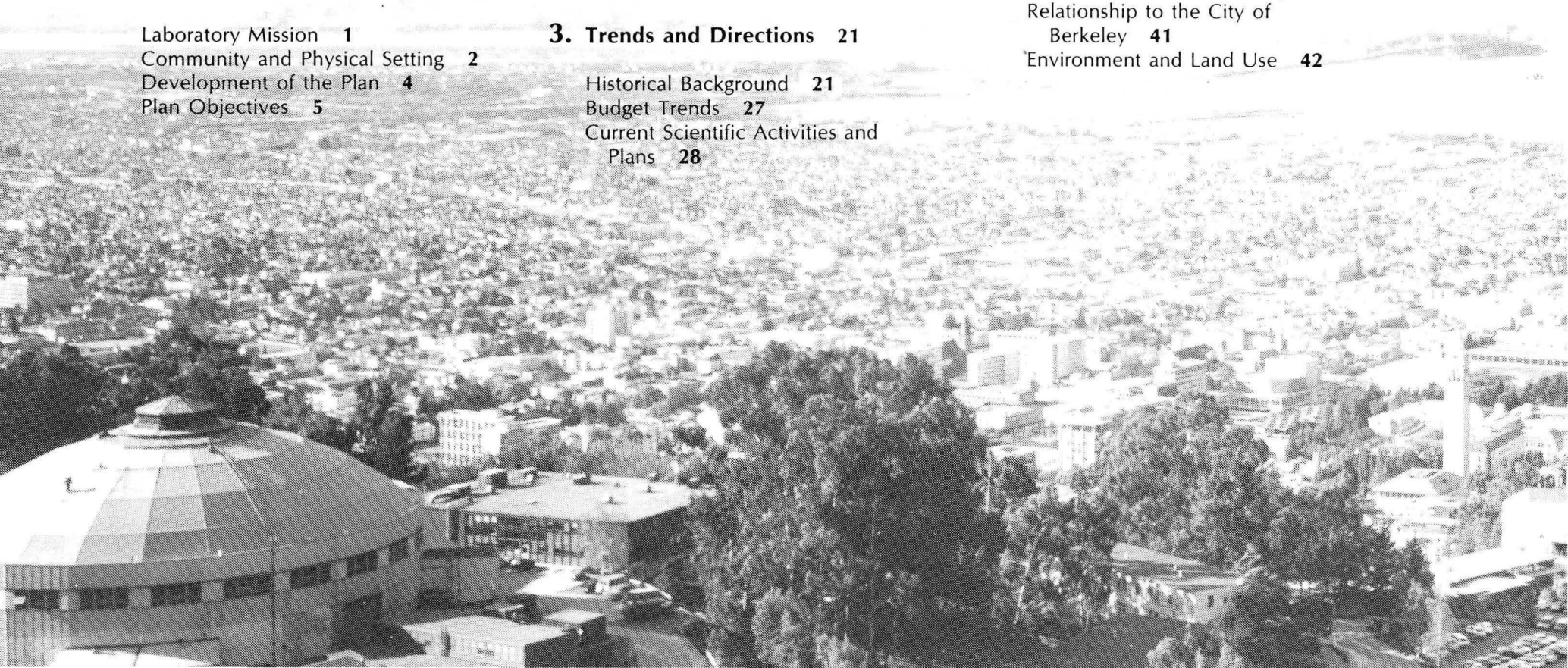

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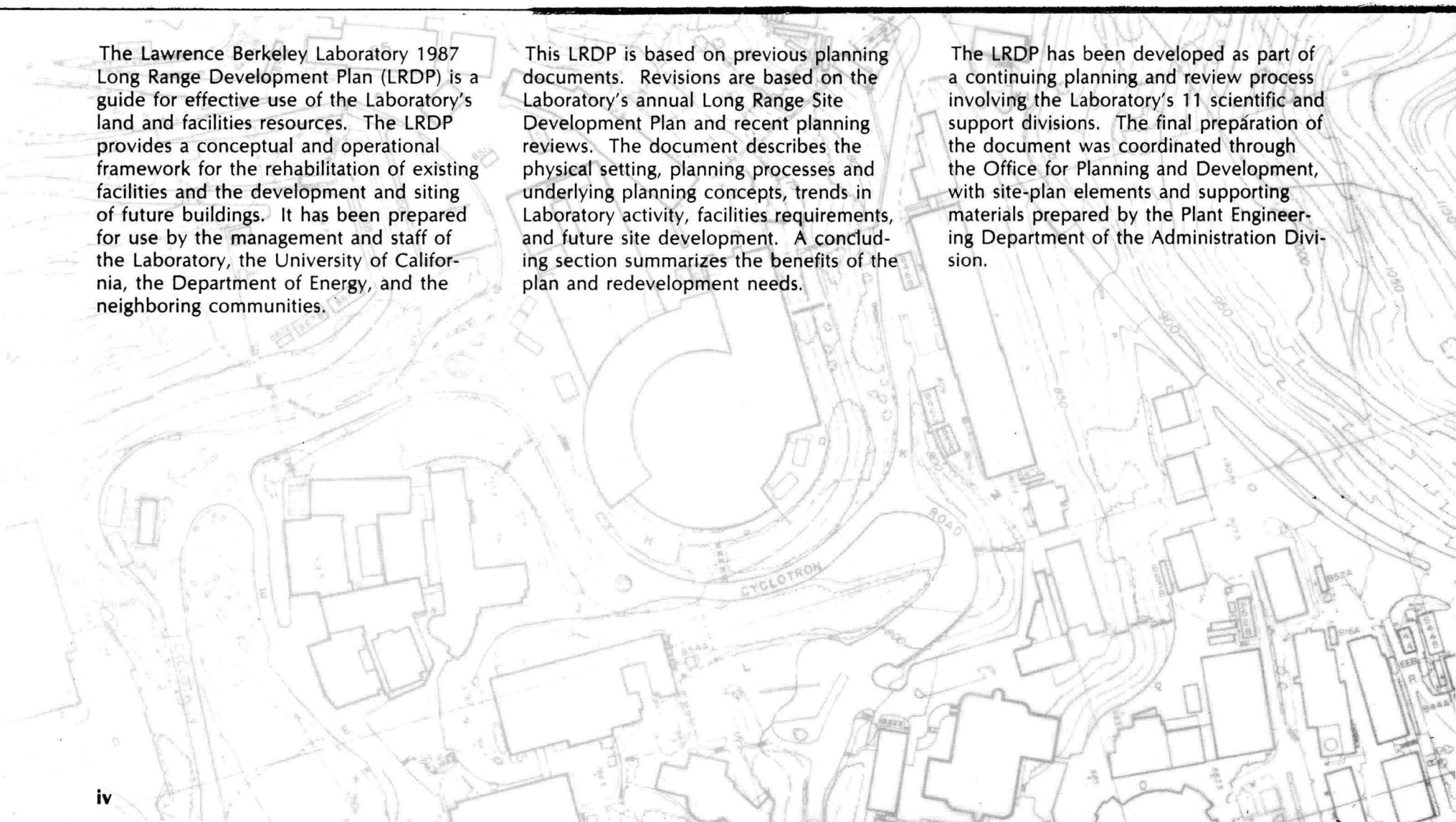
PREFACE

The Lawrence Berkeley Laboratory 1987 Long Range Development Plan (LRDP) is a guide for effective use of the Laboratory's land and facilities resources. The LRDP provides a conceptual and operational framework for the rehabilitation of existing facilities and the development and siting of future buildings. It has been prepared for use by the management and staff of the Laboratory, the University of California, the Department of Energy, and the neighboring communities.

This LRDP is based on previous planning documents. Revisions are based on the Laboratory's annual Long Range Site Development Plan and recent planning reviews. The document describes the physical setting, planning processes and underlying planning concepts, trends in Laboratory activity, facilities requirements, and future site development. A concluding section summarizes the benefits of the plan and redevelopment needs.

The LRDP has been developed as part of a continuing planning and review process involving the Laboratory's 11 scientific and support divisions. The final preparation of the document was coordinated through the Office for Planning and Development, with site-plan elements and supporting materials prepared by the Plant Engineering Department of the Administration Division.



DIRECTOR'S FOREWORD

The Lawrence Berkeley Laboratory's mission as a multiprogram national laboratory is to perform leading research, to develop and operate unique national experimental facilities, to train the next generation of scientists, and to enhance industrial innovation. The Long Range Development Plan addresses the major issues and the opportunities for improvement of the site that are critical to the continued fulfillment of this mission.

The Laboratory occupies 80 permanent buildings on the main site and space in 18 buildings on the University of California, Berkeley (UCB) Main Campus and Richmond Field Station. This is a significant change since 1931, when the Laboratory consisted of a single campus building for the 27-Inch Cyclotron. During the past year LBL conducted more than 800 research programs and projects involving 3600 people, including 600 graduate students and 500 guests.

During the 25 years since the 1962 LRDP the Laboratory's evolution to a multiprogram laboratory has resulted in new building construction and major additions in utilities, transportation, and parking. The current plan, like its predecessor, is a sound framework for future development. Implementation of the LRDP will require the continuing collaboration of the University, the U.S. Department of Energy, and the Laboratory community.

David A. Shirley

EXECUTIVE SUMMARY

Purpose

The Lawrence Berkeley Laboratory 1987 Long Range Development Plan (LRDP) is a land-use guide for the main site that provides a comprehensive physical framework for implementing the Laboratory's mission. As a multiprogram national laboratory operated by the University of California for the Department of Energy, LBL's mission includes the conduct of research in the general and energy sciences, development and operation of scientific user facilities, training of scientists and engineers, and transfer of research results to industry.

To support this mission the LRDP is motivated by the need to rehabilitate existing obsolete facilities, to identify sites for anticipated programmatic growth, and to establish a planning framework under current environmental constraints in recognition of site amenities and the surrounding community. As a long-term guide for development of the main site, the LRDP does not include a construction schedule for buildings, nor does it recommend the initiation of specific building projects. The specific purposes of the LRDP are to:

- *Summarize the Laboratory's setting, planning processes, planning concepts, and design objectives;*
- *Define the physical context for facilities development on the main site;*
- *Indicate redevelopment needs for existing buildings and utility systems;*
- *Summarize site amenities and constraints to protect the environment and landscape;*
- *Identify locations to be reserved for future building sites and potential population growth.*

The LRDP presents a concise expression of the policy for the future physical development of the Laboratory based upon anticipated operational needs of research programs and the environmental setting.

Historical Background

The Laboratory has prepared site plans for the Department of Energy and its predecessor agencies since 1953. In 1962, The Regents approved the Long Range Development Plan (LRDP) for the Lawrence Radiation Laboratory in conjunction with the LRDP for the University of California at Berkeley. That plan identified locations of existing and proposed buildings and tabulated the size and type of proposed structures. The plan emphasized the development of the central campus of the University and did not include a description of the Laboratory's existing and projected program activity or an analysis of long-term facilities needs. Since then the Laboratory has diversified from a single-purpose laboratory devoted to physics and nuclear medicine and has become a national multiprogram laboratory.

The 1987 LRDP provides for new facilities associated with the Laboratory's redirection as a leading multiprogram laboratory. In addition, improvements are identified for rehabilitation and replacement of obsolete temporary buildings constructed since the beginning of World War II. The site areas occupied by these proposed facilities are closely related to the 1962 LRDP, reaffirming the general framework established at that time.

Planning Process

The Laboratory conducts long-range planning through an annual cycle of facilities and institutional management activities. Formal planning documents are prepared on a periodic basis for the University and the Department of Energy. This preparation includes an annual update of the site development plan required to implement existing missions and anticipated program activity.

An initial draft of the 1987 LRDP was completed in December 1986. In conformance with University procedures for implementation of the California Environmental Quality Act (CEQA), the Laboratory filed a "Notice of Completion of Environmental Document" with the State Clearinghouse and provided notice of the Draft Environmental Impact Report (EIR) on the LRDP and conducted a public hearing. Presentations and discussions on the plan elements were also made to the University of California Berkeley Campus Planning Office and the Chancellor's Planning Committee. The Final EIR provides responses to the comments and issues raised during the public review process, and the Final EIR and the draft LRDP were revised to provide additional explanation and clarification.

Planning Objectives

Site planning at the Laboratory is based on long-range institutional goals and values that support the conduct of LBL's mission. The long-range institutional site-planning objectives are to:

- *Provide research facilities and accommodate changes or growth required for anticipated national scientific needs;*
- *Protect the environment, plan for site amenities and constraints, and buffer activities from adjacent populations;*
- *Ensure a safe, healthful, and attractive workplace, improve access and communication with the University community, and provide transportation and parking systems for employees and the visiting public;*
- *Secure and sustain the investment in valuable government-owned research and support facilities;*
- *Improve support and research services through proper siting and consolidation of functions; and*
- *Promote energy conservation and cost economies through efficient design, location, operation, and maintenance.*

Planning Concepts

To achieve these six objectives, the LRDP is based on five LBL site-plan concepts. These concepts accommodate the facilities requirements of the Laboratory within existing geophysical, environmental, and operational conditions. They provide a basis for understanding and evaluating the more detailed elements of the actual site-plan, which is characterized by specific buildings, utilities, and transportation elements. The site-plan concepts are:

- *Consolidate activities within seven functional planning areas that are related groupings of facilities and population centers to enhance interaction and efficiency;*
- *Redevelop obsolete buildings and infrastructure, eliminate temporary trailers for permanent functions, and*

improve building arrangements to increase open space in the "Old Town" area;

- *Coordinate development along the East-West circulation and utilities axis that extends from the Life Sciences Research Area to the 88-Inch Cyclotron Research Area to enhance transportation and service systems, develop off-road parking, and improve the system of pedestrian pathways;*
- *Improve and maintain perimeter buffer zones and natural beauty by, for example, restricting construction in highly valued landscape areas; and*
- *Provide off-site "satellite" locations for receiving, warehousing, and other support and research activities well suited to decentralized locations.*

Framework for Replacement, Relocation, and Additions

The LRDP provides a framework for the rehabilitation and replacement of obsolete and deteriorated structures, primarily in the Old Town area, including:

- *Replacement of obsolete and substandard mechanical- and electrical-engineering buildings and accelerator testing and fabrication facilities;*
- *Rehabilitation of electrical and mechanical utility systems and other infrastructure, including roadways (site wide); and*
- *Replacement of trailers and obsolete wood-frame light-duty laboratory and office buildings, primarily to accommodate users of the Advanced Light Source.*

The LRDP allows for a relocation of support functions and some research activities for improved efficiency and safety:

- *Relocation of the materiel-storage and supply-services personnel from the Light Source Research and Engineering Area to the the Shop and Support Facilities Area, with the elimination of temporary use of trailers;*
- *Consolidation of reclamation and materials-handling activities to the eastern end of the Laboratory site; and*
- *Relocation of selected research programs and printing support staff from off-site leased space to the main site.*

The plan allows for potential additions for program-related or support projects:

- *New buildings and additions to existing structures for anticipated program growth in molecular genetics and medicine, conservation, and renewable energy research and provision for sites for growth in the materials science and chemistry programs;*
- *Extension of the experimental hall of the Bevalac for accelerator improvements and other additional facilities for accelerator and fusion research; and*
- *Additions to existing buildings for research and for administrative, shop, engineering, and other support functions, including a small conference facility for multiprogram support and for science education programs.*

Potential Development and Land Use

If all these projects were constructed, it would result in a net increase of approximately 404,800 gross square feet (gsf) to the existing main site of the Laboratory, for a total of 1,996,200 gsf. In comparison, the 1987 laboratory area, including current construction, consists of a total of 1,591,400 gsf at the main site.

The increased need expressed in the 1987 LRDP is due to the expanded development of programs in materials science and chemistry, earth sciences, conservation and renewable energy, and fossil energy that were not a part of the Laboratory's mission in the early 1960's under sponsorship of the Atomic Energy Commission.

In addition, the specialized research facilities and program expansion in the physical sciences and the life sciences, such as electron microscopy and molecu-

lar genetics and new facilities for the Advanced Light Source, were not anticipated at that time and have required, or will require, new buildings or extensive additions to existing buildings.

The LRDP also emphasizes utility rehabilitation, improved parking and circulation, and respect for nine buffer-zone landscape planning areas that unify the site and enhance compatibility with the surrounding hillside. The major site-development proposals are redevelopment of Old Town to eliminate obsolete buildings and enhance the open space, expand the "East Canyon" area by four acres (included in the 1962 Plan), and eliminate the use of 60,000 gsf of trailers. The Plan allows for a Laboratory staff size of 4750 at all existing activity areas. These areas include 4100 staff at the main site, 640 on the UC Berkeley campus and at the Richmond Field Station, and about 10 at other off-site locations. The net land-use change will reduce open space within the Laboratory boundaries from 61.8 percent to 58.3 percent.

Design Guidelines

Design guidelines in the LRDP have been developed to achieve specific facilities planning requirements while respecting site constraints and providing coherence among building elements and the landscape. These reference guidelines address the following areas:

- Open Space and Outlooks;
- Landscaping and Visual Enhancement;
- Topography and Grading;
- Utilities Corridors;
- Building Mass and Orientation;
- Building Exteriors;
- Building Flexibility;
- Energy and Operational Efficiency;
- Circulation and Parking; and
- Guideline Conformance Review.

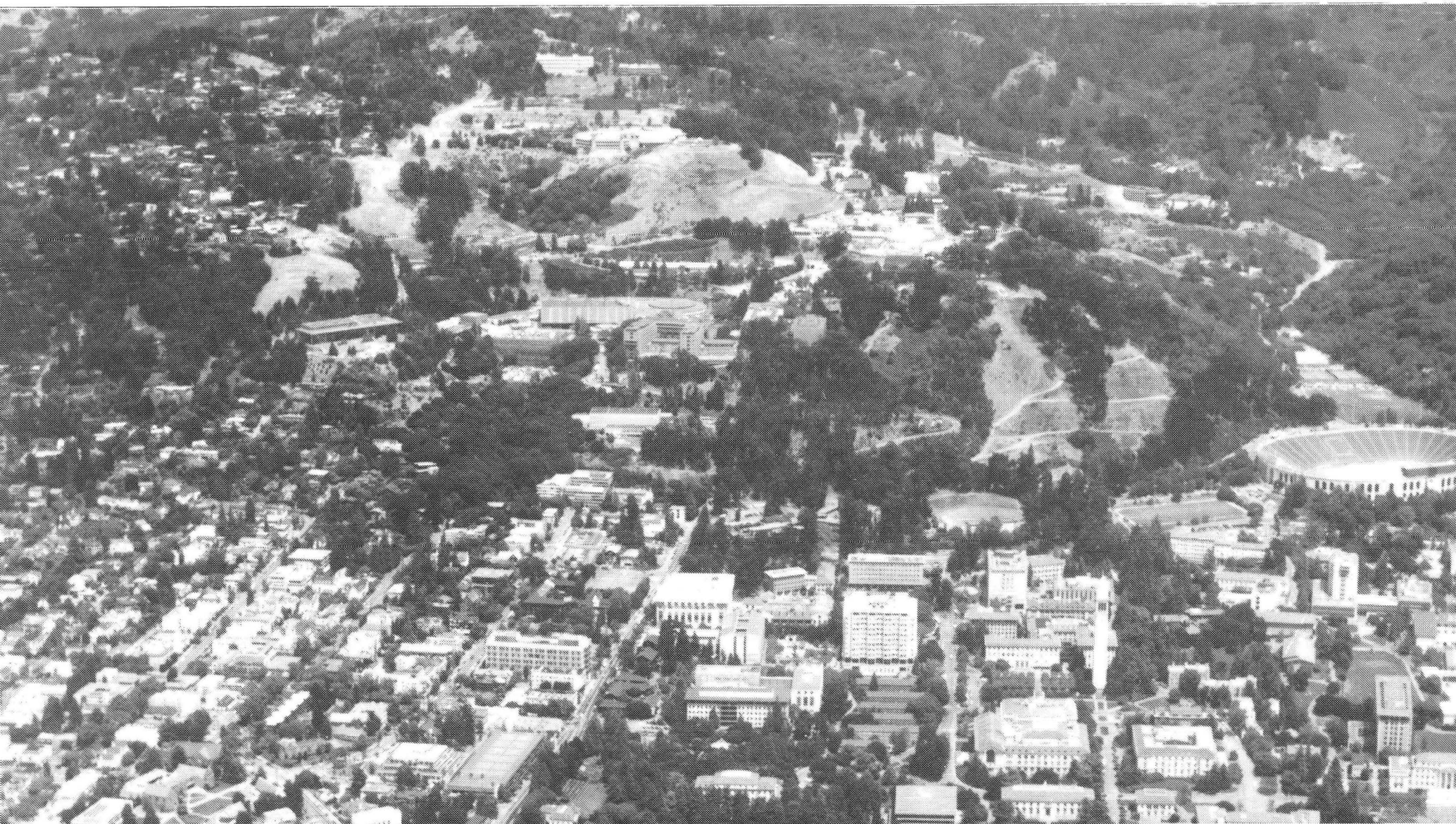
Community Relations

In addition to enhancing the physical facilities, development programs have been identified in the LRDP to accommodate growth at the Laboratory Site. Three principal programs are directed toward fire-safety coordination, traffic and parking management, and historical preservation:

- *The fire-safety measures include participation in preventive burn programs and control of vegetation on LBL land and the development of a plan for planting fire-resistant species;*
- *The Laboratory is developing a Traffic and Parking Mangement Plan to discourage "drive-alone" vehicles and to encourage other transportation options; and*
- *A historic preservation review was conducted in 1987 by independent consultants to ensure compliance with California Environmental Quality Act guidelines.*

The perimeter of the Laboratory will be enhanced through additional landscaping to augment the natural beauty of the area and to act as a buffer to the Campus, to residential areas, and to the Lawrence Hall of Science and the UCB Botanical Garden. Landscape planning zones will sustain and augment the shrub, grassland, and forested, areas of the hillside to unify the site visually and to provide a buffer between functional areas, buildings, and adjacent properties.

In conclusion, the 1987 LRDP provides for consolidation and redevelopment to provide locations reserved for future research and support activities. Implementation of the plan will reduce costs through consolidation of activities and improvements in land use. Design guidelines are identified to maintain and improve a good working environment and enhance compatibility with the surrounding community.



1 INTRODUCTION AND OBJECTIVES

Laboratory Mission

The Lawrence Berkeley Laboratory is a major national laboratory operated by the University of California (UC) for the U.S. Department of Energy (DOE). The Laboratory is an independent academic unit of the University of California system and is located adjacent to the University of California, Berkeley Campus. The Laboratory also maintains strong ties with other academic units, including UC San Francisco.

The Laboratory was established in 1931 as the Radiation Laboratory as the result of research conducted by Ernest Orlando Lawrence to develop particle accelerators. The role of the Laboratory is now broader, and LBL provides national scientific leadership and supports technological innovation to:

- *Perform leading multidisciplinary research in the general sciences, energy sciences, and life sciences.* The general sciences include nuclear physics and high-energy physics as well as accelerator research and development; the energy sciences include materials research, chemistry, geology, applied science, and engineering appropriate to DOE's programs; the life sciences include molecular biology and biomedical research.
- *Develop and operate unique national experimental facilities for use by qualified investigators.* These facilities include the Bevalac, the 88-Inch Cyclotron, the National Center for Electron Microscopy, and the National Tritium Labeling Facility. In addition, the Advanced Light Source is now budgeted for construction and is scheduled for completion in 1992.
- *Educate and train future generations of scientists and engineers.* Six hundred graduate students pursue research at the Laboratory with about 100 students receiving advanced degrees every year. Precollege programs are also conducted for science educators and students.
- *Foster productive relationships between LBL research programs and industry.* The Center for Advanced Materials, the Center for X-ray Optics, and the Center for Building Sciences are examples of collaboration with industry; technology transfer programs also promote application of research results.

The Laboratory is among the world's leading research institutions. Ernest Lawrence was the Laboratory's first Nobelist, winning the prize in 1939 for the invention of the cyclotron. Since then, eight other LBL scientists have become Nobel Laureates, the most recent being Yuan T. Lee, who received the 1986 Nobel Prize in Chemistry. Of its present staff, 50 have been elected to the National Academies of Sciences or Engineering.

The Laboratory has made major contributions to DOE's program in energy technology research and development, in the basic energy sciences, and in the general sciences. Among the Laboratory's major contributions are advances in particle accelerators and detectors, discoveries in chemistry and materials science, applications of biophysical research to medicine, and the development of advanced energy conversion and utilization technologies.

Fourteen of the heaviest elements known were discovered at LBL, including californium, berkelium, and lawrencium. Relativistic heavy-ion nuclear physics was pioneered at LBL. Other, more-recent, developments include the discovery of iridium anomalies associated with mass

extinctions, invention of the Time-Projection Chamber and the Ten-Meter Telescope, and the synthesis and characterization of advanced electronic and structural materials.

The Laboratory's research makes use of multidisciplinary collaboration and advanced engineering, computation, communications, fabrication, and other support facilities characteristic of a national laboratory. The Laboratory's facilities are planned, constructed, and maintained to support directly the research programs and planned, constructed, and maintained to support directly the research programs and scientific goals, while maintaining compatibility with the University community and the physical setting.

Community and Physical Setting

LBL is located three miles east of San Francisco Bay on the slopes of the Coast Range within 1183 acres of contiguous land owned by The Regents of the University of California (Figure 1-1). Most of the Laboratory's 130-acre site is located within the City of Berkeley, a largely university and residential community with a population of 107,000. Activities are also conducted in buildings of the University of California at Berkeley, a campus with a student population of 31,500, and at the Richmond Field Station, a facility operated by the University of California, Berkeley.

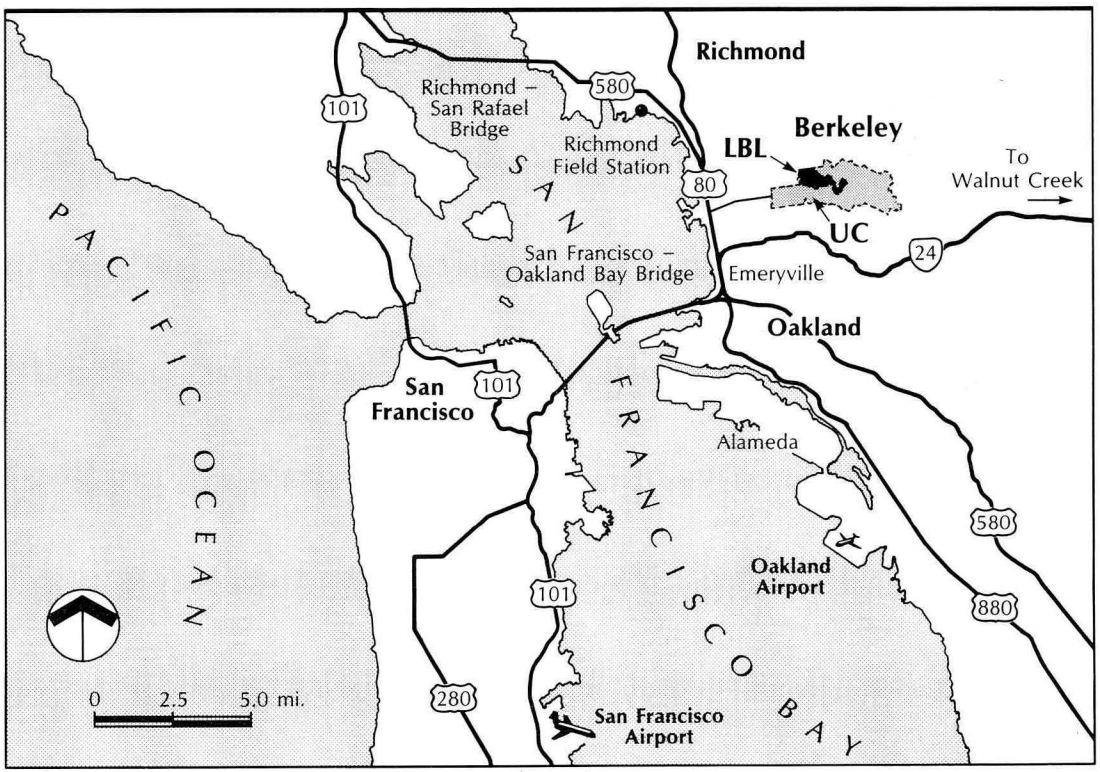


Figure 1-1. Map of the Lawrence Berkeley Laboratory location indicating its proximity to major airports, interstate highways, and public transportation.

The eastern section of the main Laboratory site is located along the nonurbanized northeast boundary of Oakland, population 350,000, the seat of government for Alameda County, which has a population of 1,175,000. Although largely urban and served by interstate highways and an extensive transit system, the Laboratory site has a backdrop of botanical gardens and regional parks that preserve the rural character of the foothills.

LBL's hillside location, with elevations ranging from 500 ft to 1000 ft above sea level, affords dramatic views of the San Francisco Bay and surrounding cities. The LBL site is drained by the west and south

branches of Blackberry Creek and by Strawberry Creek and is underlain by folded sedimentary and volcanic rock that has weathered to form soils several feet thick.

The hillside topography and vistas are both an amenity and a constraint and add an important dimension to site planning at LBL. Grading and filling are necessary to provide most building sites, and a slope-stabilization program includes shallow dewatering wells, vegetation cover, and soils management. The Hayward Fault, at the western edge of the main LBL site, is a part of the active San Andreas Fault system that developed as the Berkeley Hills were uplifted. Proposed new buildings and building additions will not be sited across the fault (Figure 1-2).

Originally the site was coastal shrubland, but during the past century the University property was extensively grazed by cattle and, with the exception of the land near creeks, was primarily grassland. Since the 1950s the cessation of grazing and subsequent management of the land has resulted in the growth of vegetation now dominated by eucalyptus, oak, and evergreen trees. Deer, various small mammals and reptiles, and birds populate the Laboratory site and the surrounding hills.

The Laboratory property, leased from UC by DOE, is bounded by lands owned by the University. Adjacent to this University property on the north are residential areas; to the west and south lie the UCB Campus and the Strawberry Canyon Recreation area; and to the east are the Lawrence Hall of Science, the Mathematical Sciences Research Institute, and the Space Sciences Laboratory. These facilities and the Laboratory are served by a network of state-, county-, city-, University-, and LBL-maintained roadways and public-, University-, and Laboratory-operated transit services (Figure 1-3).

Most of the Laboratory's main-site buildings are owned by DOE and were constructed on University land under long-term lease to the federal government. LBL employees occupy buildings on campus and at the UCB Richmond Field Station under agreements between UC and DOE, and space in Berkeley and Emeryville is leased for warehousing and for some support and research activities (see Table 1-1).

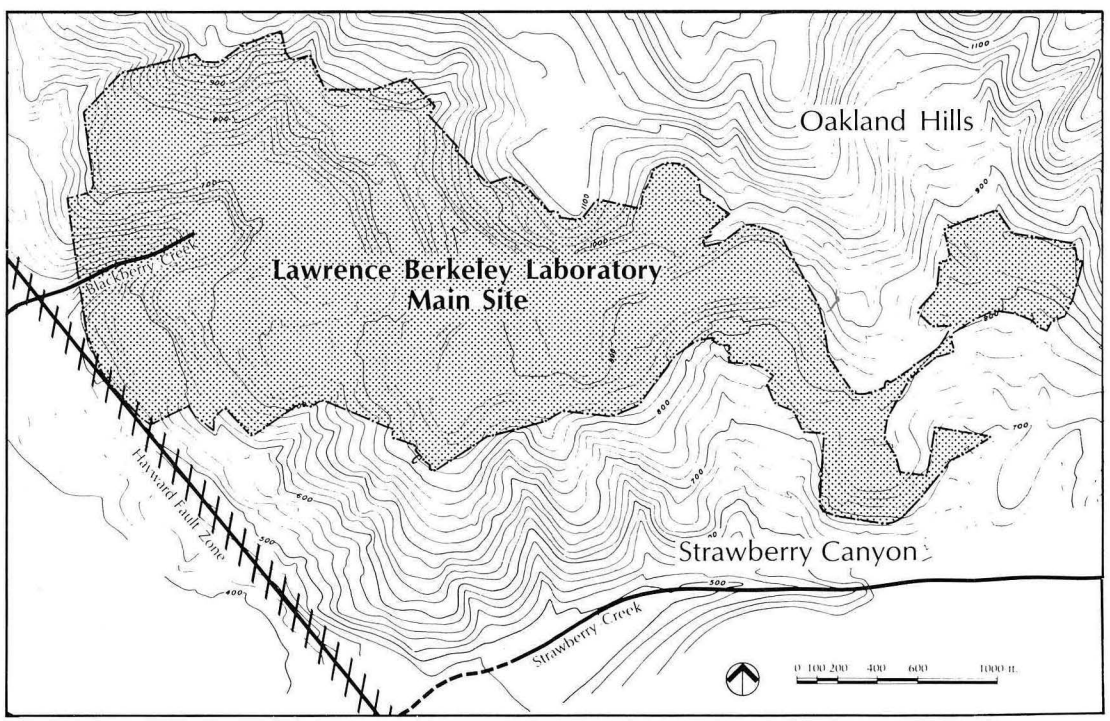


Figure 1-2. Laboratory planning constraints include Blackberry and Strawberry Creeks, steep hillside slopes, and the Hayward Fault Zone.

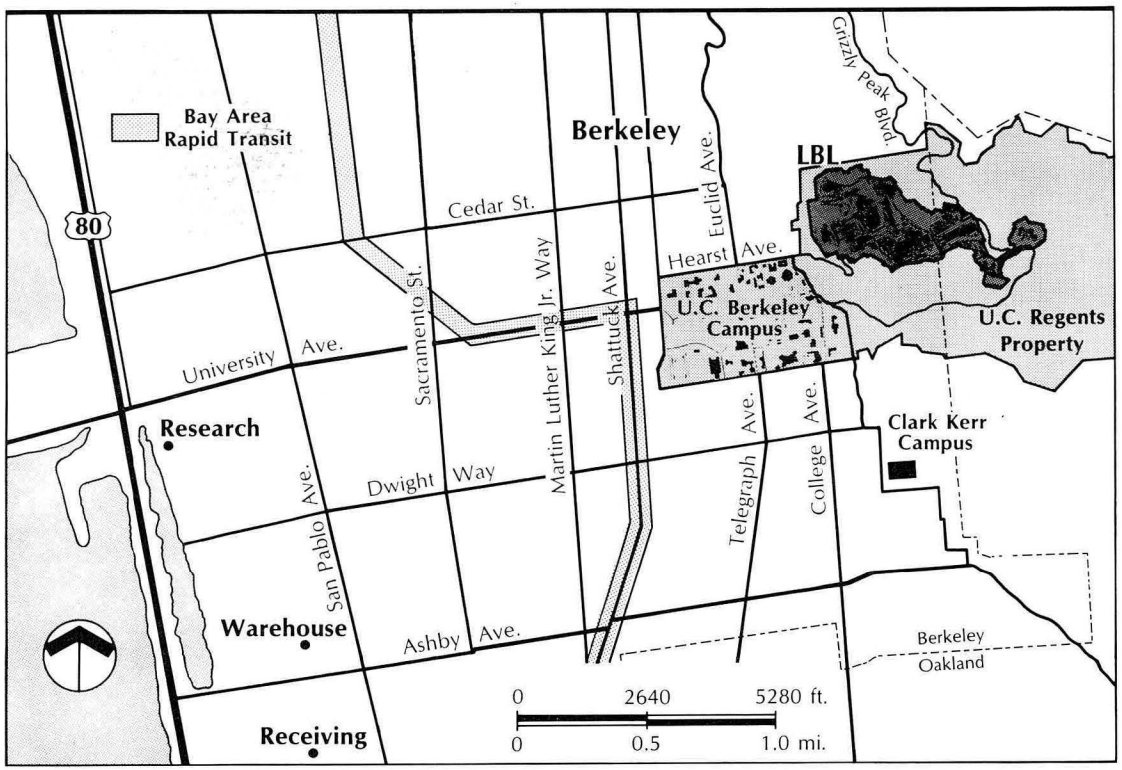


Figure 1-3. LBL in relationship to major arterials and satellite research and support locations.

Research facilities and their support functions include the major user facilities, light- and heavy-duty laboratories, shops, maintenance facilities, material-supply areas, and offices. There are 80 permanent buildings on the LBL hillside site (Figure 1-4), with additional facilities in 16 buildings on the UCB Campus, notably the Donner Laboratory of Biology and Medicine and the Melvin Calvin Laboratory of Chemical Biodynamics (Figure 1-5). Construction of the Advanced Materials Laboratory and the Advanced Light Source, two major new buildings on the main site, is expected to continue during fiscal year 1988.

Table 1-1. Space Distribution.

Location	Area (gsf)
Main site	1,591,400
Campus and RFS[a]	299,600
Leased Off Site	127,000
Total	**2,018,000**

[a]Richmond Field Station

Development of the Plan

The Laboratory has prepared site plans and analyses since the early 1950s (see Appendix A). These plans provided for new research program needs and also sought replacement of the congested temporary structures that were hurriedly constructed at the original hill site during and shortly following World War II. The 1987 Long Range Development Plan follows a period of continuing site development since the UC Board of Regents approved the 1962 UCB LRDP, prepared when UCB was coordinating planning matters for the Laboratory (Figure 1-6). In 1975 the Laboratory prepared a site-development plan for DOE that emphasized consolidation of functions and the redevelopment of the central area of the Laboratory.

Figure 1-4. The Laboratory Main Site extends about 1 mile from West (left) to East (right) along a ridge in the Berkeley/Oakland Hills.

From 1982 to 1984, revised site plans incorporated new materials research facilities and a next-generation synchrotron radiation source for research in many fields. A comprehensive Long Range Site Development Plan was prepared for the DOE in 1984 and was updated in 1986. The 1987 LRDP provides for site and building development in general conformance with the 1962 LRDP and is based on technical analyses and studies listed in Appendix A.

Plan Objectives

The purpose of the Laboratory LRDP is to provide a management guide and policies for the future development of land and facilities resources in support of the Laboratory's research mission. This guide provides a long-term framework for rehabilitating and replacing obsolete buildings, identifying areas for future buildings, and satisfying LBL's research and support needs while maintaining proper regard for land-use constraints. As described in subsequent chapters, land-use constraints include: respecting open space and landscaping, maintaining slopes and soil stability, adhering to design guidelines, providing adequate parking, and minimizing traffic congestion (Appendix A).

The oldest part of the Laboratory, which is located on a geologically competent 15-acre plateau surrounding the 184-Inch Cyclotron Building, was constructed during World War II. Many of these old

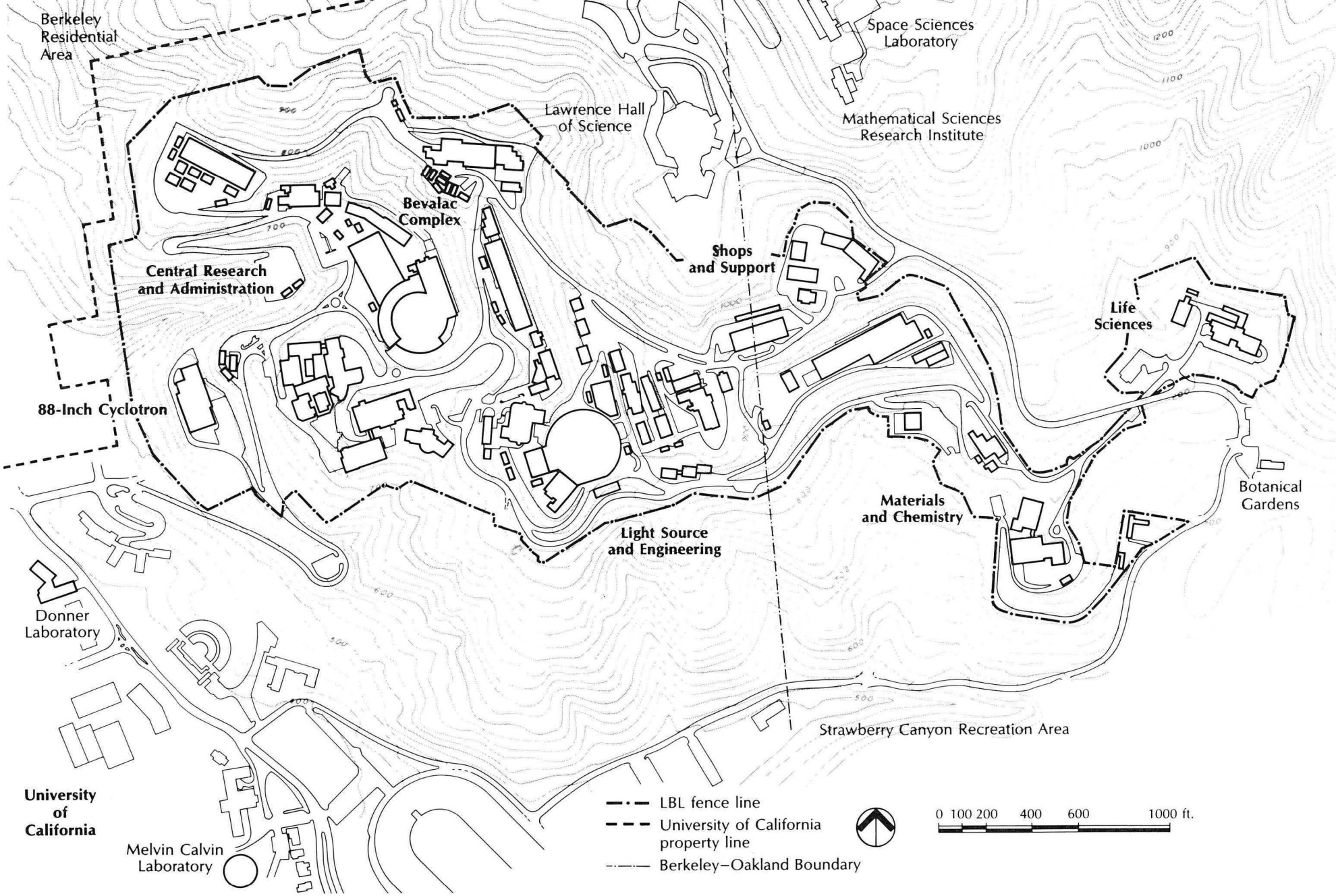


Figure 1-5. Laboratory map showing functional areas for LBL and adjacent institutions and facilities. This map includes budgeted construction. Appendix B contains a detailed identification of buildings.

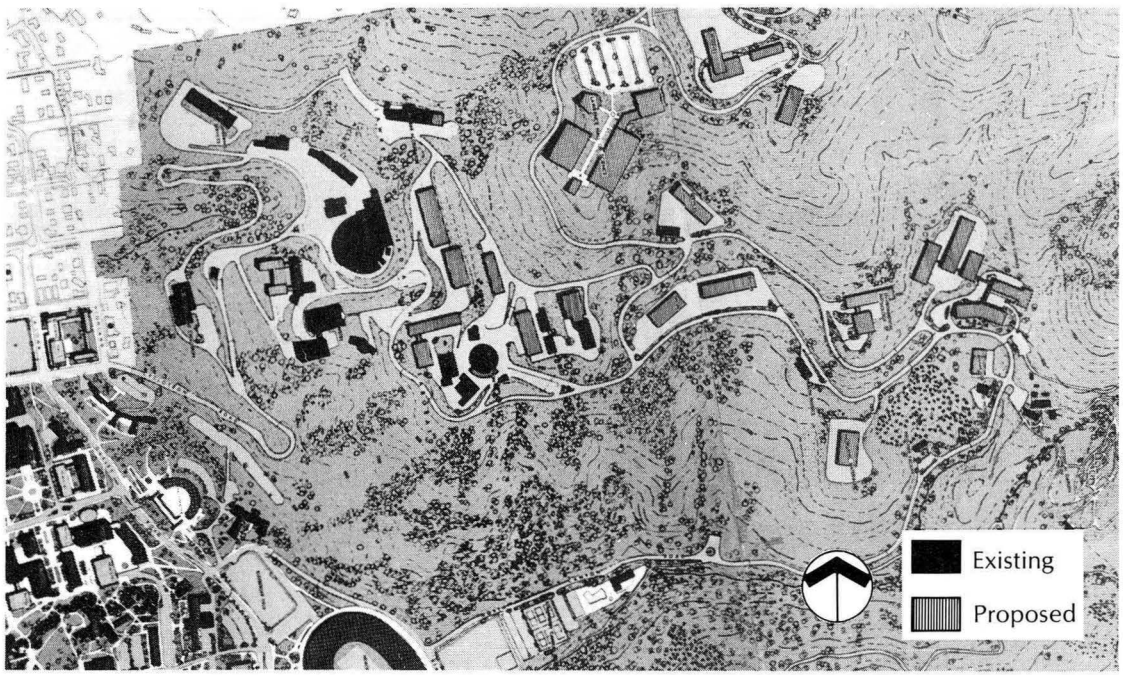


Figure 1-6. The section of the 1962 LRDP map that includes LBL, depicting existing and proposed buildings.

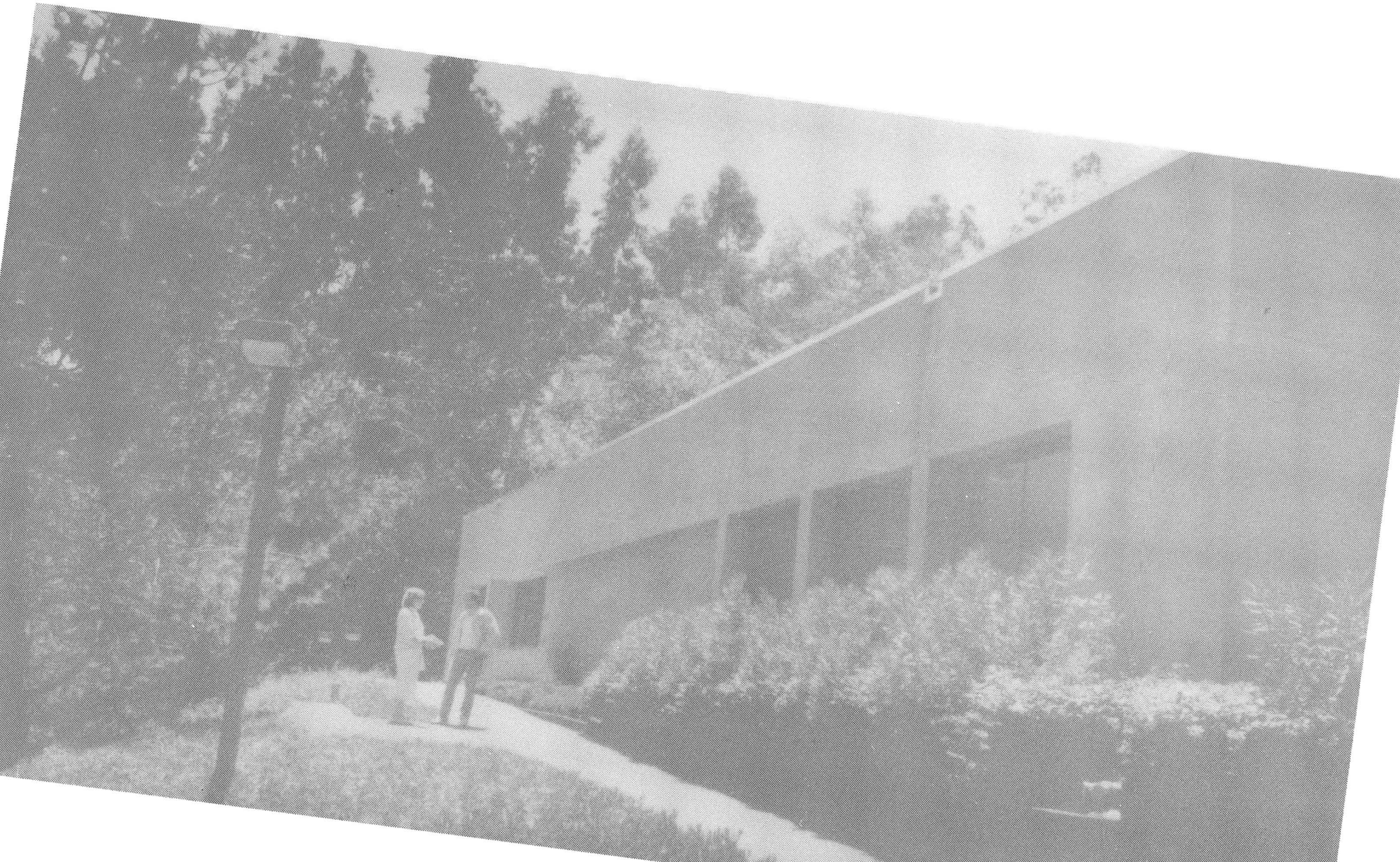
industrial-type buildings are substandard and will be replaced with modern, low-rise research and support facilities. Others, such as the 184-Inch Cyclotron Building, which were well designed and constructed, will be renovated and upgraded to modern standards. The redevelopment of this older area will be designed to create a campus atmosphere and to greatly improve the aesthetic environment of the Laboratory as a whole. The master plan for this redevelopment will preserve and enhance the superlative views of the Bay Area from this site, incorporate significant landscaping, improve pedestrian walkways and vehicle circulation, and enhance the views of the Laboratory from the surrounding community.

Like the 1962 LRDP, the 1987 LRDP reserves areas for future building sites for programs that LBL and DOE have identified as important. However, it is likely that some of these sites will not be developed for more than twenty years; national research priorities influence the pace of development of these reserved building sites.

The LRDP identifies the principles and processes that facilitate the conduct of future activities in a productive, efficient, safe, and pleasing environment. To complement the objectives, comparisons are made to the past LRDP and to the existing physical plant. Specific LRDP objectives are to:

- *Summarize the Laboratory's community and institutional setting, planning processes, planning concepts, and design objectives;*
- *Define the physical context for facilities development on the main site, including research programs and needs for buildings and utilities, landscaping, transportation, and parking;*
- *Indicate redevelopment needs for existing buildings and utility systems;*
- *Summarize site amenities and constraints to protect the environment and to provide for buffer and landscape planning areas; and*
- *Identify locations to be reserved for future building sites and potential population growth.*

The LRDP presents a concise expression of the policy for the future physical development of the Laboratory based upon anticipated operational needs of research programs and the environmental setting.



2. Planning Process and Principles

Planning Process

Planning activities at LBL support effective management and coherent implementation of its mission. These activities include: long-term (i.e., 5–15 years) research program planning; institutional planning; information resources planning; and site development planning and short-term (operational) project planning, budget planning, and maintenance planning. As a leading research center, the Laboratory's management and scientific staff participate in national scientific planning and review activities that help to define future federal and regional research programs and national research facilities needs.

Planning is a continuing component of the Laboratory's management activities. The LBL's Director's Office, in coordination with the scientific and support divisions and the DOE, supports and advances research program goals for LBL and provides management guidance and approval of facilities plans (Figure 2-1). The Laboratory is a major organizational unit of UC, reporting to the President of the University through the Senior Vice President for Academic Affairs. As a part of the

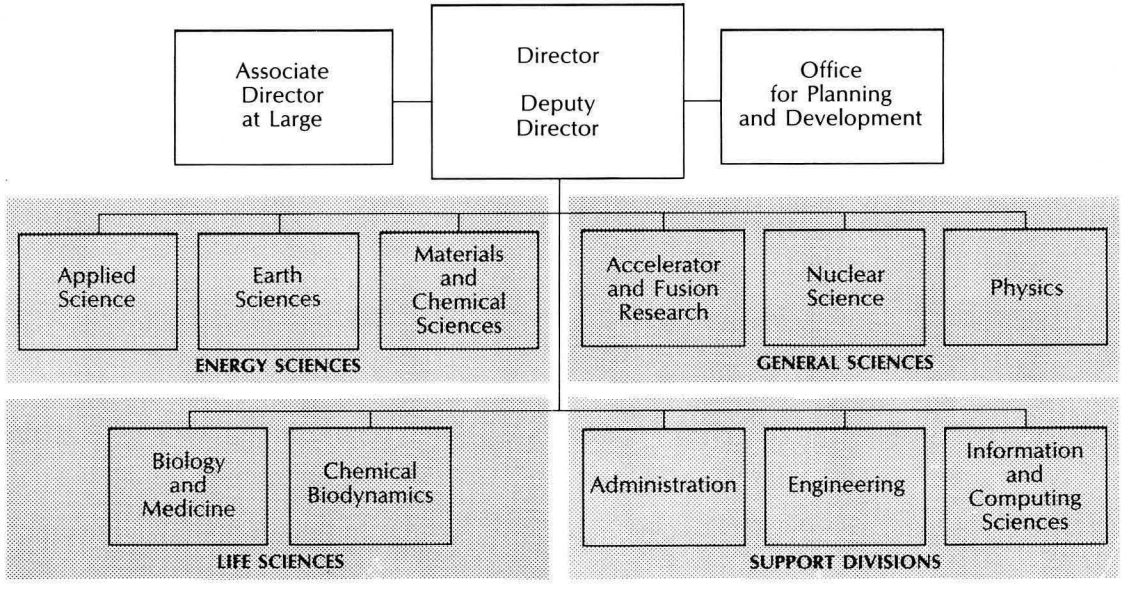


Figure 2-1. The Laboratory's divisions are grouped within the areas of general science, energy sciences, life sciences, and support functions. Planning is coordinated through the Office for Planning and Development.

University's management of LBL, the overall LBL goals and directions are reviewed semiannually by the Scientific and Educational Advisory Committee (SEAC), which reports to the President of the University. In addition, the Laboratory is reviewed by The Regent's Committee on Oversight of the Department of Energy's national laboratories. External reviews of current research programs and divisional plans are conducted by the LBL Director's peer-review committees, by review groups from the DOE, and by SEAC.

Internal reviews and development of scientific and facility plans are conducted by the Laboratory management. Acting jointly, the Associate Directors provide a comprehensive and Laboratory-wide perspective for the evaluation of scientific and facilities plans. The Director's Executive Committee and the Associate Directors of Support Divisions review plans and provide management recommendations to the Director. The Office for Planning and Development provides management and staff to coordinate facilities and institutional planning activities.

Facility-related issues and solutions are also identified by advisory committees reporting to the Laboratory Management. Committees with responsibilities germane to facility development include:

- Space Committee
- Parking Committee
- Overhead Budget Task Force
- Safety Review Committee
- Staff Transportation Committee

These committees make their findings available for review by the Director, with formal review by the Director's Executive Committee and the Associate Directors.

Institutional planning at the Laboratory is a formalized internal and external process for identifying planning assumptions, technical trends, scientific initiatives, and resource needs. The Institutional Plan is coordinated by the Office for Planning and Development to provide a five-year forecast of program activity within a fifteen-year strategic outlook. The annual Institutional Plan cycle requires the definition of initiatives, formulation of draft planning documents, internal Laboratory review, an analysis from the DOE, and the completion and approval of an Institutional Plan.

Information technology resources planning conducted by the Laboratory's Information and Computing Sciences Division provides a five-year outlook for voice and data communications and data-processing needs. The Information Technology Resources Long-Range Site Plan affects all divisions and is developed through a process of survey, assessment, and multidivisional review.

Operational and budget planning is conducted both for the Laboratory as a whole and for each of the Laboratory's divisions. The annual Budget Review cycle, initiated at the beginning of the calendar year, provides an outlook for the current and next two fiscal years for each division and for the Laboratory as a whole and is based on the research-project submissions and DOE program office guidance. Each fiscal year operational plans are periodically prepared and reviewed on a monthly basis. The Laboratory's support services and overhead operations are reviewed by the Overhead Budget Task Force, which annually recommends overhead rates and support-staffing plans to the Laboratory Director.

The Laboratory's site and facilities plans are developed through a continuing process of Laboratory review and analysis (Figure 2-2). The planning process includes the following elements:

- *Scientific divisions propose research initiatives* and identify facilities needs. These facilities needs are further defined by the Plant Engineering Department and the Administration Division Office.
- *The Director's Office and the Director's Executive Committee review research program initiatives and associated facilities requirements* for their suitability, scientific promise, and resource requirements. Major priorities are established by the Laboratory Director in consultation with the Associate Directors and are reviewed through existing managerial arrangements by DOE and UC. The Director's Architectural Consultant provides

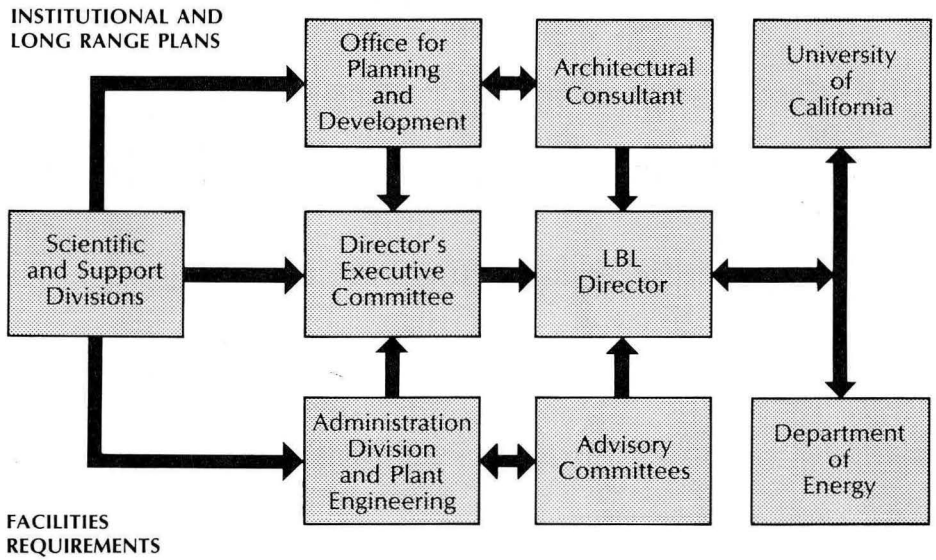


Figure 2-2. Schematic diagram of major LBL organizational elements in site planning. Scientific and support divisions initially identify facilities needs, which are developed, reviewed, and approved by Laboratory management before their submission to UC and DOE.

independent review and advice on building projects and plans to enhance the quality of the site.

- *The Plant Engineering Department and the Office for Planning and Development annually update the Long Range Site Development Plan,* which is submitted to DOE. Site engineering, design, and analysis are conducted by the Plant Engineering Department with periodic assistance from specialized consultants in such fields as landscaping, seismic safety, traffic circulation and parking, utilities, safety systems, and architectural design.
- *The Plant Engineering Department proposes facilities plans* and general-purpose construction projects necessary to support the programs and initiatives incorporated into the Institutional Plan. Proposed construction projects are reviewed three times a year by all Division Heads and by the Director as a part of budgeting and planning cycles.
- *The Laboratory presents significant plan revisions and major projects for review* by The Regents and the UC President's office, the UCB Campus Planning Committee, and DOE. An environmental evaluation is made for

significant new projects or plans, and these proposals are then submitted for required approvals or further consideration by the University President, The Regents, and DOE, as appropriate. Funding and implementation of major projects include reviews by the Federal Office of Management and Budget and the U.S. Congress.

In summary, site planning at LBL is coupled to scientific-program and budget planning and to internal and external review (Figure 2-3). Program planning defines research needs, which in turn determine facilities requirements. Specific facilities plans are developed to be compatible with site development plans, and both facilities and site plans are subject to periodic management review. Specific construction projects and the site development plans are subject to UC and DOE review and approval.

In accordance with University guidance, the 1987 LRDP also reflects the provisions of the LBL Environmental Impact Report (EIR) prepared in conformance with the California Environmental Quality Act (CEQA). A draft EIR has been prepared, and, following public notification, a public meeting was held. An extended comment period was provided, and the Laboratory has responded to comments received. Mitigation measures are included in the Draft and Final EIR and in the LRDP.

This site-planning process allows interested constituencies the opportunity to review and comment on the LRDP. These efforts are conducted within a framework of basic planning principles that take into consideration the objectives and needs internal to the Laboratory and the University sponsoring agencies and other external constituencies.

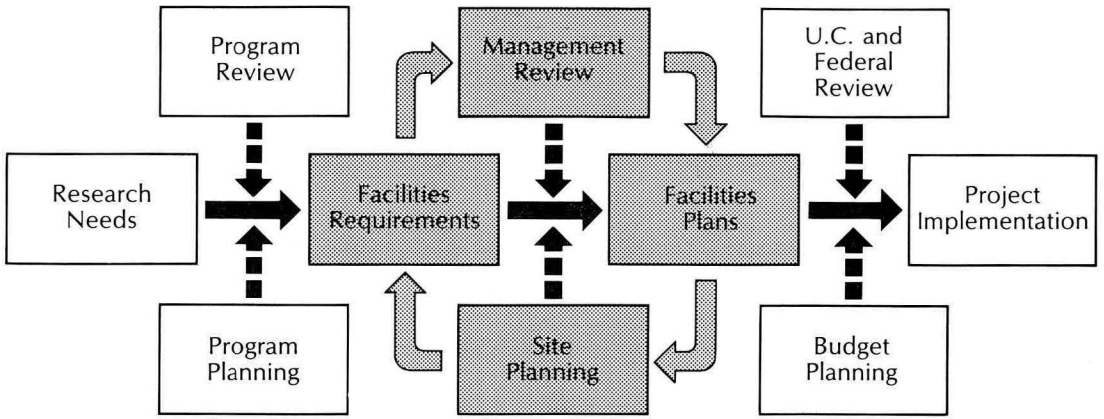


Figure 2-3. Schematic diagram of relationships among program planning, site planning, and budget planning and the review of facilities plans. Site and facilities plans are subject to continuing management review.

Site-Planning Concepts

Site planning at the Laboratory is based on long-range institutional goals and values that support the conduct of LBL's mission. The long-range institutional site-planning objectives are to:

- *Provide research facilities and accommodate changes or growth required for anticipated national scientific needs;*
- *Protect the environment, plan for site amenities and constraints, and buffer activities from adjacent populations;*
- *Ensure a safe, healthful, attractive, and efficient workplace, improve access and communication with the University community, and provide transportation and parking systems for employees and the visiting public;*
- *Secure and sustain the investment in valuable government-owned research and support facilities;*
- *Improve support and research services through proper siting and consolidation of functions; and*

- *Promote energy conservation and cost economies through efficient design, location, operation, and maintenance.*

To achieve these six objectives, the LRDP is based on five *LBL site-plan concepts.* These concepts accommodate the facilities requirements of the Laboratory within existing geophysical, environmental, and operational conditions. They provide a basis for understanding and evaluating the more detailed elements of the actual site-plan, which is characterized by specific buildings, utilities, and transportation elements. The five site-plan concepts are:

- *Consolidate activities within seven functional planning areas,*
- *Redevelop obsolete buildings and infrastructure,*
- *Coordinate development along the East-West circulation, communications, and utilities axis and enhance transportation and parking systems,*
- *Improve and maintain perimeter buffer zones and natural beauty,* and
- *Provide off-site locations for research and support activities, where appropriate.*

These planning concepts and the design objectives provide the underlying basis for the evolution and development of the 1987 LRDP. The concepts and their relation to the physical setting of the Laboratory are defined below.

Consolidate Within Seven Functional Planning Areas

The functional planning areas are related groupings or precincts of facilities and population centers that enhance interaction and efficiency of work activities (Figure 2-4). In general, parking is at the perimeter of these areas to reduce internal vehicle traffic. The seven functional planning areas are:

- **The 88-Inch Cyclotron Research Area** includes the building housing the accelerator, beam halls, and offices; cooling towers and utility buildings; and a parking lot.
- **The Central Research and Administration Area** houses research scientists, most of the management functions, centralized computers, and communications. Most visitors come to this location, which also contains the cafeteria, an auditorium, and conference rooms.
- **The Bevalac Accelerator Complex**, currently LBL's largest user facility, is located near the Administration Area. The high-bay spaces accommodate accelerator upgrades and experiments, with adjacent offices for scientists and engineers.
- **The Light Source Research and Engineering Area** is a focal point for new research in the basic energy sciences. The Advanced Light Source, to be operational in 1992, is central to

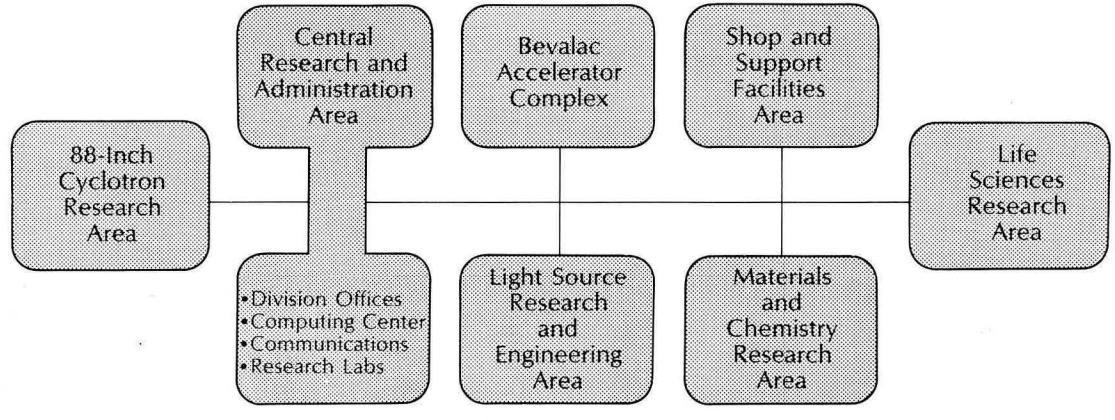


Figure 2-4. Schematic concept of the seven functional areas.

laboratories planned for rehabilitation. The area includes the new Advanced Materials Laboratory and engineering support areas in Old Town, the original laboratory site during the 1940s.

- **The Shop and Support Facilities Area** includes engineering shops and materiel management, with further consolidation of support services planned. Small branch shops will continue to be operated in major buildings to provide fast local support to research programs.
- **The Materials and Chemistry Research Area** contains flexible light-duty laboratories, a new Surface Science and Catalysis Laboratory, and the National Center for Electron Microscopy.
- **The Life Sciences Research Area** contains biomedical sciences research facilities. A canyon extension also offers a site for reclamation services and waste handling.

Redevelop Obsolete Buildings and Infrastructure

The average age of existing buildings at the LBL site is 28 years. Buildings at the original Laboratory site were constructed 40 to 45 years ago and need to be replaced (Figure 2-5). Efficient and productive research programs and cost-effective operations require that substandard buildings be renovated and that obsolete and deteriorated structures be replaced. LBL's redevelopment plans are focused on the buildings in the Light Source Research and Engineering Area to complement the developing Light Source research facility, to sustain general-purpose engineering and technical support, and to maintain other scientific programs.

Coordinate Development Along the East-West Circulation, Communications, and Utilities Axis

The East-West Axis extends from the 88-Inch Cyclotron Research Area to the Life Sciences Research Area. The Laboratory is

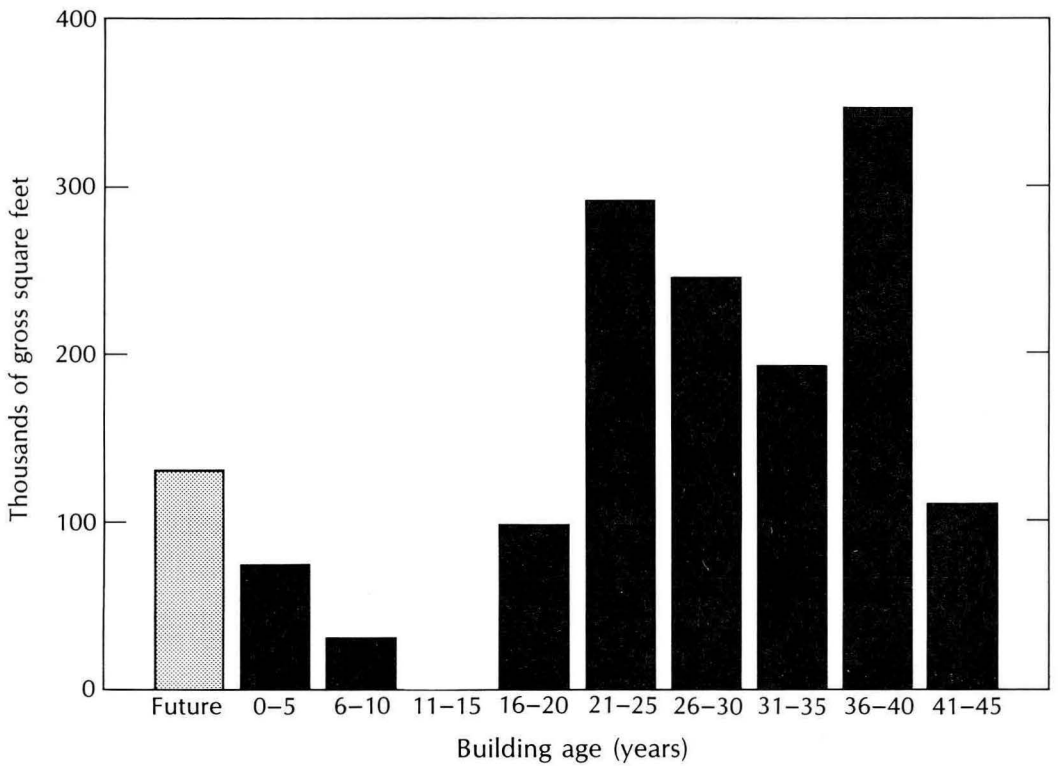


Figure 2-5. Age distribution of permanent main-site buildings, including budgeted construction.

arrayed along this topographic axis, which serves as a central conduit for transportation and utilities (Figure 2-6). Aligned along this axis are functional planning areas. The principal alignment includes:

- *Traffic circulation along the East-West Axis served by a central serpentine road and two loops*—a north loop and a south loop. Connecting the seven planning areas are pedestrian paths and shuttle-bus service. Each loop encompasses one or two of the functional planning areas. Outside of these loops open space is maintained for environmental, aesthetic, and buffer functions. Gates to the Laboratory are provided at the ends of the East-West Axis for vehicle control and physical security.

- *Utility access provided at the ends of the East-West Axis* (with the exception of water and radio communications). High-voltage electricity transmission lines enter from the east end, and 12-kV service is provided to the UCB Campus out the west end. Natural-gas and sewer services are provided at both east and west ends. Utility distribution services, including electricity, vacuum, compressed air, and voice/data communications services, are generally centralized near the support-services areas and extend as a distribution network to the east and west.

The Laboratory's East-West Axis is primarily dependent on topography, circulation, and utility access points and generally provides a building alignment that takes advantage of the views of San Francisco Bay and the Golden Gate Bridge.

The transportation and parking improvements are planned to: (1) improve pedestrian pathways, (2) minimize vehicle use, (3) control access, and (4) optimize land use. The Plan includes both design and operational activities. For example, the on-site cafeteria and automated banking kiosk reduce the need to leave the Laboratory grounds during business hours.

The Laboratory operates an on-site and off-site shuttle-bus service to reduce the use of personal vehicles. These shuttle buses provide access to the AC Transit public buses in downtown Berkeley, the main Berkeley Bay Area Rapid Transit (BART) station, and University bus systems on the UCB Campus and to the Richmond Field Station. Improvements and additions to pedestrian walkways and stairways also reduce vehicle use. The conceptual arrangement is to provide off-road parking

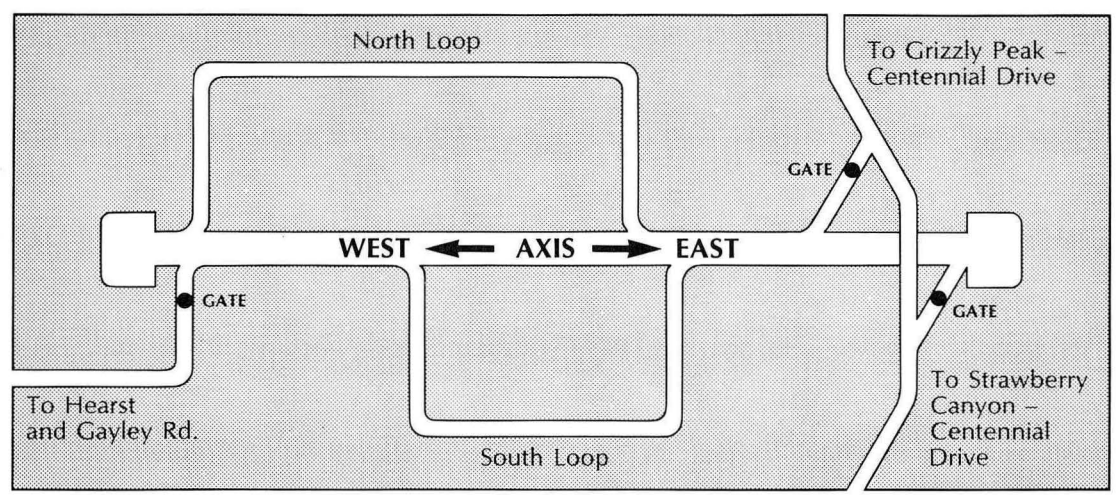


Figure 2-6. Schematic concept of the East-West circulation, communications, and utilities axis, running from Hearst Avenue to Centennial Drive.

areas adjacent to roadways with landscaped plantings to screen parking lots and roads (Figure 2-7). The LRDP includes improvements for pedestrian and vehicle circulation and parking and incentives for the staff to use shuttle buses, car pools, and van pools.

Maintain Perimeter Buffer Zones and Natural Beauty

The perimeter buffer-zone concept provides an organizational framework for landscape planning for the East-West Axis and functional areas (Figure 2-7). The perimeter of the Laboratory is designated as open space that preserves the natural beauty of the area and acts as a buffer between LBL and the Campus, the nearby residential areas, the Lawrence Hall of Science, and the UC Botanical Garden. The buffer areas are managed with the following objectives: (1) maintain environmental values, (2) stabilize slopes and manage runoff, (3) mitigate fire hazards, and (4) visually screen facilities, roadways, and parking areas.

Landscape planting areas are established throughout the Laboratory grounds to sustain or augment the shrub, grassland, and forest areas of the Laboratory site. Major goals for landscape planning are to unify the site visually, to relate the site to adjacent vegetation of the Berkeley Hills, and to provide compatibility between buildings and adjacent properties.

Provide Off-site Facilities for Support and Research

Off-site, or satellite, facilities for support functions and research programs are used when decentralized locations are appropriate. The warehousing and receiving support functions were moved in 1980 to

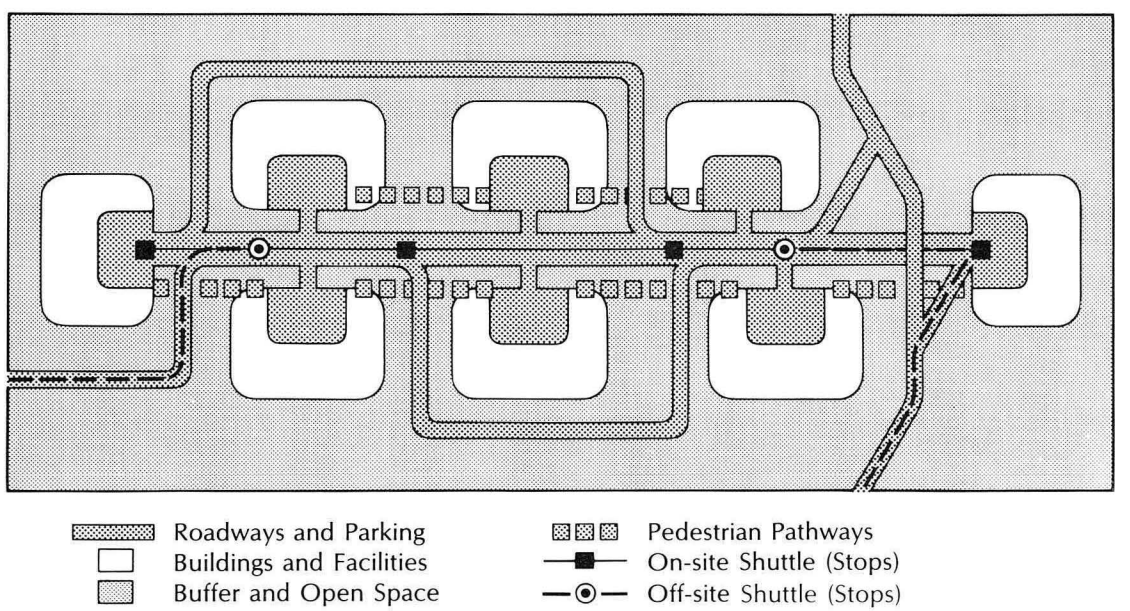


Figure 2-7. Conceptual diagram showing landscape buffer areas, the East-West axis and loop roadways, and parking adjacent to the perimeter of building area.

61,000 gsf and 28,000 gsf of space in Emeryville and Berkeley, respectively. Siting these functions in industrial areas near major freeways eliminated much of the LBL heavy-truck traffic that added to the traffic congestion of Berkeley city streets. In addition, LBL's Printing Plant was relocated to 4500 gsf of space in an industrial park in West Berkeley in 1979 as a near-term solution to a space shortage.

LBL research programs also use off-site locations. For example, there are facilities at UCB's Richmond Field Station (RFS) for the Earth Science Division's research programs in waste isolation and the Applied Science Division's indoor environment program. The indoor environment program maintains at the RFS a research building known as the Radon Research House, a unique experimental facility used for the national radon research program and other indoor air quality research. The Engineering Division monitors particle decay in a low-cosmic-radiation-background environment at the Oroville Dam powerhouse. In addition, research programs are located in short-term-leased buildings when temporary space is required or when cost-effective facilities are not available at the main site.

LBL will continue to evaluate its needs for support services and for research program facilities with respect to their appropriateness to the main site. Those needs that are characterized as being well suited to decentralization will be placed off site when suitable space is available.

Design Guidelines

Design guidelines in the LRDP have been developed to achieve specific facilities planning requirements while respecting site constraints and providing coherence among building elements and the landscape. As a summary, these reference guidelines include:

- *Open Space and Outlooks.* Open space is provided to enhance the working and research environment, to maintain landscape compatibility, and to take advantage of the mild Bay Area climate and the views. Open areas are to be set aside for employee picnics, outdoor gatherings, and exercise.
- *Landscaping and Visual Enhancement.* Landscaping contributes to the compatibility of buildings with the vegetation of the hillside and generally includes native plant materials. It visually screens service areas, provides summer shade, improves the aesthetic qualities of the site, and creates new areas for the use and enjoyment of staff and visitors. Existing natural landscaping will be preserved to the extent possible.
- *Topography and Grading.* Grading and retaining walls are to contribute to the stability of slopes and soils and allow for smooth topographic transition between hillsides and structures and are to be constructed of materials visually suitable for their locations.

- *Utilities Corridors.* Utility distribution systems are, where feasible, to be placed in trenches and under roadways. Central and localized distribution stations and feeder lines are located and sized for future building locations and anticipated demand and will be subject to design reviews for compatibility with general site developments and future site needs.
- *Building Mass and Orientation.* Buildings are to be designed to fit well into the slope of the land, to conserve important landscape features and open space, and to be closely integrated with the landscape plan. They are to be no more than five stories high and may not present an uninterrupted wall greater than four stories high.
- *Building Exteriors.* Exteriors of buildings will be compatible in design with surrounding building elements and landscaping. Textures and colors, including those of roofs, will be unobtrusive.
- *Building Flexibility.* Building systems cores for circulation space and utilities will provide flexible and modular space to allow for changes in partitioning and function.
- *Energy and Operational Efficiency.* Buildings are to employ optimum energy strategies and efficiency features to include building orientation, natural illumination and sun control, and automated ventilation and climate-control systems, where feasible.
- *Circulation and Parking.* Circulation and parking plans are to provide compatibility between vehicle use and pedestrian safety. Pedestrian paths are to be separated from vehicles, where practicable, with distinct access and termination points so that bus stops, parking areas, loading docks, and building entrances are safe and efficient. Emergency-vehicle and handicapped-person access is incorporated into building and circulation design. Shuttle-bus stops are provided with shelters.
- *Guideline Review Process.* Detailed design guidelines will be established for each development site before design begins. Each project will be reviewed for conformance to these guidelines by the Laboratory's architects and engineers and by the Director's Architectural Consultant.

These guidelines provide a general framework for facilities design and will be augmented with more-detailed landscape plans that identify criteria for suitable building sites and clarify landscape planting form. Landscape plans and additional design-guideline information prepared for LBL are identified in Appendix A.

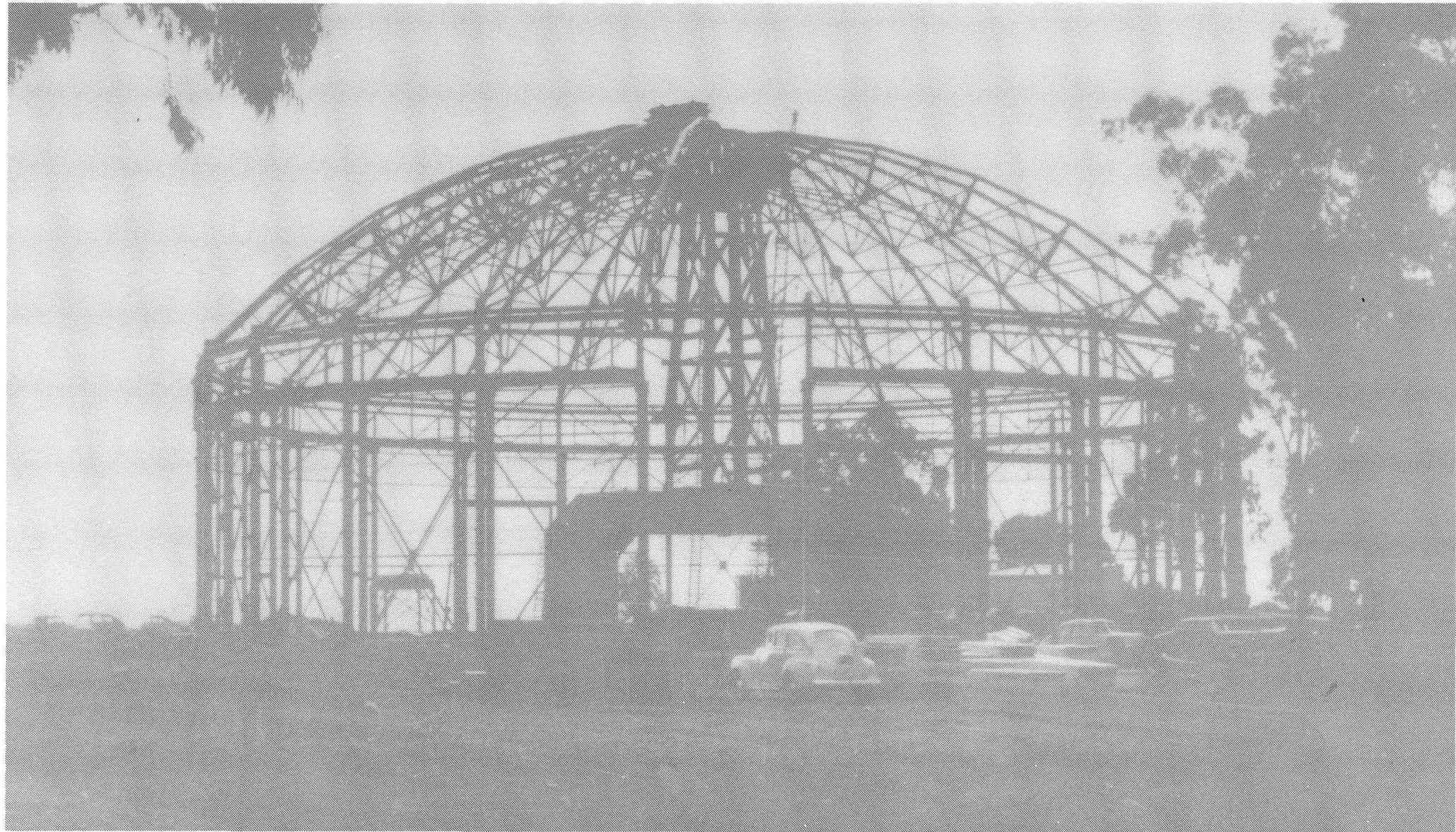
Accommodation for Growth

In addition to these planning concepts and design guidelines, three development programs have been identified during the

LRDP preparation and review process: fire safety coordination, traffic and parking management, and historical preservation. Fire-safety measures are necessary to minimize the possibility of fire in the undeveloped buffer zones. Although the natural-vegetation areas between LBL and nearby residences are outside LBL's formal jurisdiction, the Laboratory assists the University of California, Berkeley and the cities of Berkeley and Oakland with fire-safety measures. The Laboratory has agreed to provide back-up fire control/patrol teams and equipment during preventative burns. Historically, the Laboratory's Fire Department has responded to calls for assistance from local fire departments and is committed to continue to do so in the future. The Laboratory is cooperating and participating with the University of California, Berkeley in their Fire Management Plan for the U.C. Hill Area. In addition to scheduled burns coordinated with UCB, plans include the planting and maintenance of fire-resistant species to create a fire break between the Laboratory fence line and adjacent grassy slopes.

As described in subsequent sections, a new Laboratory organization is being created to assist in planning for and controlling parking and traffic, and a Traffic and Parking Management Plan is being prepared. Elements being considered in the plan include: discouraging drive-alone vehicular traffic and promoting car pools and van pools, expanding bicycle paths and providing increased bicycle storage, encouraging the use of flextime to reduce congestion during peak hours, selling BART tickets on site, adding pedestrian gates to facilitate foot traffic, and using stack parking, for the short term, and constructing parking structures, for the long term.

A historic preservation review was conducted by an independent consultant in 1987. The review documents LBL's facilities and provides recommendations to ensure LBL's compliance with CEQA guidelines. Additional background and planning measures for fire prevention, parking and traffic control, and historical preservation are included in Chapters 4 and 5 and in Appendix A.



3. TRENDS AND DIRECTIONS

Historical Background

Historically, LBL has been an accelerator laboratory since its 1931 inception, when Ernest O. Lawrence established the Radiation Laboratory with the construction of the 27-Inch Cyclotron on the UCB Campus. In 1939 the need for higher-energy accelerators resulted in the construction of the 184-Inch Cyclotron on a hill overlooking the Campus and the City of Berkeley (Figure 3-1). Driven by forefront nuclear science and biophysics until World War II, then by the Manhattan Project and later by high-energy physics, the Laboratory grew steadily until about 1965. During the initial phases of rapid growth between 1940 and 1946, the original Laboratory site became crowded with temporary buildings hastily erected in response to national defense needs (Figure 3-2). However, development during the 1950's was more carefully planned, with the construction of permanent concrete and steel-frame structures east and west of the original site.

Under the auspices of the Atomic Energy Commission, LBL's largest accelerator, the Bevatron, became operational in 1954 as the nation's leading high-energy physics facility (Figure 3-3). The Heavy Ion Linear

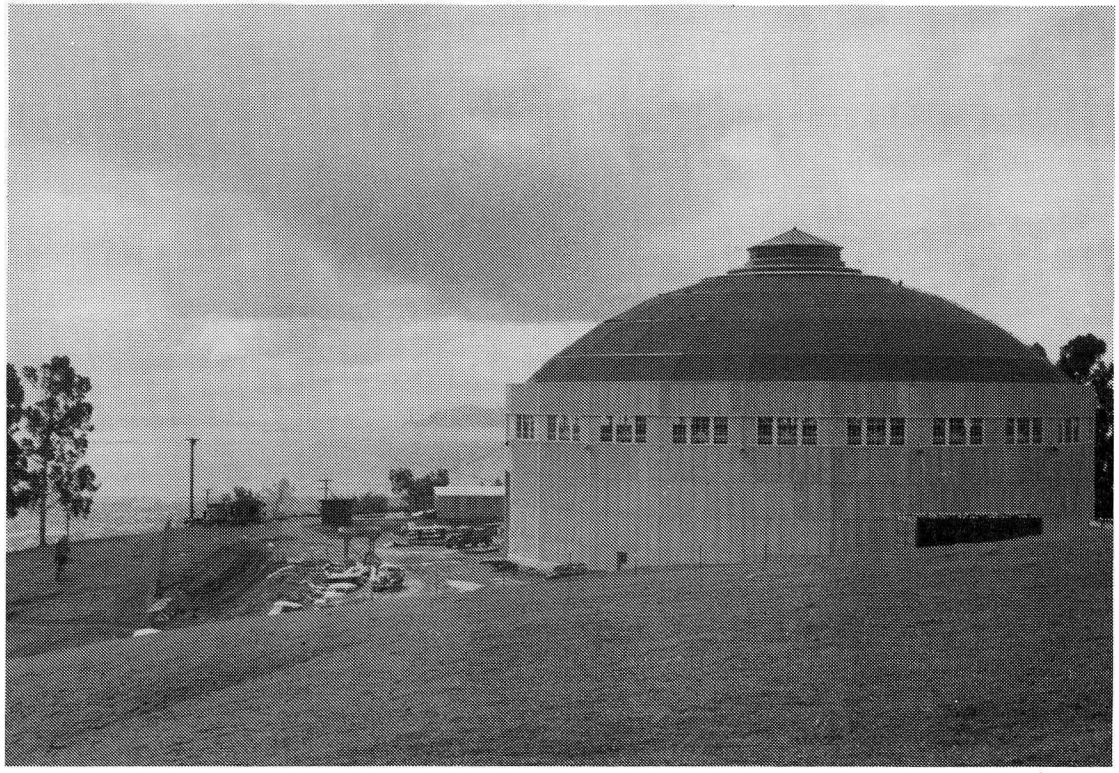


Figure 3-1. The 184-Inch Cyclotron under construction in 1943 on a hill overlooking the city of Berkeley and San Francisco Bay.

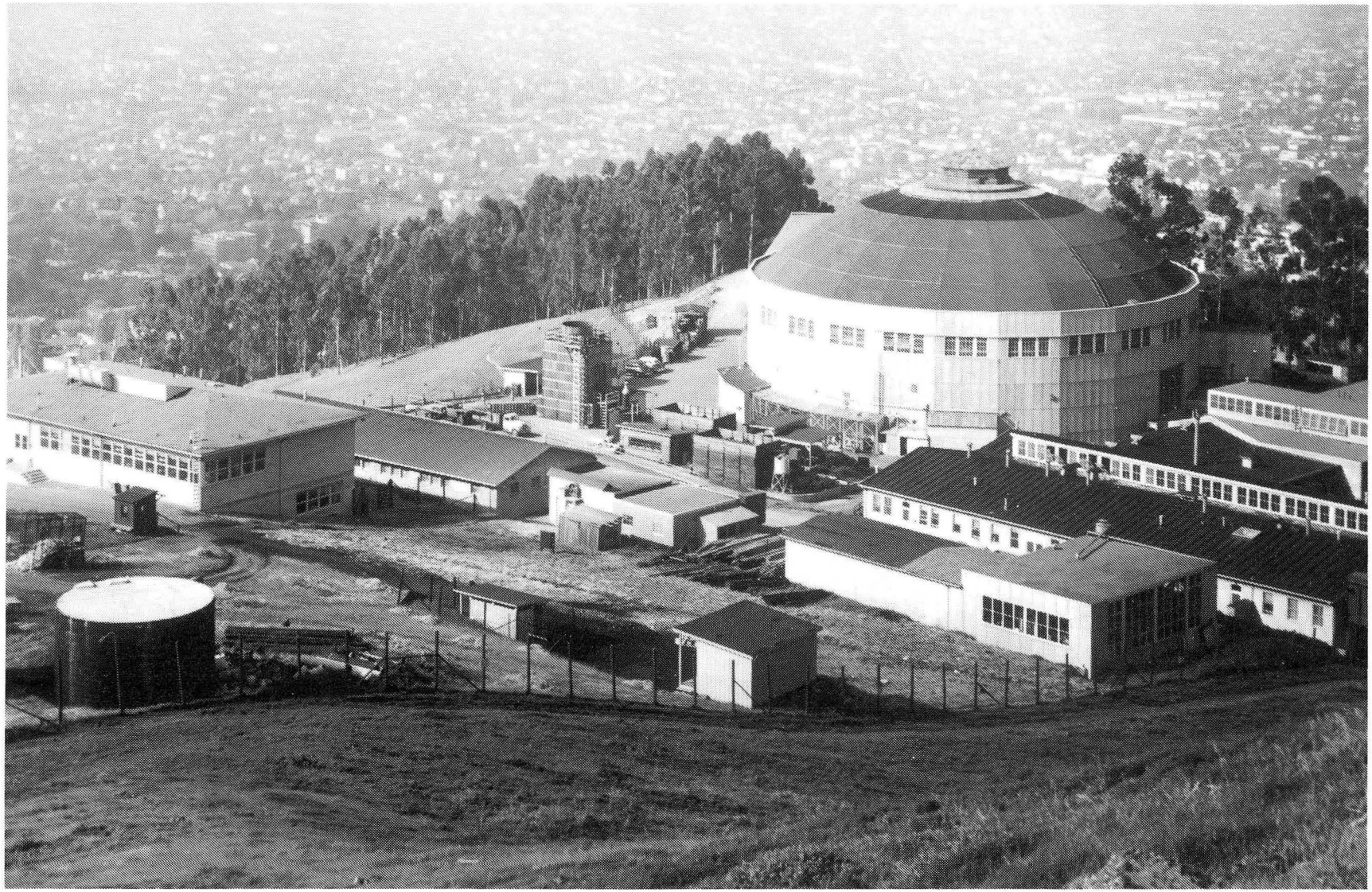


Figure 3-2. Development at the original Laboratory site after World War II.

Figure 3-3. A view of the Laboratory looking to the south-east during 1955.

Accelerator (HILAC) was completed in 1958, and the 88-Inch Cyclotron was completed in 1964. All three accelerators have been modernized and continue to make important contributions to nuclear physics research.

The late 1960s through the early 1970s was a period of reduced program activity at LBL as much of the nation's high-energy physics research was conducted at other laboratories with larger accelerators. In 1974 the Bevatron was combined with the HILAC to form the Bevalac, and the Laboratory regained its position as a world-leading accelerator facility, this time for heavy-ion nuclear physics research (Figure 3-4).

Following the 1973 oil embargo, a number of new research programs broadly relevant to national energy supply and end use were initiated as the Atomic Energy Commission's activities were transferred to the Energy Research and Development Administration in 1975. Although the Laboratory grew to its largest population in 1979 following the establishment of the Department of Energy, no permanent buildings were constructed to accommodate this growth; temporary buildings and leased space in the Cities of Berkeley and Emeryville were used to house research programs and support services (Figure 3-5). By 1980 only 25 percent of the Laboratory's activity was in high-energy and nuclear physics, a dramatic change from 75 percent of program activity in

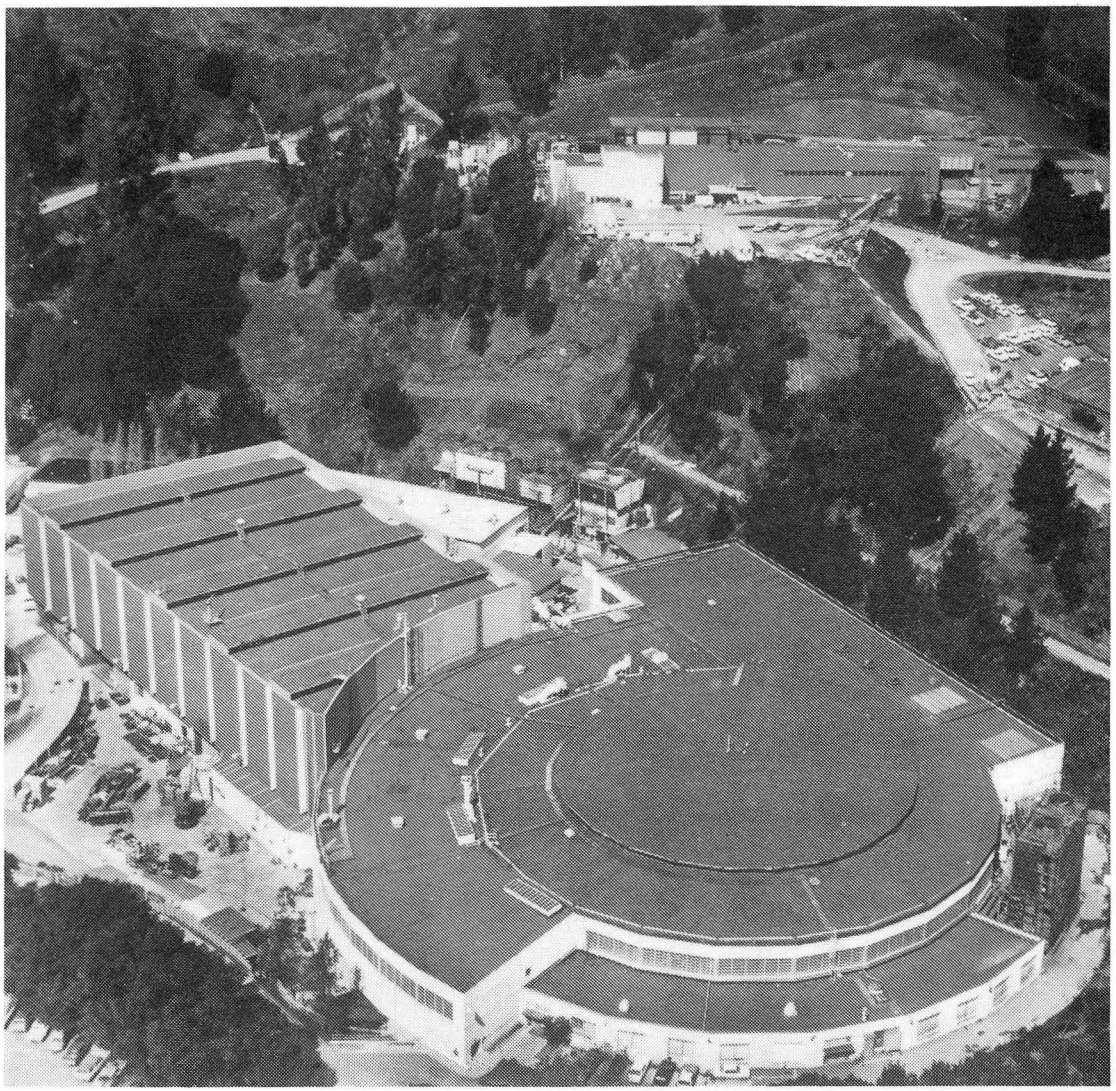


Figure 3-4. The Bevatron in tandem with the SuperHILAC forms the Bevalac (1974), capable of accelerating beams of ions as heavy as uranium (see also Figure 3-10).

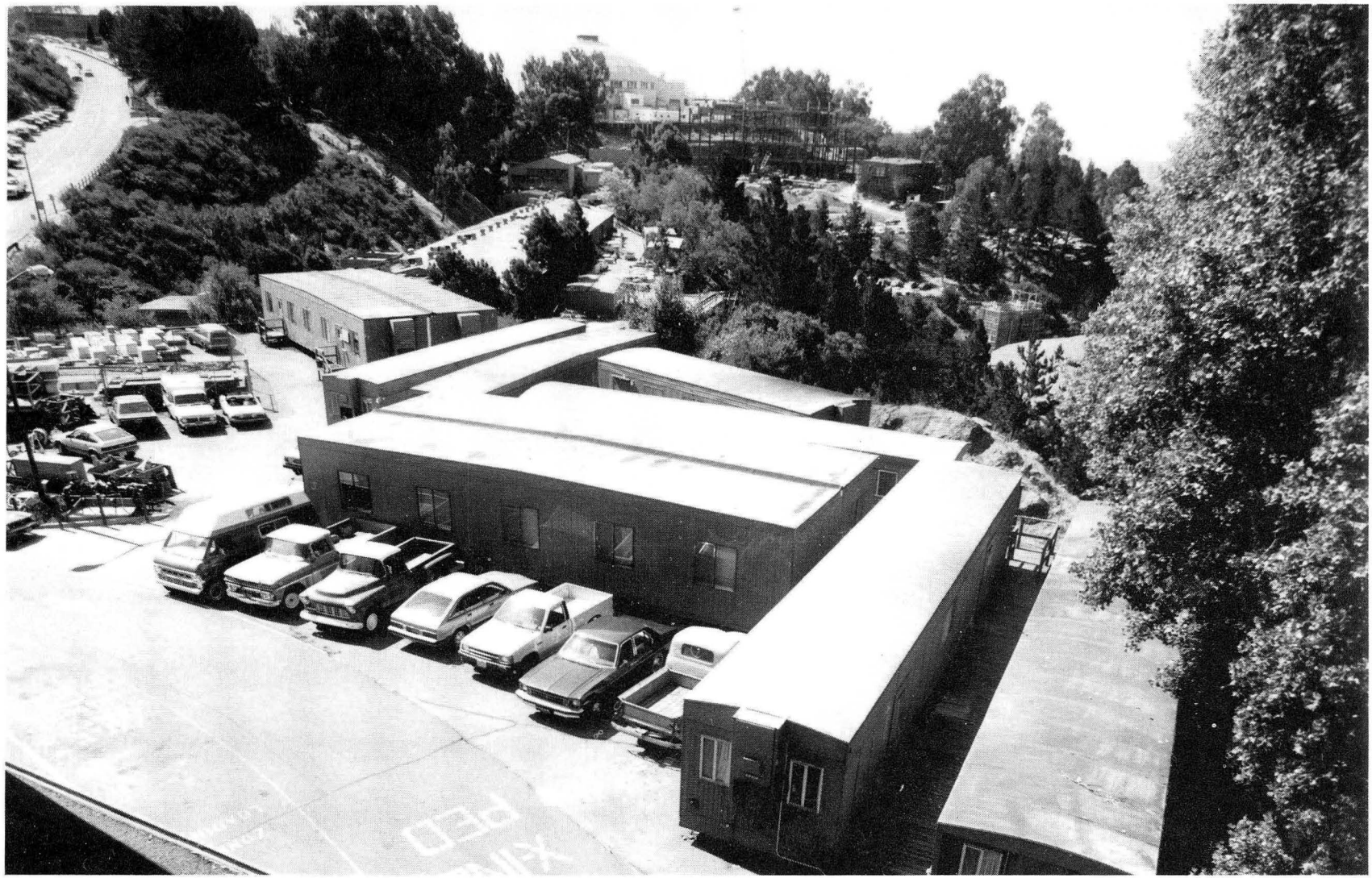


Figure 3-5. Temporary structures have been used to house research programs and support services because of the limited construction budgets between 1963 and 1984.

1970. The Laboratory had become a multiprogram national laboratory, a fundamental shift in mission since the 1962 LRDP was prepared.

From 1980 to 1982, federal support for energy technology research dropped precipitously, and basic research declined, resulting in a 19-percent reduction in LBL's workforce. The Laboratory's plans re-emphasized more-basic, laboratory-based research founded on its multidisciplinary scientific strengths. These plans called for development of the basic energy sciences and life sciences while maintaining historically important roles in high-energy and nuclear physics. In 1984 the National Center for Electron Microscopy was completed (Figure 3-6). Through the 1980s the stronger conservation and environmental research programs in building sciences, energy storage, and air qual-

Figure 3-6. The National Center for Electron Microscopy: the two silos house the Atomic Resolution Microscope and the High Voltage Electron Microscope.

ity that grew during the 1970s were retained. Facilities plans and research programs with long-term potential for contributing to the nation's technological capabilities in materials science, chemistry, biology, and the earth sciences were initiated.

Budget Trends

The trend of diversification toward multiprogram research activities and the development of Basic Energy Sciences are reflected in the budget trends for the Laboratory over the past two decades (Figure 3-7). In the early 1970s the Laboratory was supported primarily for high-energy and nuclear physics research, but by 1975 significant diversification had taken place, and by 1980 conservation and fossil-energy programs had grown substantially. The 1987 budget levels are indicative of a recent trend of reduced support in the fossil energy, conservation, and technology-demonstration programs. However, the budget sustains support in physics and is expanding in the basic energy sciences such as chemistry, materials science, and the geosciences, where the Laboratory has growing research strengths.

Over the past decade the Laboratory has emphasized increasing support for capital investment in its physical plant (Figure 3-8). This has reversed the low funding levels during the late 1960s and 1970s and is

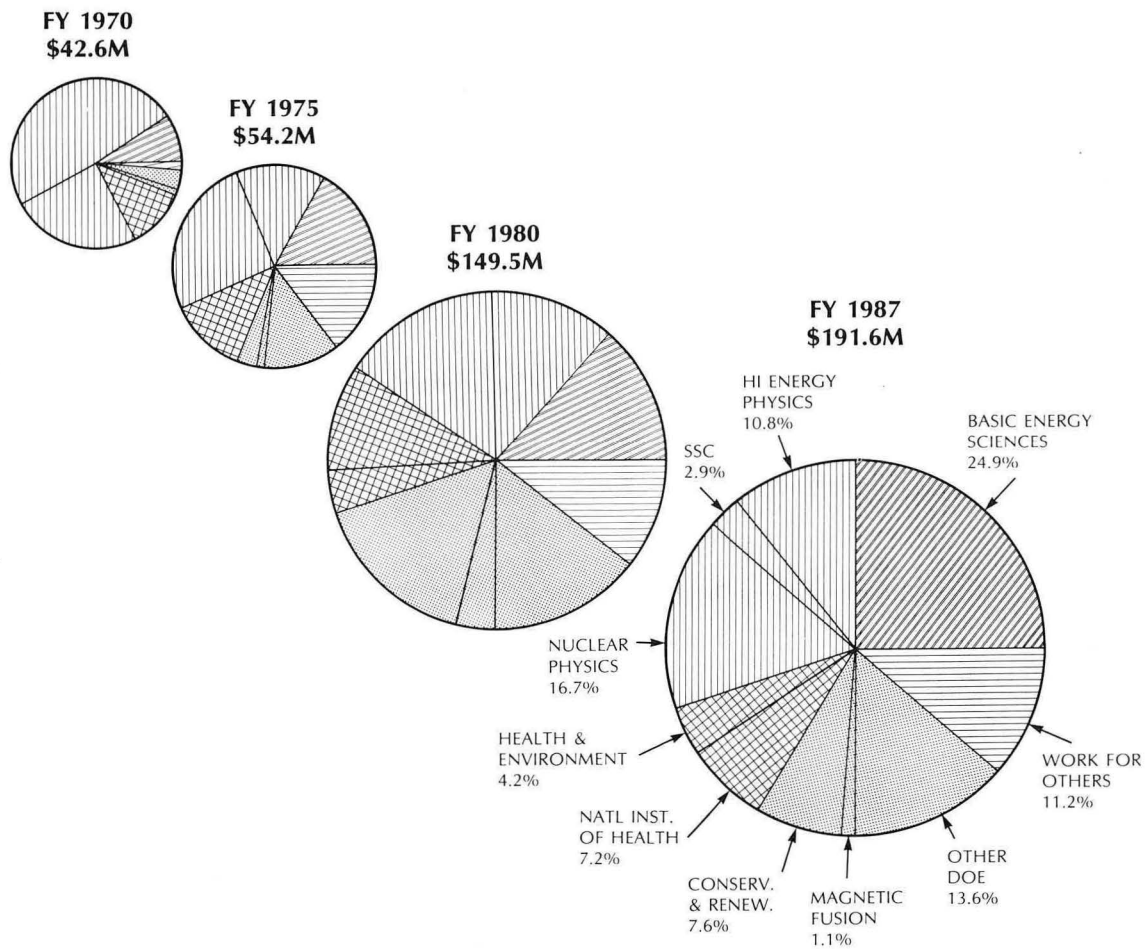


Figure 3-7. Budget trends at LBL over the past 20 years.

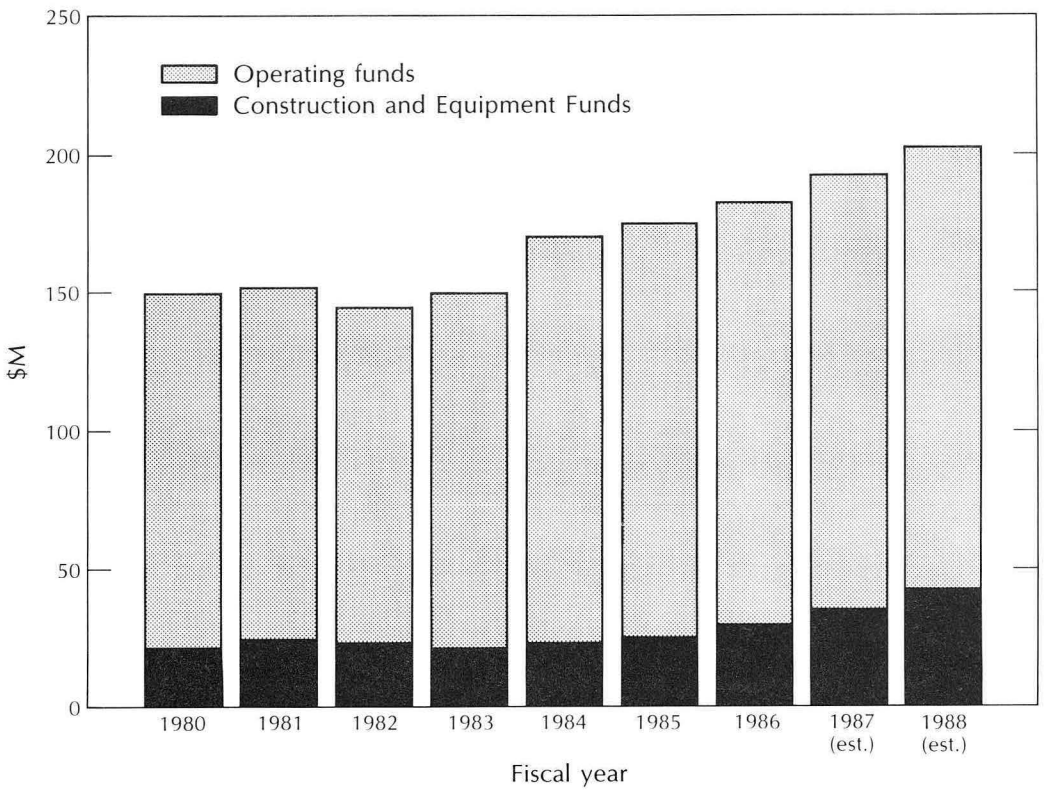


Figure 3-8. LBL capital investment in physical plant in the past 10 years.

representative of plans to revitalize existing facilities and to support major new research facilities within DOE's multiprogram laboratories. The 1987 LRDP provides guidance for the effective use of these capital funds and for accommodating the significant changes in the Laboratory's mission since the 1962 LRDP.

Current Scientific Activities and Plans

The Laboratory has now identified core research areas and has prepared facilities plans aimed at providing the nation with technical and educational strengths based on high-quality science. A planned major design and construction project at LBL is the Advanced Light Source, a national user facility that will provide ultraviolet and soft-x-ray photon beams of high spectral brightness, high flux, and partial coherence in pulses of several-picosecond duration (Figure 3-9). This facility will serve a large number of users from industry, academia, and other national laboratories. The facility is the focus for redevelopment of research facilities in the original Laboratory site.

Consistent with the national long-range plans in nuclear physics, there are plans for an upgraded accelerator in the Bevalac Accelerator Complex that can play an important role in the exploration of nuclear matter under extraordinary condi-

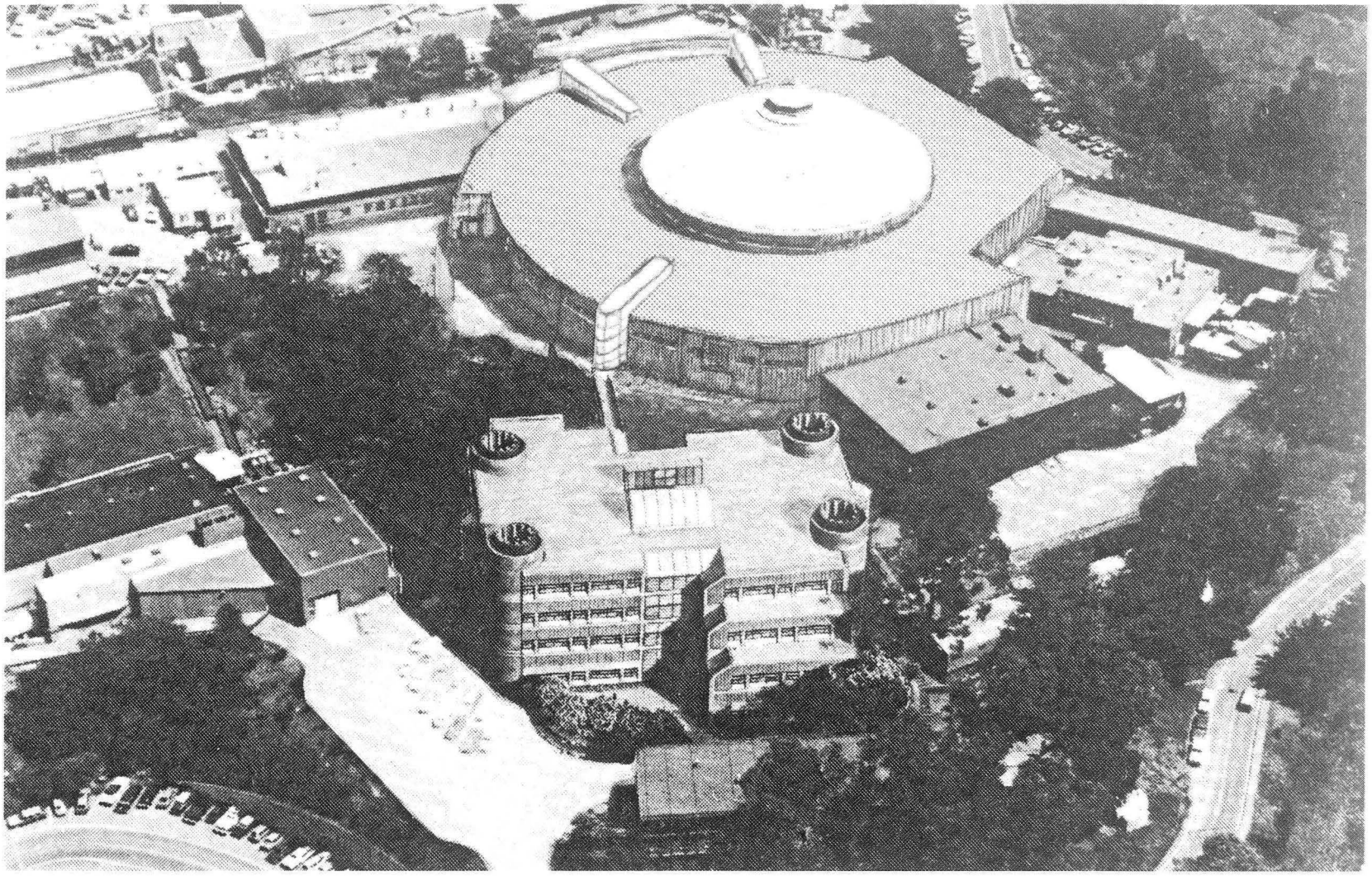


Figure 3-9. Architect's concept of the Advanced Materials Laboratory (foreground), currently under construction, and the Advanced Light Source, an electron accelerator and storage ring that will provide beams of ultraviolet light and soft x-rays for scientists in many fields. The Advanced Light Source is scheduled to be completed in 1992.

tions. The Bevalac Upgrade will permit forefront scientific investigations of the equation of state of nuclear matter, nuclear dynamics, nuclear astrophysics, and biomedical science (Figure 3-10). The Upgrade can provide 100-fold, or greater, increases in beam intensity, greatly improved control systems, and improvements in operating efficiency. The Bevalac Upgrade will be constructed within the existing Bevalac building and experimental hall.

LBL currently continues to initiate important new research programs on advanced accelerators and detectors for physics research. New experimental and fabrication facilities are being developed to support national high-energy physics programs. At LBL, these support facilities include ultrahigh-vacuum facilities and clean rooms and the redevelopment of high-bay space for detector assembly and fabrication.

Materials and chemistry research activities now constitute a significant share of research activity at LBL. A focal point for these programs is the materials science and chemistry research area (Figure 3-11). The Center for Advanced Materials has established programs that integrate materials research on synthesis, processing, characterization, and instrumentation development in collaboration with U.S. industry. The Center for X-ray Optics develops sources of radiation and techniques to transport, focus, disperse, and detect soft

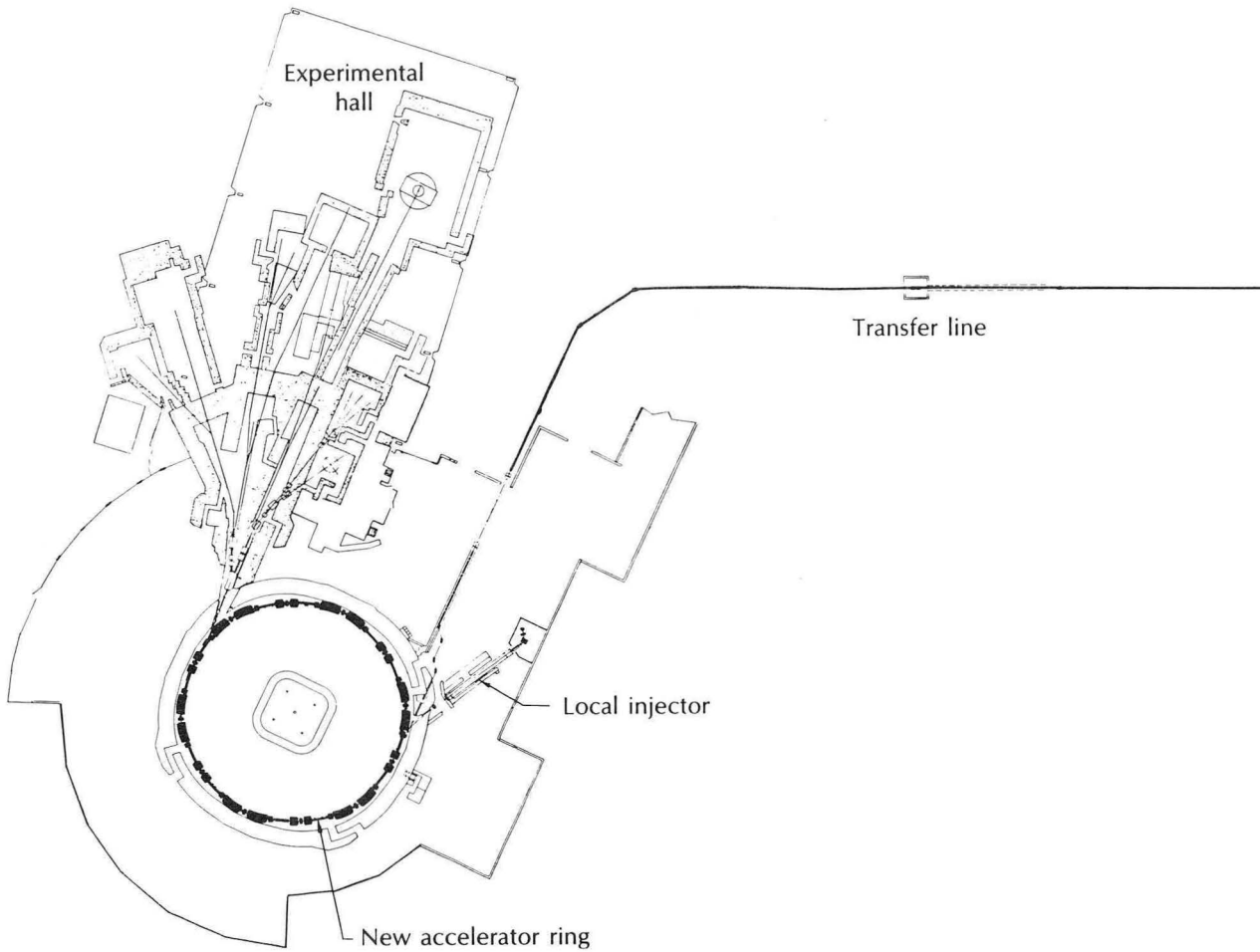
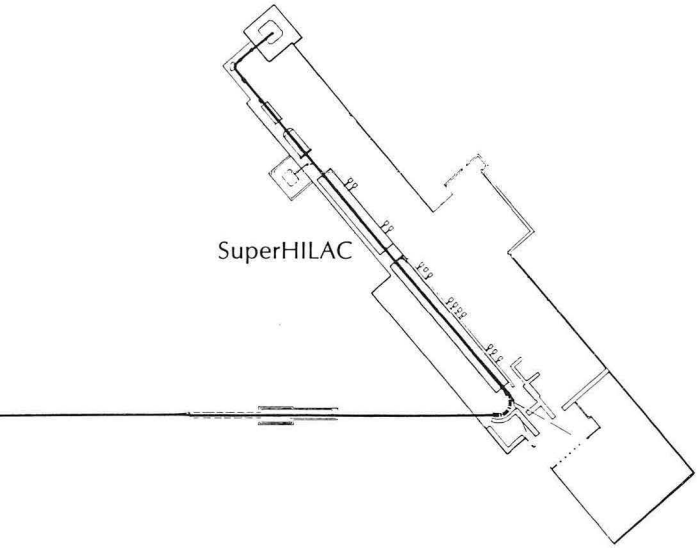


Figure 3-10. Diagram of the Bevalac Upgrade, a new synchrotron accelerating ring that would be constructed within the existing Bevatron building.



x-rays in support of research in many fields of the natural sciences.

Life sciences research is conducted in six major program areas: molecular genetics and nucleic acid studies, gene expression and physiology, nuclear medicine, carcinogenesis and mutagenesis, structural biology, and environmental research. Most of this research is conducted at the Donner Laboratory and the Laboratory for Chemical Biodynamics on the Campus and at the Life Sciences Research Area, where additional facilities for human-genome research are anticipated (Figure 3-12).

Energy technology and conservation research emphasizes potential new

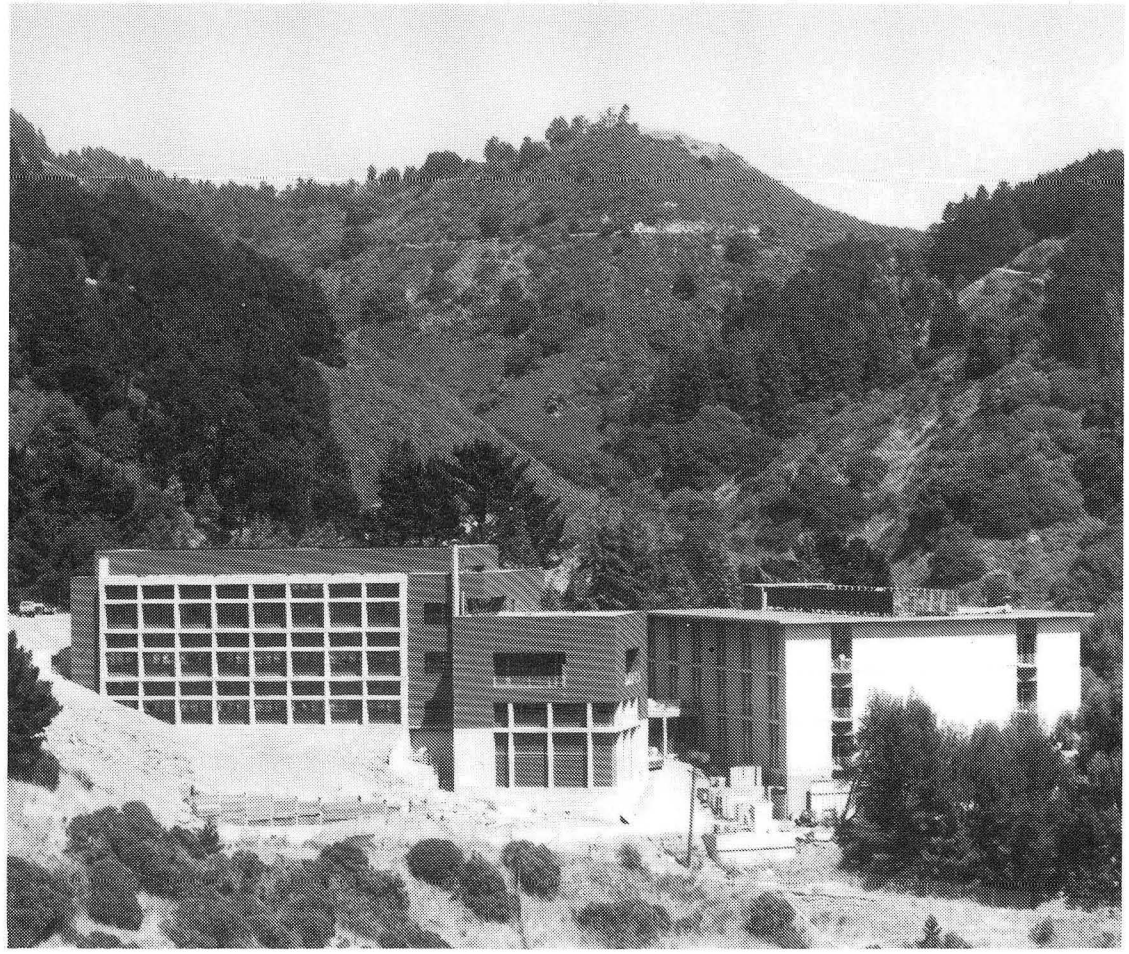


Figure 3-11. The new Surface Science and Catalysis Laboratory and the Materials Science and Chemistry Division office and laboratory building.

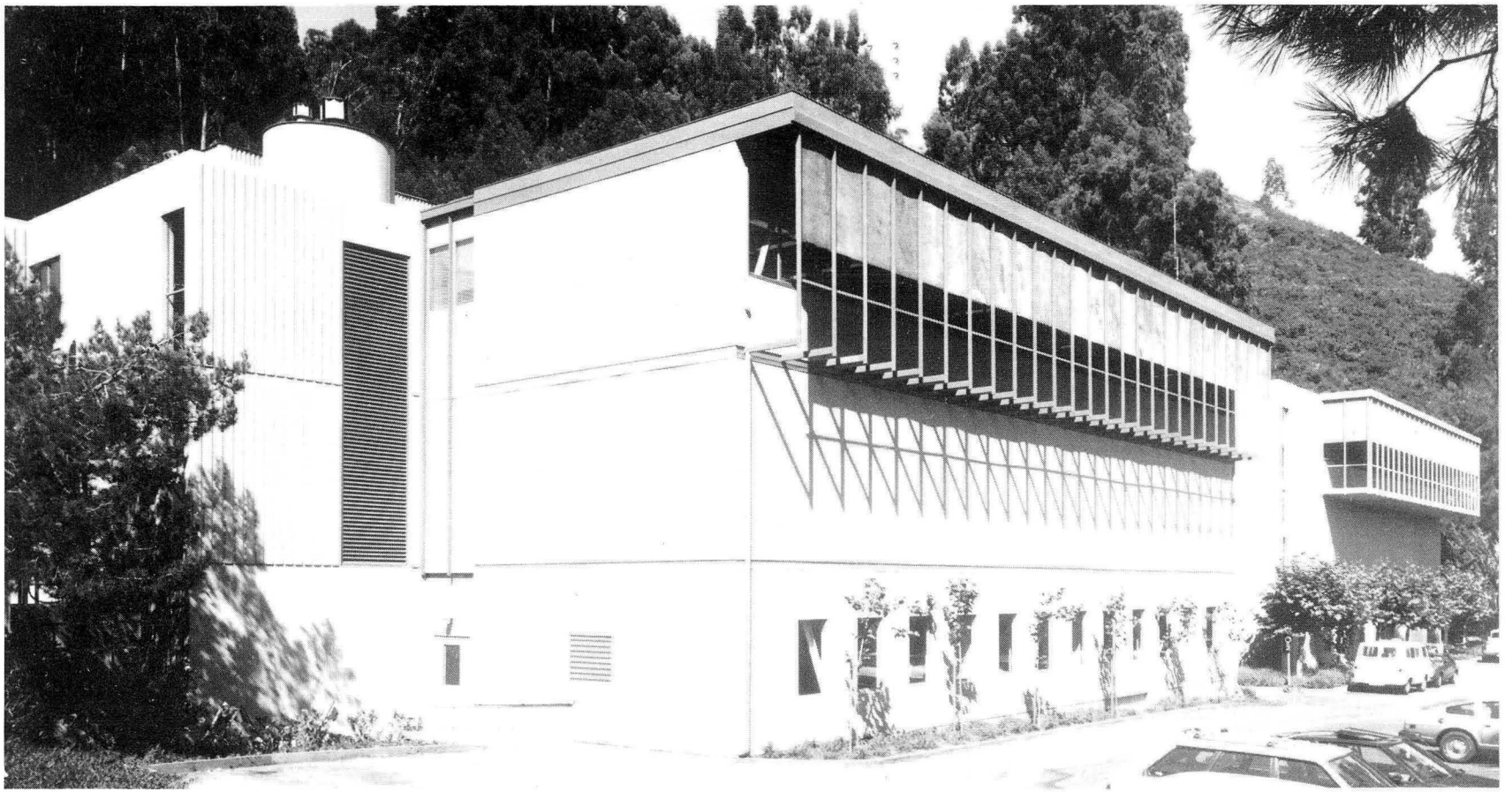


Figure 3-12. Life sciences research is conducted in the light-duty laboratories at the eastern end of LBL's main site.

fusion-generation systems, electric-energy storage, and building systems. Examples include the evaluation of heavy-ion accelerators as drivers for inertial confinement fusion, new battery systems, and advanced concepts for fluorescent lamps (Figures 3-13 and 3-14). In the geosciences LBL has several programs, including, for example, a national leadership role in the Continental Scientific Drilling Program (Figure 3-15).

In the future, the role of national laboratories as centers for research services will grow in order to ensure the availability and efficient use of advanced research facilities. The major facilities at the

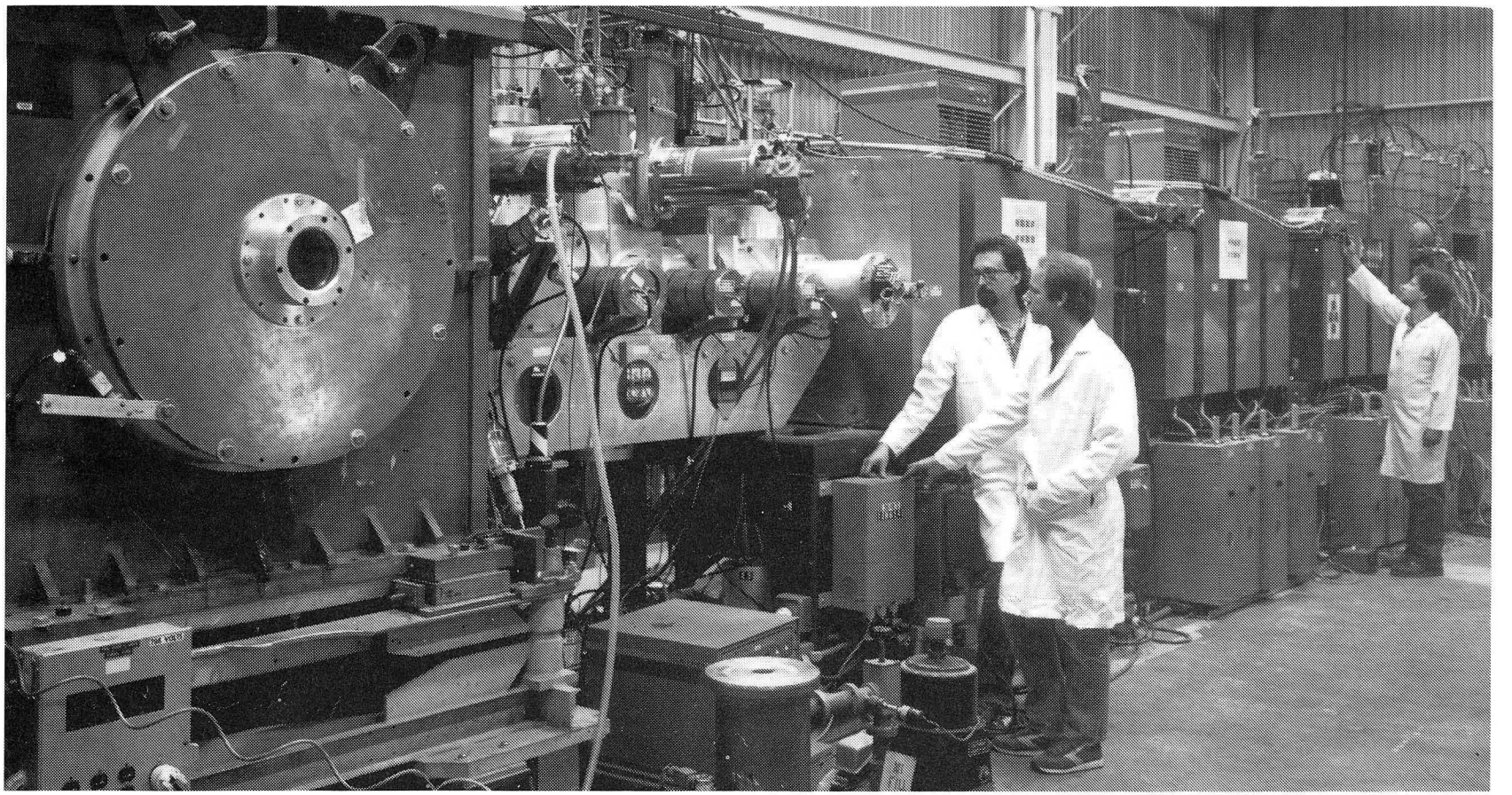


Figure 3-13. Heavy Ion Fusion Accelerator research in Building 58.

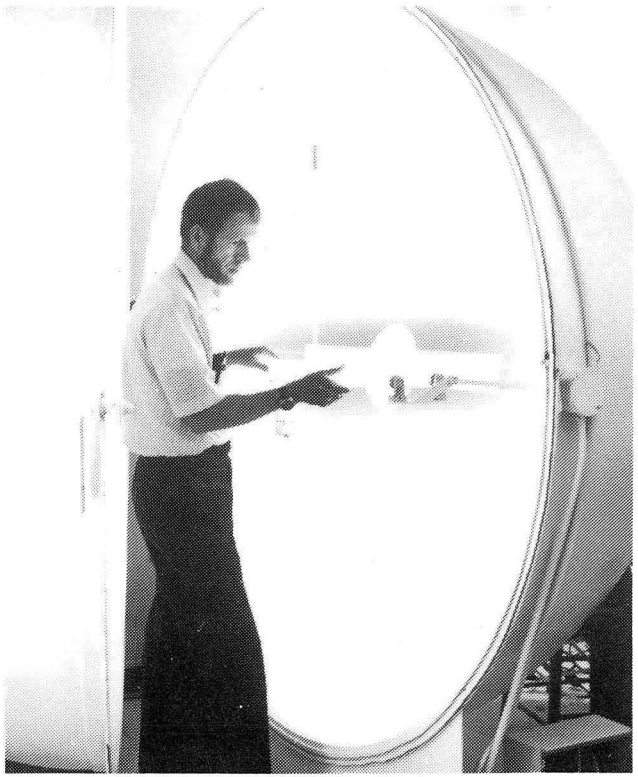


Figure 3-14. Researcher measuring the efficiency of an energy-saving isotope-enriched fluorescent lamp.

Figure 3-15. The Chicken Creek Staging Area for earth sciences field research.

Laboratory will be the Advanced Light Source and the Bevalac Upgrade. Complementary coherent sources of radiation, including those in the visible and infrared wavelength regions are also planned.

Additional facilities for advanced accelerator physics research, biotechnology development, heavy-ion storage-ring experimentation, and advanced engineering support activities are also in the planning stages or are defined as areas reserved for further development (Table 3-1). The Laboratory anticipates that the trend toward advanced instrumentation, improved computational capabilities, and multidisciplinary scientific programs will continue.

Beyond the 1980s, the nation will continue to face increasing demands for research and training programs that support technical and economic competitiveness. To provide the required technological innovation and scientific expertise, the Laboratory will emphasize fundamental research programs, advanced user facilities for the general scientific community, new educational and training initiatives, and increased interaction with industry. With this approach, the Laboratory's expertise and facilities will contribute to meeting national scientific and economic goals well into the next century.

Table 3-1. Research-Program-Related Facilities Needs.

Program Area	Additional Facilities Needs
Basic Energy Sciences	Advanced Light Source additions for users Heavy Ion Fusion Research experiment additions Materials Science laboratory addition
Nuclear Physics	Bevalac beam hall extension Detector assembly facilities Heavy-ion storage ring for the upgraded Bevalac
High-Energy Physics	Detector assembly facilities Accelerator testing and development facilities
Health and Environmental Research	Human Genome Laboratory and life sciences additions Biomedical Isotope Facility Biotechnology-related additions
Conservation and Renewable Energy	Conservation and Renewable Energy Research Complex
Educational Programs and Program Support	Conference Center and office additions

4. PLANNING ANALYSIS

Infrastructure and Population

The Laboratory's research is conducted by scientists, engineers, and support staff that together are responsible for the the Laboratory's 800 research projects and programs. The total estimated LBL population in 1987 is 3,595, comprising 2,008 full-time employees, 1,064 part-time employees, and 523 guests (Table 4-1), of whom seventy-nine percent are located on the LBL hill site. More than 200 of the staff are also University of California faculty, and about 600 of the part-time appointments are to graduate students working on advanced-degree programs. Thirty-five percent of LBL employees reside in the City of Berkeley.

Including graduate students and postdoctoral research associates, about one-half of the staff are scientists and engineers, representing a wide variety of scientific disciplines (Figure 4-1). The development and retention of a high-quality staff have been critical to the success of the Laboratory's research programs. Staff development is closely related to the LRDP's objective of maintaining a high-quality working environment.

Historically, the size of the Laboratory population has undergone fluctuations rather than continuous increases or decreases, primarily due to changing national research priorities and new developments in scientific fields and their required facilities (Figure 4-2). With the completion of the Advanced Light Source in 1992, an initial increase of about 50 guest scientists per year, increasing later to 250, is anticipated.

Overall, the Laboratory's long-term growth is expected to be about one-percent per year. Without significant changes in building density or transportation systems (see Appendix A, which identifies several site-capacity studies), the LRDP reserves building space for 4100 people on the main site. This planned maximum allows for consolidation of staff onto the main site, although some staff would remain off site (Table 4-2), primarily at the receiving and warehouse operations in the cities of Emeryville and Berkeley. Although the anticipated reserve capacity is less than the peak Laboratory population in 1978, the LRDP provides a reserve for growth of approximately 1100 persons above the 1986 main-site population of 3000 and

Table 4-1. LBL 1987 Population.

Location	Staff		Guests	Total
	Full-Time	Part-Time		
Main Site	1,797	697	350	2,844
Campus	165	340	171	676
Other	46	27	2	75
Total	**2,008**	**1,064**	**523**	**3,595**

Table 4-2. LBL Anticipated Population Capacity.

Location	Staff		Guests	Total
	Full-Time	Part-Time		
Main Site	2,625	910	565	4,100
Campus	150	390	100	640
Other	10	0	0	10
Total	**2,785**	**1,300**	**665**	**4,750**

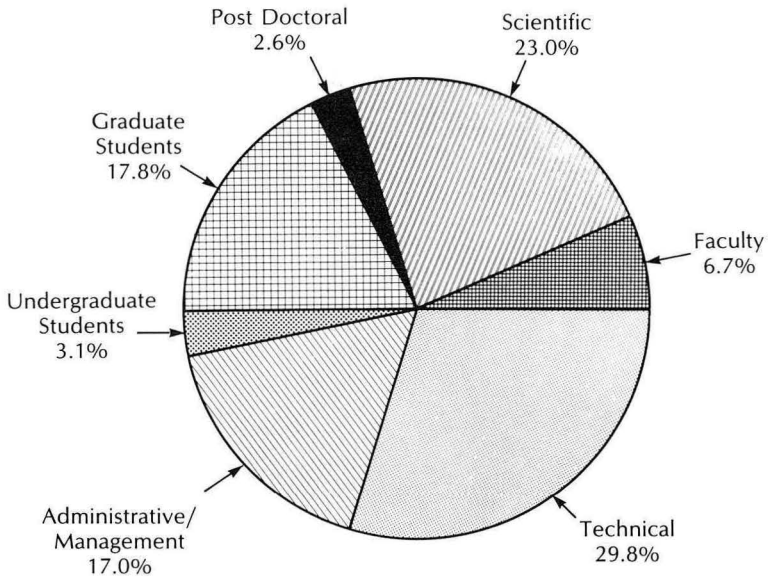


Figure 4-1. Composition of the Laboratory staff.

will allow the Laboratory to accommodate anticipated scientific programs effectively.

During the past decade the scientific manpower of the nation has grown at an average of about 5 percent per year. The moderate allowance for Laboratory growth and the planned redevelopment of the Laboratory's facilities are based on anticipated program goals. As described in Chapter 3, these goals include service in the basic energy sciences, primarily through advanced high-brightness sources of photon radiation, further development of materials sciences research, growth in the life sciences, the upgrade of nuclear physics research facilities and other accelerator-development activities, and sustained quality research in other programs as a multiprogram national laboratory.

Present Laboratory Facilities

As summarized in Chapter 1, the facilities and the currently funded construction at LBL constitute 2.01 million gross square feet (gsf) located on the main site, the UCB Campus, and the Richmond Field Station and in leased off-site locations. The off-site leased buildings, other than those housing the receiving and warehouse operations and the Richmond Field Station programs, are a temporary arrangement. However, this arrangement does free space for essential research and support functions. At the main site 1.522 million gsf are permanent buildings, and 69 thousand gsf are trailers.

LBL Facilities Needs

LBL's future facilities requirements fall into three general categories: (1) advanced and specialized research facilities for specific programmatic needs; (2) flexible and multipurpose laboratories, offices, and support buildings; and (3) shops and utilities that meet support requirements. To meet the needs of current and anticipated research programs and support requirements, the LRDP identifies the following types of facilities for improvement or replacement:

Research Facilities

- *Heavy-duty laboratories* for advanced research-equipment fabrication and

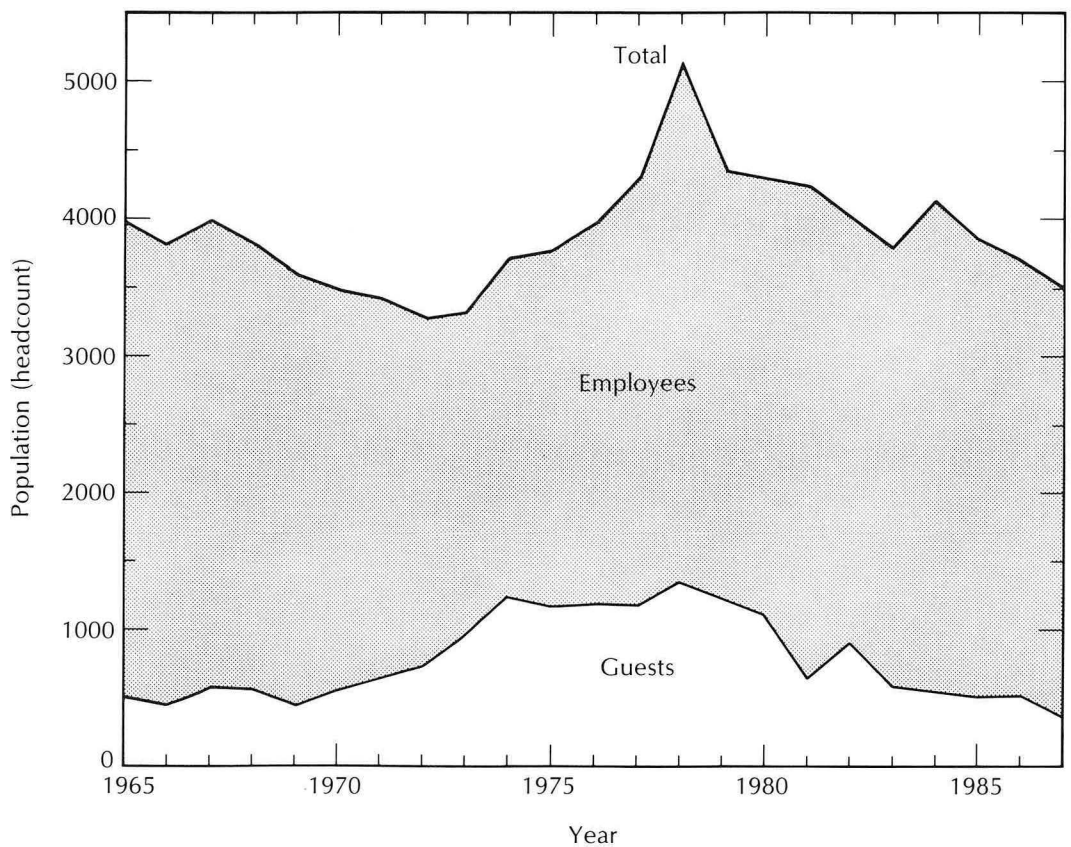


Figure 4-2. Laboratory population levels.

operation. These heavy-duty laboratories are planned for housing several current and next-generation accelerators, future particle storage rings for electrons and heavy ions, extensions to experimental halls, and facilities for advanced detectors. These facilities must meet requirements for ceiling height, floor loading, crane capacity, and cleanliness that are typical of LBL's modern heavy-duty-laboratory needs.

- *Wet and dry light-duty laboratories* for specialized and general-purpose needs. The specialized laboratories include, for example, facilities with clean-room operating standards, for radiopharmaceutical preparation, and with isotope-handling capability. More general-purpose laboratories are needed, for example, for molecular genetics studies on the human genome, bioreactor testing and development, chemical reaction dynamics studies, and lighting technology research.

Multipurpose Space and Offices

- *Office space* is needed near laboratories and shops to meet program requirements efficiently within DOE office-space guidelines. Of current office space, 48,400 gsf now consists of temporary buildings.
- *Miscellaneous space* for storage, computer facilities, and utility equipment is adequate in terms of its quantity, but much of it is in need of renovation. In addition, support space for technology-transfer activities, meeting facilities, visitor accommodations, cafeteria operations, and other functions is needed.

Shops and Utilities

- *Shop facilities* for mechanical and electronics instrumentation are required for plating operations, magnet winding, beam-line development, precision machining, and high-vacuum opera-

tions. Shop assembly now requires use of computer-aided design and fabrication, and space must be modified to accommodate computer terminals and central processing units. All shop facilities must be periodically upgraded to meet increasingly stringent standards for environmental health and safety.

- *Utility and roadway* improvements include replacement of elements of the electricity, gas, and water distribution systems that are nearly 50 years old. Although the main electrical substation is now being replaced, the 12-kV electrical distribution system and substations and mechanical utilities and roadways need improvement.

Improvements to the aged and obsolescent laboratories, offices, and shop facilities call for the rehabilitation of 788,500 gsf of existing on-site space (Figure 4-3). However, several buildings (totaling 203,000 gsf), many in the Light Source Research and Engineering Area, are obsolete structures that cannot be upgraded to meet existing standards, and the LRDP calls for their removal and replacement (Appendix B).

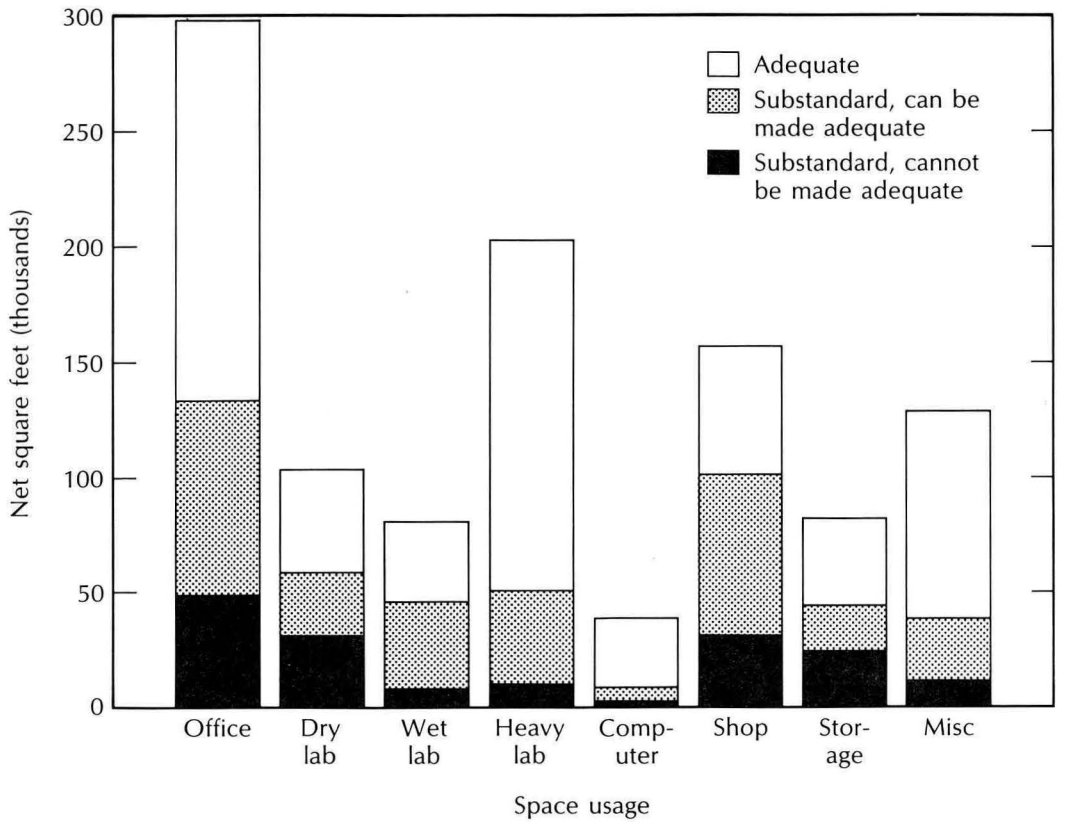


Figure 4-3. Condition of main-site buildings, including funded construction projects (classified as adequate space).

Reserve for Long-Term Development

The overall need for site locations and buildings as a reserve for growth is approximately 420,000 gsf. Although site

redevelopment and some new replacements for engineering and multipurpose buildings are required promptly, construction of programmatic facilities that would significantly increase Laboratory size is not expected over the near term. The near-term projects emphasize rehabilitation and replacement and consolidation of functions for activities occurring both on site and off site in leased space.

The major research program space needs are for accelerator- and detector-development heavy-duty laboratories and laboratories for energy conservation and renewable energy research, for life sciences research in support of biotechnology- and environment-related initiatives, and for chemistry- and materials-science-related research. A reserve of approximately 170,000 gsf for new research buildings would accommodate anticipated long-term growth.

Multipurpose facilities and offices, including computer and communications facilities, cafeteria facilities, conference rooms, and other general-purpose buildings, are also needed. Some of this space is safety related--for medical services and waste handling. A reserve of approximately 150,000 gsf for multipurpose facilities and offices would accommodate anticipated needs.

Mechanical and electrical engineering building replacement projects, materiel-storage buildings, and additions to ultrahigh-vacuum assembly-and-fabrication facilities are also needed. In addition, utilities improvements, primarily for electrical, gas, water, and sewage systems, are also needed. A reserve 59,800 gsf for the construction of engineering, shop, and materiel-supply facilities would fill anticipated needs.

Relationship to UC Berkeley

The planned facilities goals and improvements are related to Campus programs and to the surrounding community. The Laboratory provides research facilities for more than 200 UC Berkeley faculty and approximately 600 graduate students (Figure 4-4). The major facilities located at the Laboratory cannot be provided on the Campus; examples are the Light Source, Bevalac, SuperHILAC, 88-Inch Cyclotron, and National Center for Electron Microscopy. The Laboratory thus provides pre-eminent research facilities that otherwise would not be locally (or regionally) available to scientists in academia, industry, and government.

The Laboratory and UCB interact to facilitate the coordination and development of plans and programs of mutual benefit. These include elements of scientific program plans, selected staff and recruitment arrangements, as well as facilities and environmental plans. The Laboratory's LRDP was presented for discussion before the UCB Campus Planning Office Staff and the Chancellor's Planning Committee.

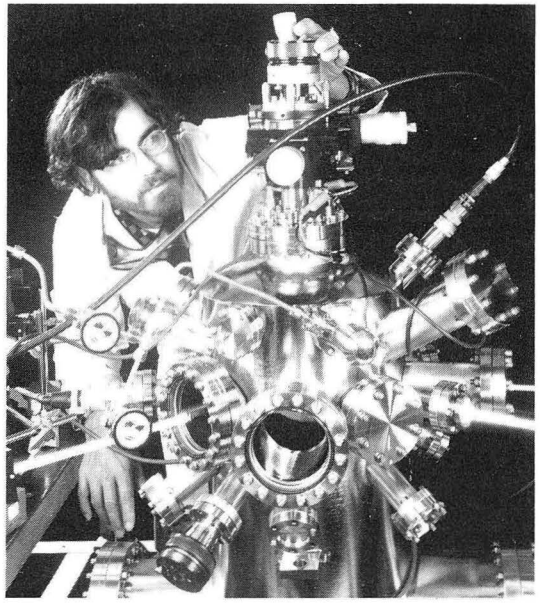


Figure 4-4. Graduate student with instrumentation for studying surface properties of new materials.

The Laboratory also participates in planning for the Upper Hill Area, including Fire Prevention Management planning. The Laboratory jointly supports cooperative and consultive studies on traffic management and other mutual concerns.

Relationship to the City of Berkeley

The Laboratory also recognizes its responsibility to make its facilities available to

the nonscientific public through tours and educational programs. For example, the Laboratory has established science education programs that operate in coordination with the Lawrence Hall of Science for extending precollege, as well as college and graduate education programs, to both teachers and students. The Laboratory also provides an extensive schedule of tours, used by 3000 visitors annually to learn about LBL research facilities and activities (Figure 4-5).

The LRDP transportation and parking plans and safety services are intended to minimize neighborhood traffic congestion, improve parking access within the site, and protect University and DOE property. The on-site and off-site shuttle buses greatly facilitate access to the Laboratory from the Campus and the City of Berkeley (Figure 4-6). Completion of existing parking and building projects should eliminate the need for off-road parking over the next five years, and completion of the long-range parking improvements provides adequate parking for the estimated growth. Long-range plans for mitigating potential traffic congestion are summarized in Chapter 5.

The Laboratory maintains both a Police Department and a Fire Department. The Police Department, which occupies 2000 gsf of office space, maintains 24-hour security at the Laboratory. Facilities and equipment include guard stations at the three gates, patrol vehicles, and a central dispatch and communications facility.

Figure 4-5. Tour group in the control room of the SuperHILAC.

LBL's Police Department assists the UCB and City of Berkeley police departments when requested.

The LBL Fire Department occupies two buildings totaling 7500 gsf and provides fire-protection and ambulance services to the Laboratory and operates the fire-alarm and sprinkler systems in all Laboratory buildings. In addition, it assists the UCB and area fire departments in controlling an average of 3–4 fires annually in the neighboring communities, and the Laboratory's fire-protection and ambulance capabilities will continue to be available as a local resource to augment community services. Fire, Safety, and Emergency Preparedness long-range plans are summarized in Chapter 5.

Environment and Land Use

Water Supply

The Laboratory's primary water supply is the East Bay Municipal Utility District (EBMUD) Shasta Reservoir, which hold approximately two million gallons. The

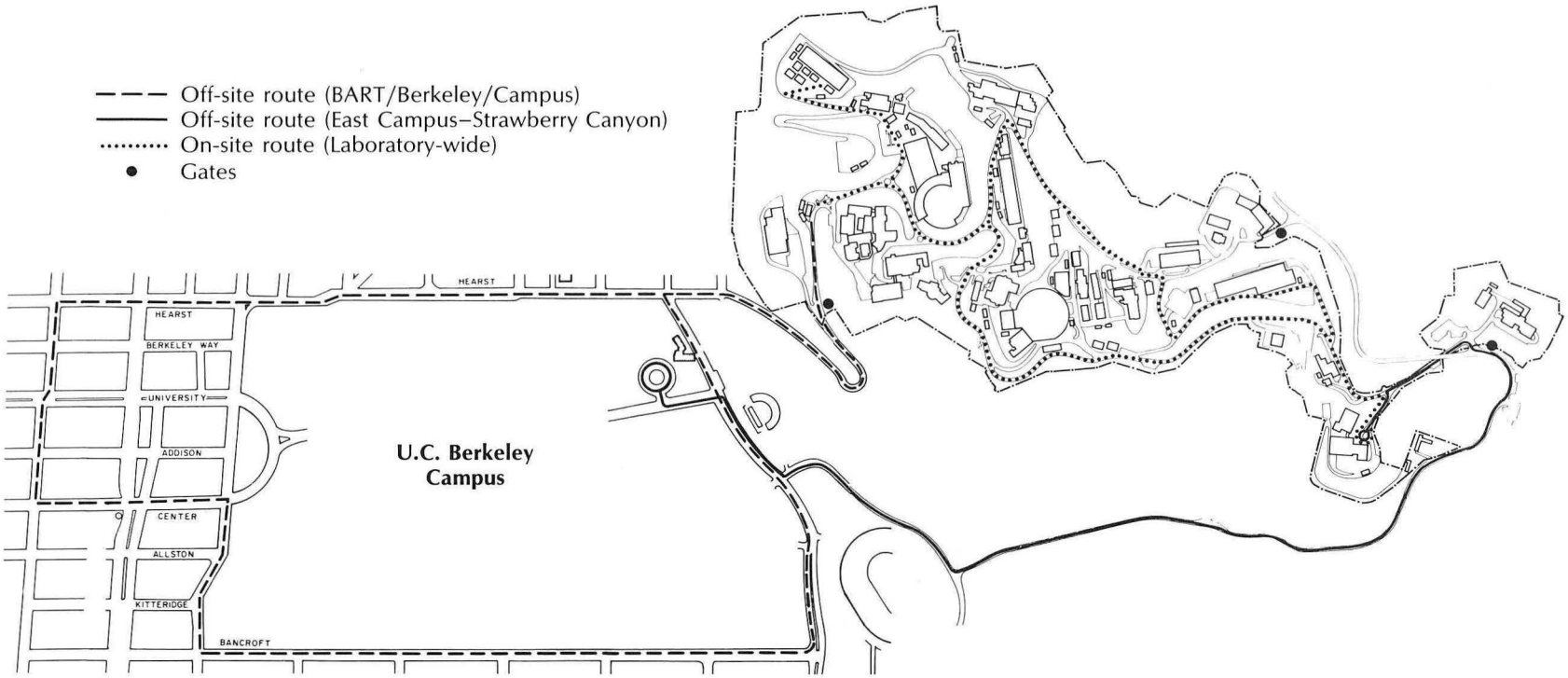


Figure 4-6. LBL shuttle-bus routes.

Laboratory's high-pressure fire and domestic water systems are supplied from this reservoir. A secondary source is the EBMUD's Berkeley View Tank, which holds approximately one million gallons. The LBL primary water-distribution system operates entirely by gravity flow, requiring no pumps or energy consumption. The Laboratory has recently installed two 200,000-gallon water tanks at separate locations for back-up fire protection. Diesel-powered pumps provide the necessary flow and pressure for maintaining this back-up system.

Sanitary Sewer and Storm Drainage

The LBL sanitary system discharges into the City of Berkeley sewer system, which flows to the EBMUD Sewage Treatment Facility, where the wastewater undergoes primary and secondary treatment. To ensure compliance with the EBMUD discharge limits, the Laboratory monitors its wastewater for pH, toxic metals, and radioactivity. Wastewater from LBL plating shops and chemistry facilities is monitored and treated before discharge to the sewer system. Because of LBL's hillside location a storm-drainage system has been installed; it discharges into the Blackberry Creek watershed to the north and the

Strawberry Creek watershed to the south. This system provides for runoff intensities expected in a 25-year maximum-intensity storm.

Slope-Stability Program

During the rainy season, ground-water levels can rise and decrease slope stability (Table 4-3). The Laboratory has installed

Table 4-3. Profile of LBL Slopes.

Slope (percent)	Area (percent)
0–10	46
11–25	7
26–50	14
> 50	33

portion. Both creeks flow through the Berkeley campus and then into the City of Berkeley storm-drainage system.

Environmental Management

The Laboratory is in compliance with local, state, and federal environmental regulations, including those affecting atmospheric emissions, discharges, and solid-waste handling and disposal. Currently planned projects would further improve perimeter landscaping and visual a ground-water detection and drainage system that feeds into Blackberry Creek on the north portion of the Laboratory and into Strawberry Creek on the south buffers (see Chapter 5 for more detail). Also planned are the increased use of pedestrian pathways and landscaped area within the developed portions of the site. The Laboratory now provides a water tank, salt licks, and periodic feed augmentation for the resident deer population.

The Laboratory's planned buildings are lower than five stories, with uncluttered roofs and subdued colors and related design elements to optimize compatibility with the hillside location and landscape. As described in Chapter 2, the LRDP design objectives are developed with cognizance that Laboratory operations must be compatible with the surrounding communities (Figure 4-7).

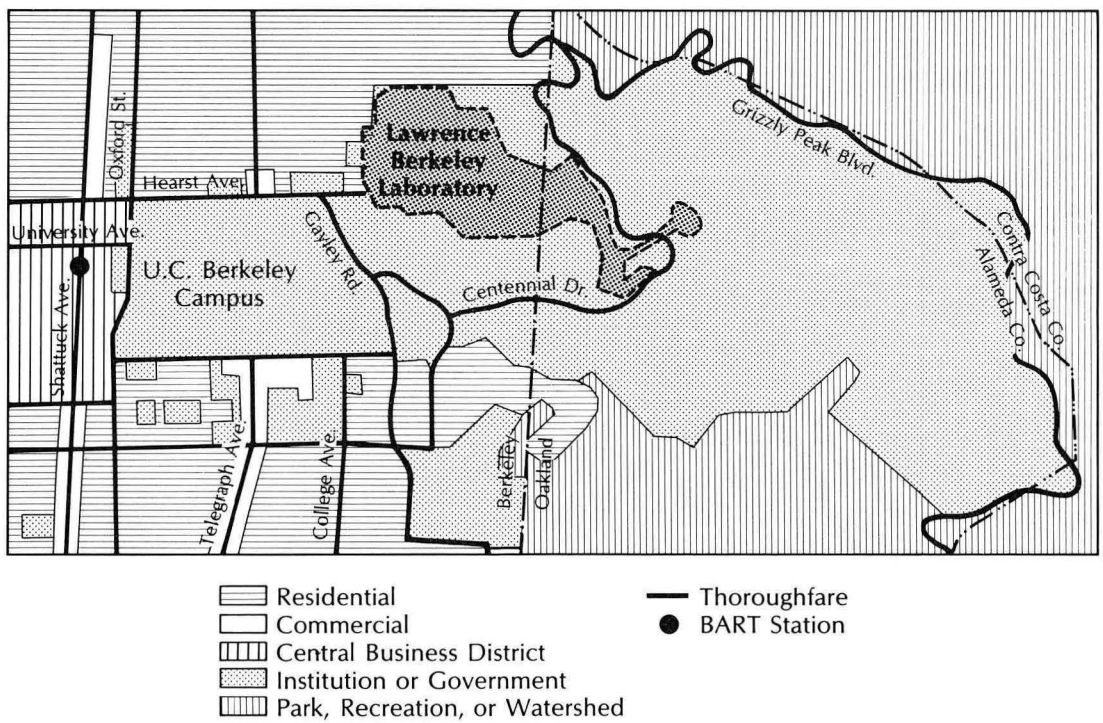


Figure 4-7. Land use in the Laboratory area.

Current LBL land use provides for developed areas along the central axis of the Laboratory site (Figure 4-8). The areas not used for buildings, roadways, and parking lots constitute about 60% of the Laboratory site and largely consist of open natural watershed compatible with the land use beyond the Laboratory boundary, i.e., residential and recreational areas, educational facilities, and botanical gardens. As described in Chapter 5, land-use planning and building-siting studies are important components of the plan, and the Laboratory retains independent consultants for periodic landscape planning studies (Appendix A).

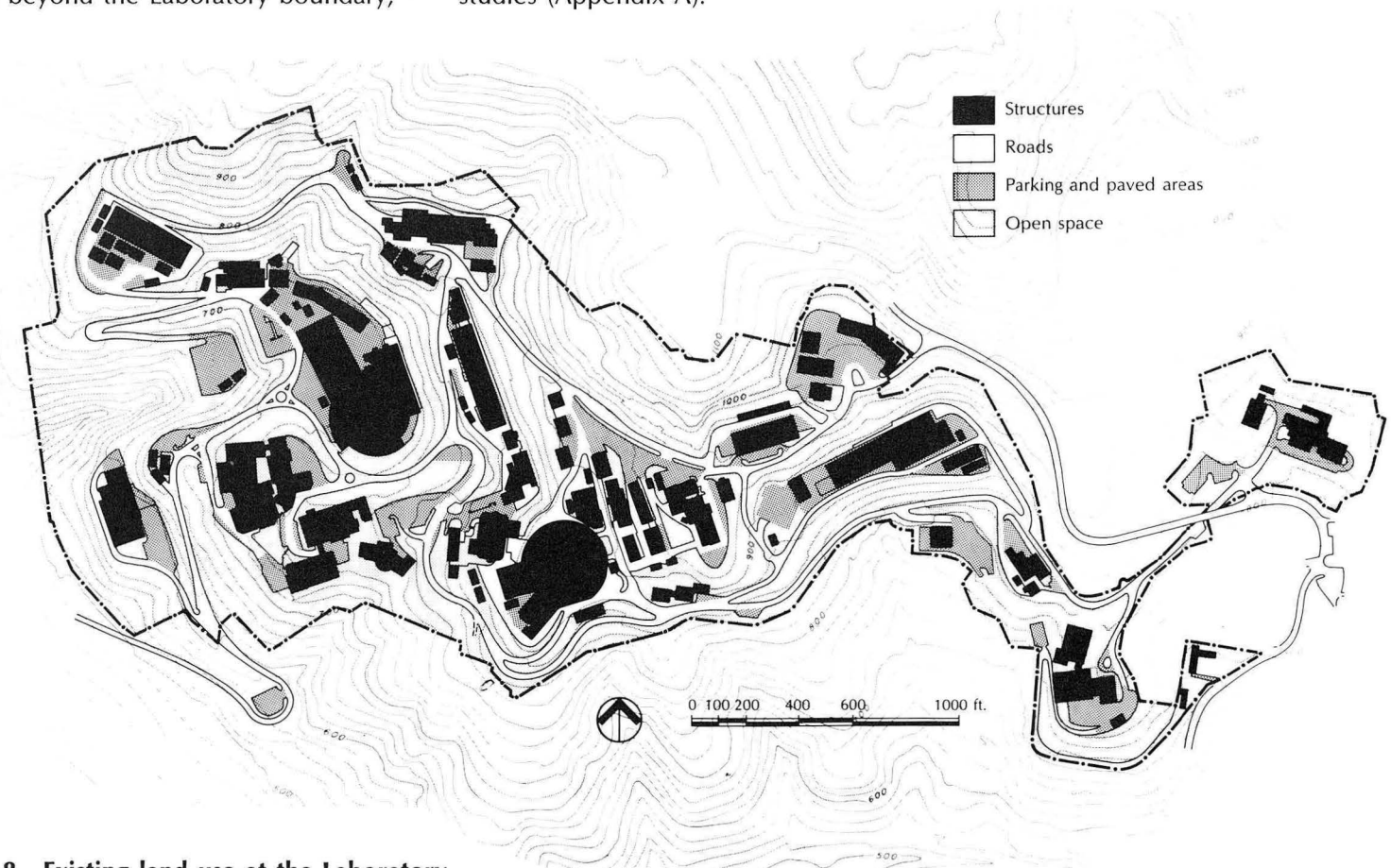
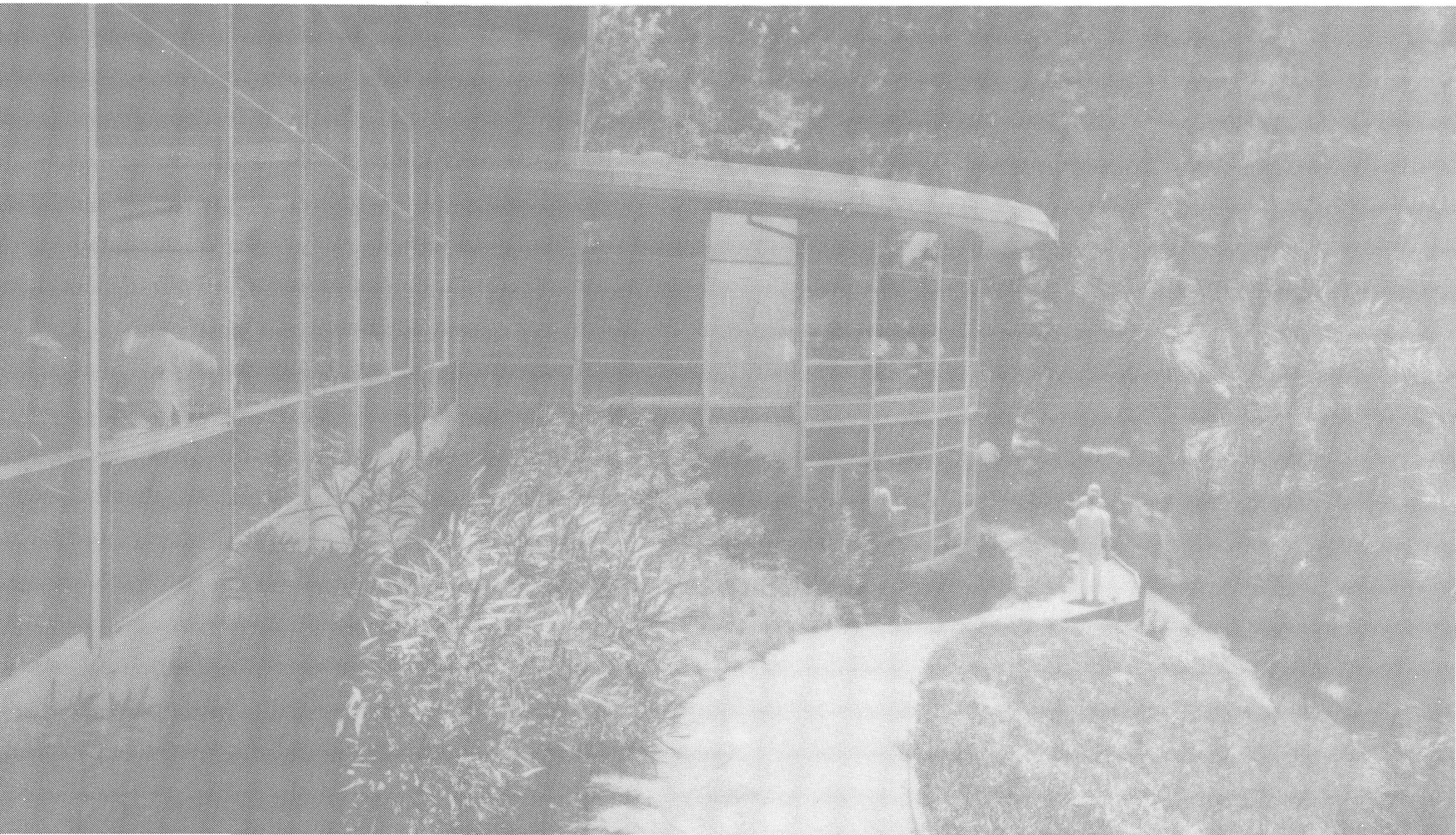


Figure 4-8. Existing land use at the Laboratory.



5. Development Plan Elements

Physical Organization

The Laboratory site plan consolidates operations and facilities into seven functional areas. Laboratory activities are more efficiently conducted with buildings consolidated in core functional areas, with perimeters serving as buffer zones, transportation access, and parking. The intent of this site design is to arrange new facilities for improved physical organization.

Large facilities in central areas are serviced by the East-West Axis and traffic circulation loops. The plan reserves land for future buildings, parking, and landscape buffer zones and does not significantly modify existing traffic circulation routes, which are planned for widening and improvement.

Land-Use Plan

Eighty acres of the site are currently designated as buffer and open-preserve areas, whereas about fifty acres have been developed with buildings, roadways, and site improvements (Table 5-1). Land-use planning analysis indicates that the Laboratory site has good potential, both for redevelopment of outmoded facilities (primarily in the Light Source Research and Engineering Area) and for the ordered development of future sites (Figure 5-1). The compact LBL site enhances efficient interaction among support services and scientific program staff and contributes to a more closely knit research community.

Buffer Zones and Building Sites

To facilitate appropriate siting of buildings and to enhance the relationship between land use, landscaping, and siting, the LRDP establishes special buffer zones. These zones provide special consideration of constraints and amenities such as particularly valuable vegetation, important scenic vistas of the Bay, visual exposure from the city and campus, important geological and topographic criteria, including earth stability and hydrology, and landscape protection in areas of high building density. Building sites in the buffer areas are largely excluded, based on these criteria of vistas, hydrology, stability, special vegetation, and building density.

Nine buffer zones are identified, eight of which are primarily adjacent to the Laboratory's boundary (Figure 5-2). The Bevalac Perimeter buffer zone includes the planted slopes around much of the Bevatron, recognizing that slope stability and

Table 5-1. Current and Future Land Use.

Use Category	Current		Future	
	Acres	Percent	Acres	Percent
Structures & Sites	18.4	14.2	22.2	16.6
Roads	14.4	11.1	16.2	12.2
Parking and Paved Areas	16.7	12.9	17.2	12.9
Open Space	80.2	61.8	77.8	58.3
Total	**129.7**	**100.0**	**133.4**	**100.0**

the steep slopes make this area generally unsuitable for building sites. The West Strawberry Canyon buffer zone protects valued views and many of the cork-oak trees east of the cafeteria. The Redwood Grove area, which includes a portion of the original laboratory site and a section of the West Strawberry Canyon perimeter, contains a small grove of coast redwoods and dawn redwoods, and several stands of eucalyptus trees. The East Strawberry Canyon buffer zone includes the dawn redwoods in that vicinity. These and other buffer zones, and the primary criteria that restrict their use as building sites, are identified in Table 5-2.

Other factors to be considered in building location and land use include pedestrian and vehicular traffic circulation, views from the buildings, erosion control, surface-drainage patterns, fire control, landscape scale, and effective use of maintenance resources.

Although plans call for future building volume to increase, future building footprints will be more compact and in accordance with landscape plans (Figure 5-2). Thus removal of outdated buildings will increase open areas between future facilities. Consequently, the Laboratory will be more attractive to the research community

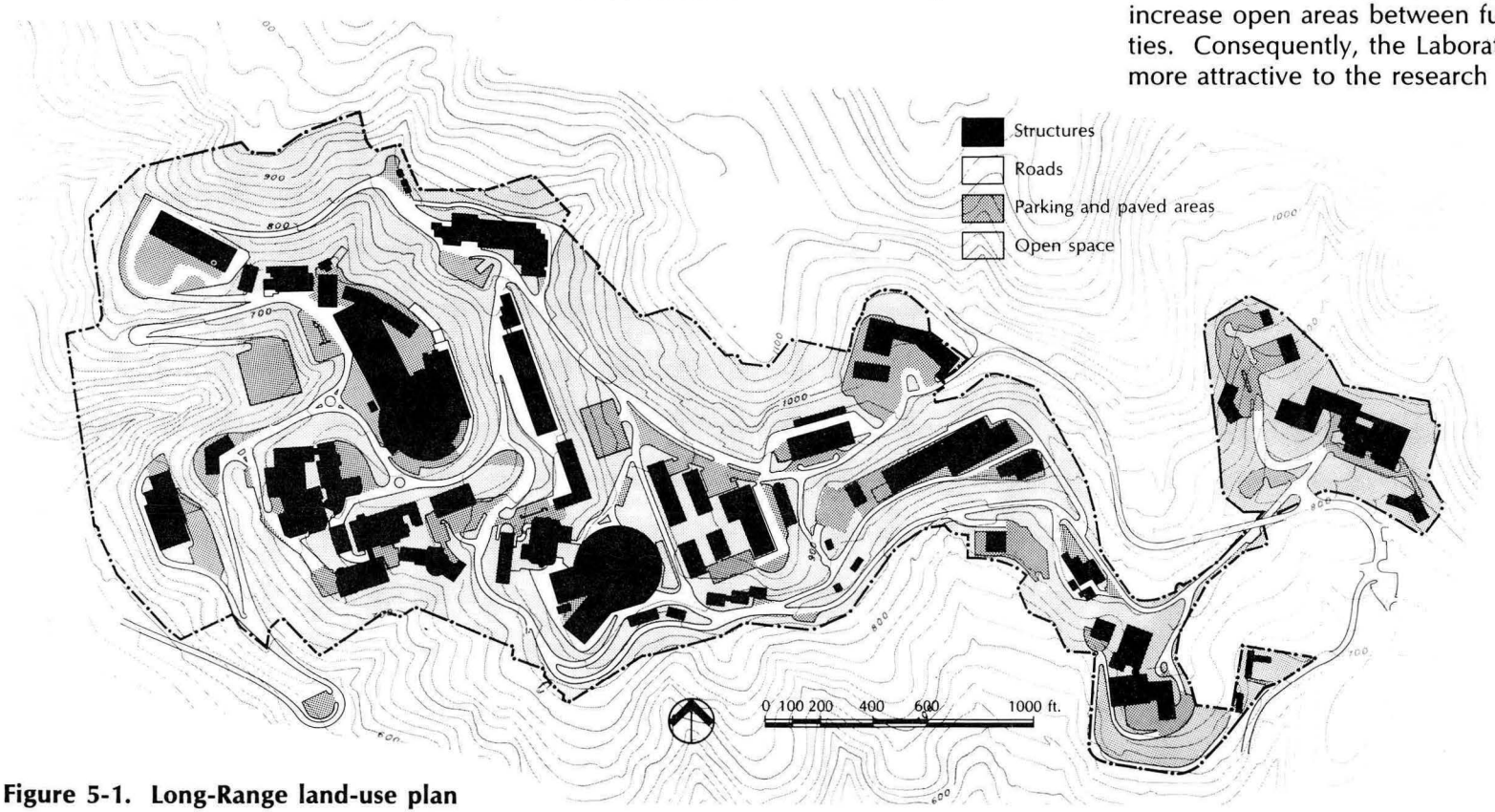


Figure 5-1. Long-Range land-use plan

Figure 5-2. Buffer-Zone landscape map.

Table 5-2. Buffer-Zone Landscape Planning Areas.

Buffer-Zone	Planning & Protection Criteria				Special Considerations
	Views or Exposure	Building Density	Hydrology & Stability	Vegetation & Landscaping	
A Central Blackberry Canyon			●	●	Forested area with creek
B West Strawberry Canyon	●			●	Bay view; eucalyptus, dawn redwoods, and cork oaks
C Redwood Grove Area	●	●		●	Sequoia redwoods, building density
D East Strawberry Canyon	●	●		●	Dawn redwoods, other evergreens
E Life Sciences Area				●	Forested area; evergreen and eucalyptus
F Grizzly Gate Perimeter			●		Slope stability
G Northeast Perimeter	●		●		Stability, drainage, and exposure
H Bevalac Perimeter		●	●	●	Slope stability; evergreen trees
I North Blackberry Canyon	●			●	Exposure; eucalyptus trees

and to the community at large. Planned entrances for new buildings, gathering areas, and other focal points will preserve or provide views across the Bay.

Landscaping

New facilities will allow enlarged open spaces in many locations, and some existing paved surfaces will be converted to landscaped open areas. Many existing mature trees will be preserved to serve as design elements. The Laboratory will develop an enhanced landscape plan and establish landscape-related criteria for new building sites.

Four categories of landscaping sustain or augment the natural grassland, shrub, and forest areas of the hillside.

- *Natural-state areas* are the most distant from buildings, consisting primarily of native grasses, low-growing ground cover, and trees in gullies, along north-facing slopes and in some other locations.
- *Drought-tolerant low-cover* areas are closer to buildings and consist of plantings that are fire retarding and remain green throughout the year.
- *Drought-tolerant high-cover* areas have trees and shrub masses with fire-retardant characteristics, often adjacent to buildings.
- *Introduced-planting* areas requiring more intensive management and supplemental watering during the summer are immediately adjacent to buildings and, frequently, along pedestrian paths and gathering areas.

The major landscaping goals are to complement the hillside setting, to unify the site visually, to relate the site to adjacent vegetation, to prevent erosion, to provide amenities to users of the site, and to provide a buffer between functional areas, buildings, and adjacent properties.

Functional Planning Areas and the Long Range Development Plan Map

Some long-term changes are planned for most of the functional planning areas to meet anticipated research objectives and to conform to the LRDP principles and objectives. The plan calls for the removal of 208,800 gsf of buildings (Table 5-3). In addition, more than 788,500 gsf of building space would be renovated. Building sites are reserved or planned in redeveloped areas for 613,600 gsf of new construction. Many of these redevelopment projects are planned for the Light Source Research and Engineering Area, although some projects will be undertaken in all the functional areas, as shown on the Long Range Development Plan Map (Figure 5-3).

Table 5-3. LBL Long Range Development Plan Space Distribution (gsf).[a]

Functional Area	Existing Space	Additions	Future Removals	Net
88-Inch Cyclotron Area	53,700	8,600	0	62,300
Central Res. & Admin. Area	487,700	41,100	27,000	501,800
Bevalac Accel. Complex	346,200	149,300	29,600	465,900
Light Source Area	364,900	233,400	139,300	459,000
Shop & Support Fac. Area	157,600	63,800	11,200	210,200
Mat. & Chem. Res. Area	126,900	32,200	1,200	157,900
Life Sciences Res. Area	54,400	85,200	500	139,100
Total	**1,591,400**	**613,600**	**208,800**	**1,996,200**

[a]See Appendix B and Tables 5-4 to 5-10. Area distribution is for general estimating purposes only.

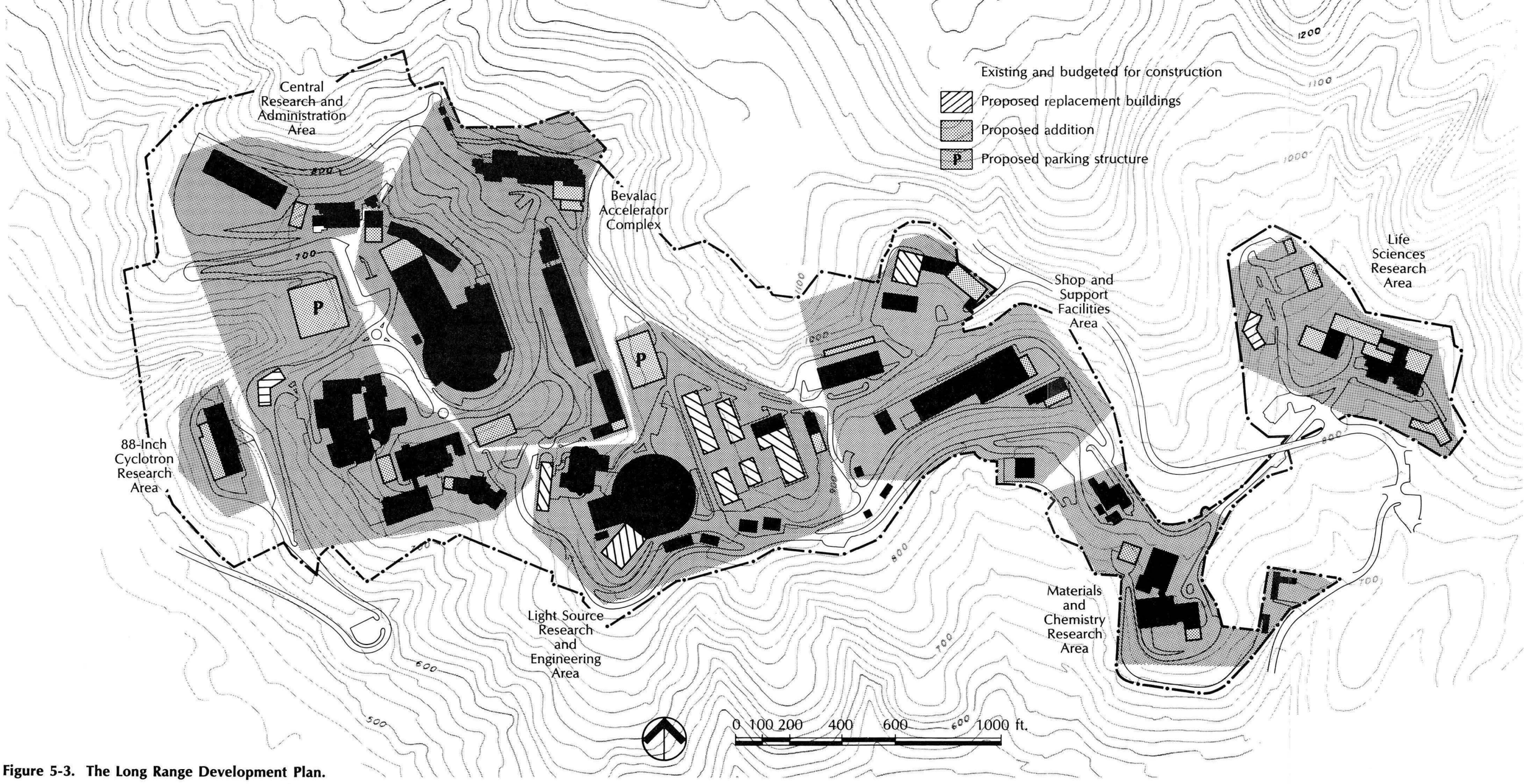
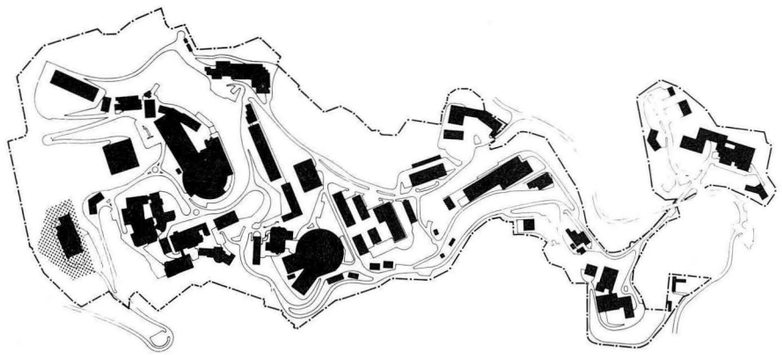


Figure 5-3. The Long Range Development Plan.

88-Inch Cyclotron Research Area



The area at the west end of the main LBL site is to remain dedicated to the 88-Inch Cyclotron, its utilities, and related support and perimeter parking facilities. Approximately 47 people are employed in this area (Table 5-4). The building area totals 53,700 gsf. The existing building structure is designed for a second-floor addition, and this potential addition is reserved for future development (Figure 5-4). The second-floor addition requires no new land to be developed. The terraces and forested character of the hillside will be maintained.

The 88-Inch Cyclotron Building won the American Institute of Architects Bay Region Merit Award of Design when it was constructed in 1962. It is secluded behind a screen of both deciduous and evergreen trees. Pathways lead from the 88-Inch Cyclotron to the Blackberry Canyon parking lot and the Central Research and Administration Area.

Table 5-4. 88-Inch Cyclotron Research Area.[a]

Category/Project	Area (gsf)	Staff (heads)
Existing Buildings	53,700	47
A 88-Inch Cyclotron		
2nd-Floor Addition	8,600	38
Net Total	**62,300**	**85**

[a]Area and staffing plans are for general estimating purposes only.

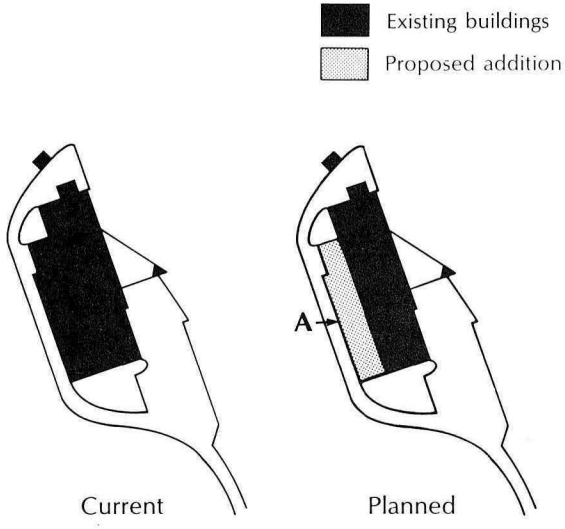
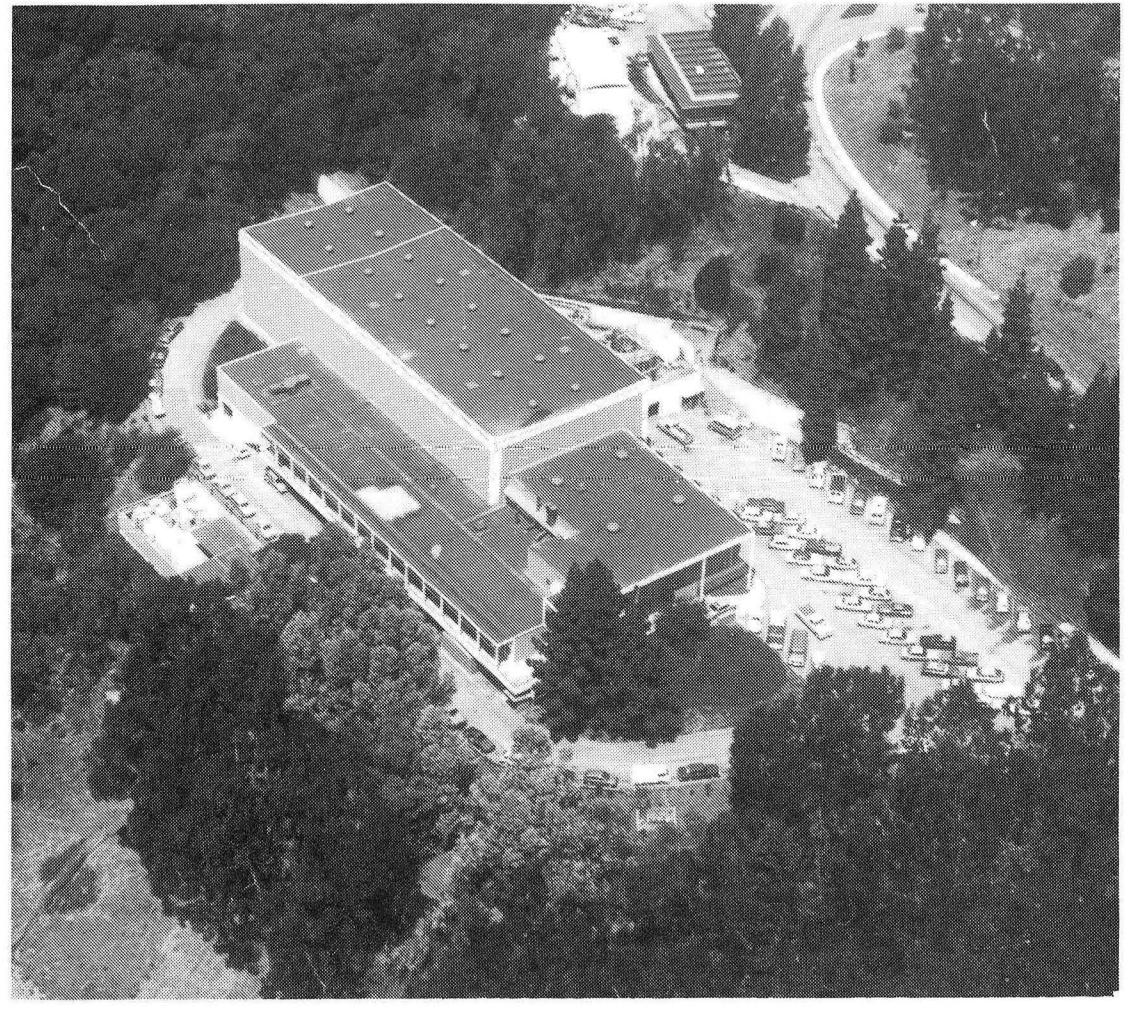
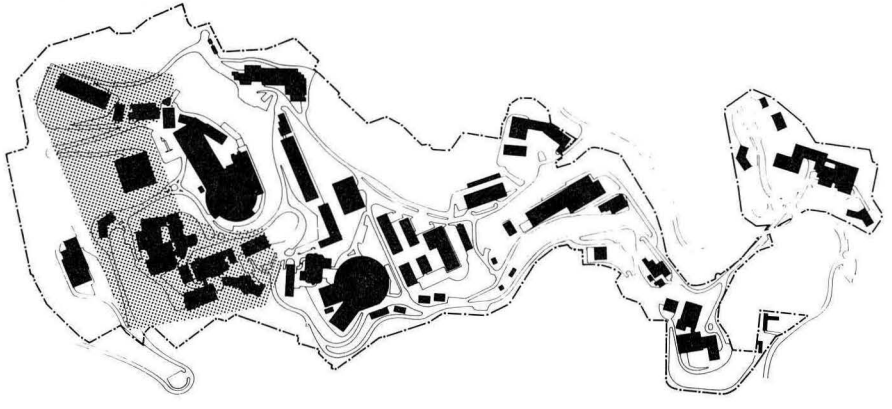


Figure 5-4. 88-Inch Cyclotron Research Area.



Central Research and Administration Area



This area will remain the management and information center of the Laboratory. Space will continue to be used for light-duty laboratories, an auditorium, the main library, and food services. The plan also provides for: new buildings for accelerator research and for conferences, roadway and pedestrian safety improvements, additional development of general-purpose office space through second-floor additions to several small buildings, extensions to high-bay space, elimination of all use of trailers, reclamation of laboratory space now used for offices, and a parking structure for 400 cars (Figure 5-5).

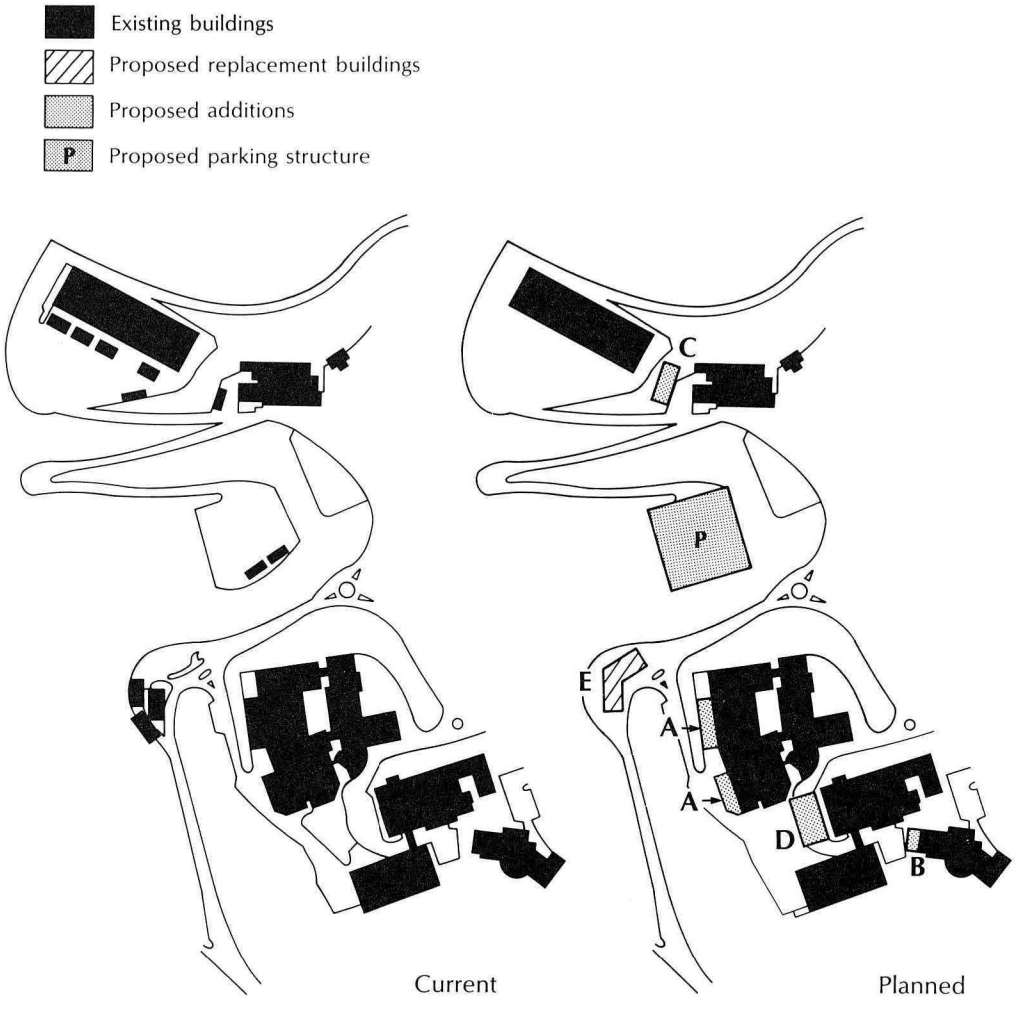
The current building area of 487,700 gsf will increase to 501,800 gsf. However, as Table 5-5 shows, 18,400 gsf of this increase are in second-floor additions that require no new land to be developed, and 28,344 gsf of land area are recovered through removal work. The existing population is 1,467; it may increase to 1,475 in the future (Table 5-5). Plans for the new buildings necessitate removal of two stands of trees, and a reforestation plan to compensate for their loss will be provided.

The Central Research and Administration Area includes several locations landscaped for outdoor uses such as picnics and other social activities. Attractive pedestrian paths are included, many of which are screened from roadways and parking lots. Many buildings, walkways, and landscaped areas offer dramatic views of adjacent communities, San Francisco, and the Bay.

Table 5-5. Central Research and Administration Area.[a]

Category/Project	Area (gsf)	Staff (heads)
Existing Buildings	487,700	1,467
Additions/Replacements:		
A 2nd Floor Additions	18,400	115
B Cafeteria Addition	1,900	0
C Biomed. Isotope Facility	3,800	4
D Conference Center	10,000	1
E 65 Replacement	7,000	20
Subtotal	41,100	140
Planned Removals	27,000	132
Net Total	**501,800**	**1,475**

[a]Area and staffing plans are for general estimating purposes only.



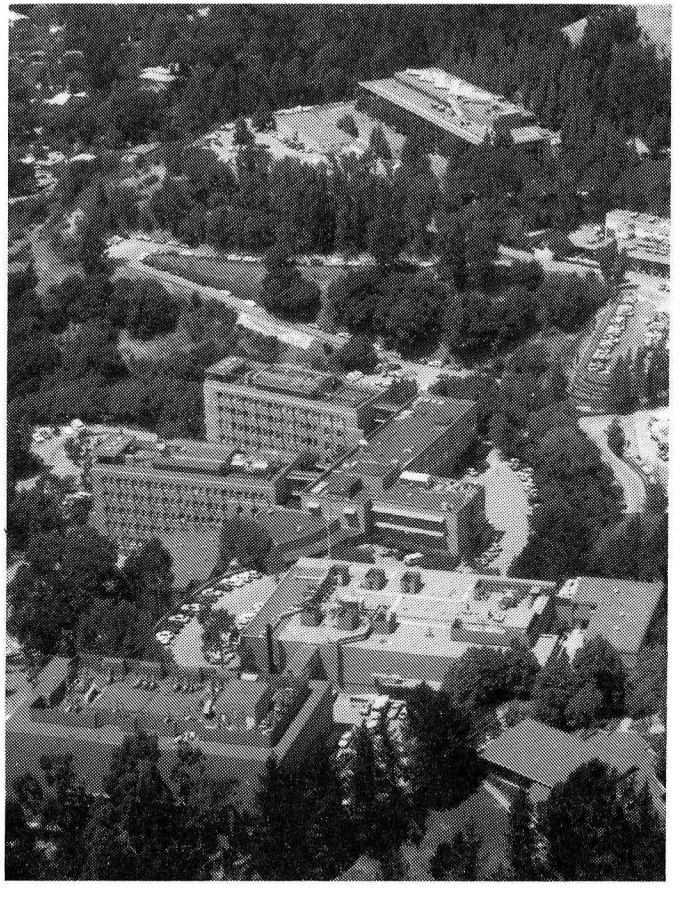
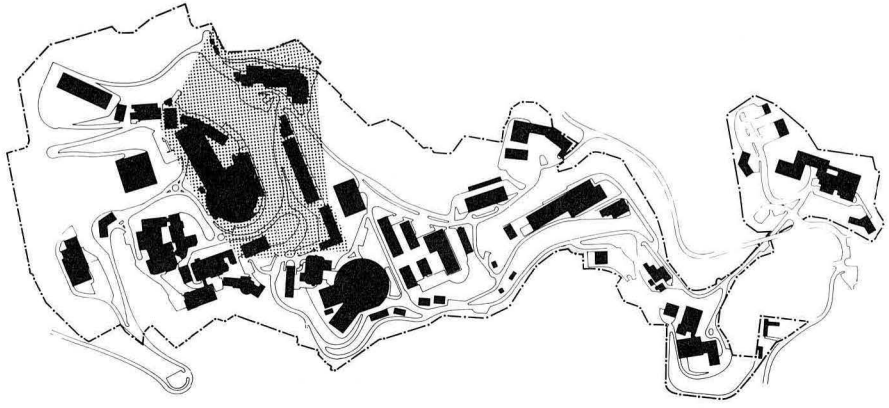


Figure 5-5. Central Research and Administration Area.

Bevalac Accelerator Complex



This area will remain as a center for nuclear physics, radiobiology, and accelerator research. The extensive array of support utilities, heavy-load-handling equipment, and related resources will be maintained. The open area of the experimental hall will be retained, since the large experimental operations undergo frequent modification and change.

Construction on the planned upgrade of the Bevalac is proposed to begin in 1990. This upgrade will provide for more than a 100-fold increase in beam intensity and a greatly increased duty factor to allow the Bevalac to continue its service as a forefront national facility. Provision is also made to set aside space to extend the experimental hall, to allow for the construction of a future heavy-ion storage ring, to remove trailers, and to renovate space for accelerator research (Figure 5-6).

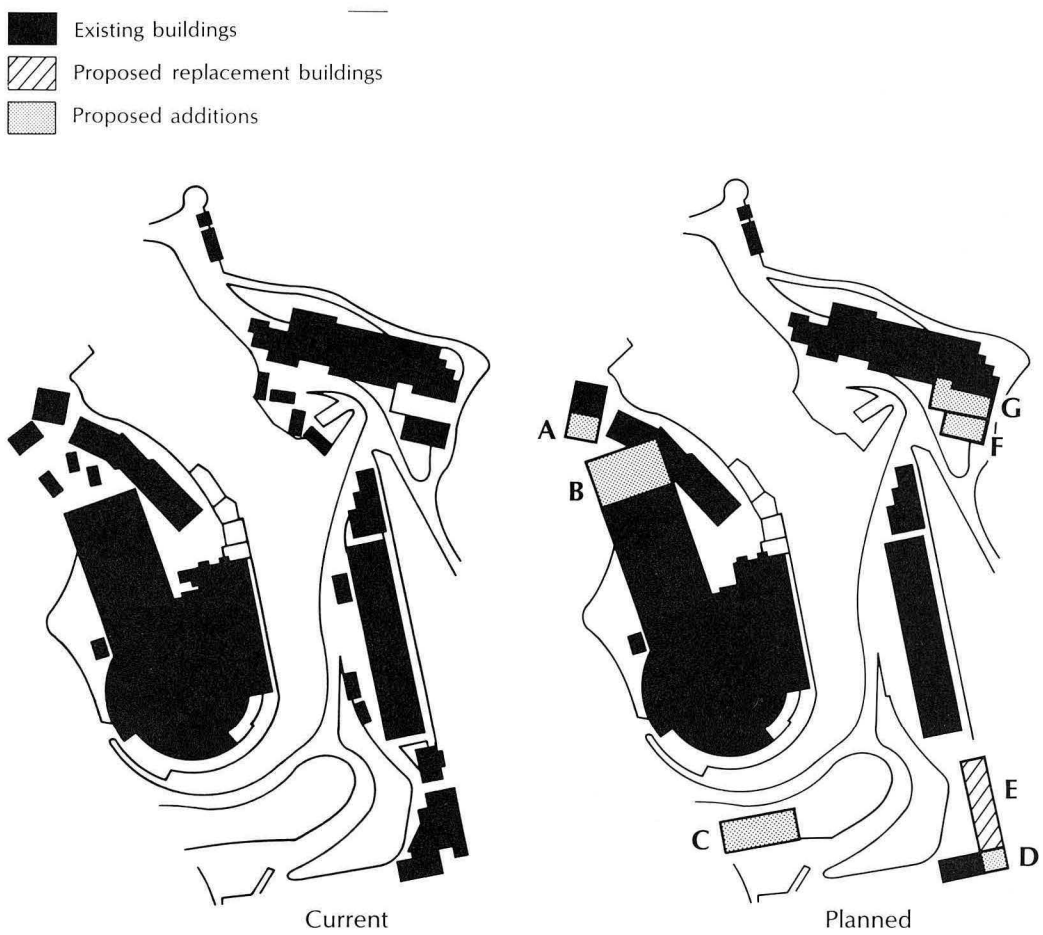
The area encompasses 346,200 gsf at present; this would increase to 465,900 gsf (Table 5-6). The removals and additions are in an area that has no landscaping. Although some parking spaces will be removed and the population is projected to increase from 438 to 520, no new spaces are planned as replacements because of the proposed nearby parking structure.

Due to the nature of the improvements, no additional landscaping is envisioned. The existing surrounding landscaping will be maintained, and a slope-stabilization project is planned northeast of the Bevatron building.

Table 5-6. Bevalac Accelerator Complex.[a]

Category/Project	Area (gsf)	Staff (heads)
Existing Buildings	346,200	438
Additions/Replacements		
A Building Addition	3,400	20
B Hall Extension	15,000	0
C AFRD Building	54,600	70
D High-Bay Addition	1,700	2
E Building Replacement	59,500	60
F 3rd-Floor Offices	3,100	20
G HILAC Addition	12,000	28
Subtotal	149,300	200
Planned Removals	29,600	118
Net Total	**465,900**	**520**

[a]Area and staffing plans are for general estimating purposes only.



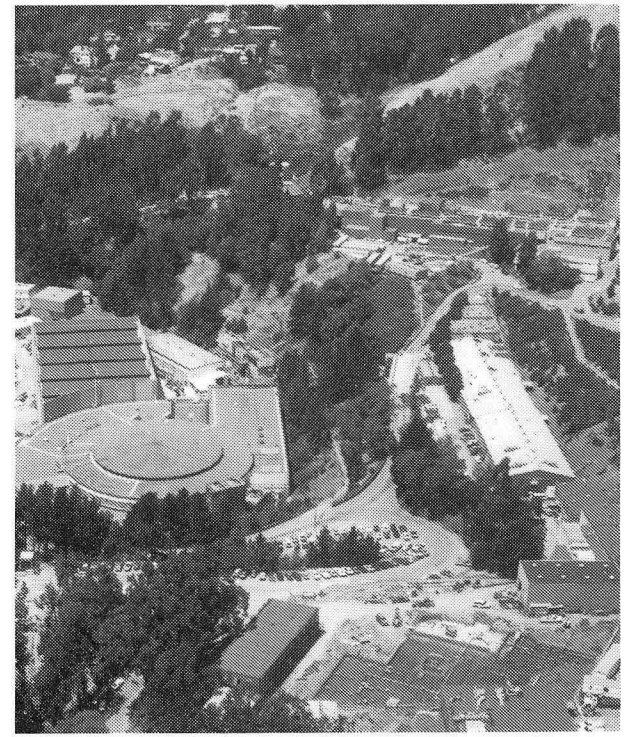
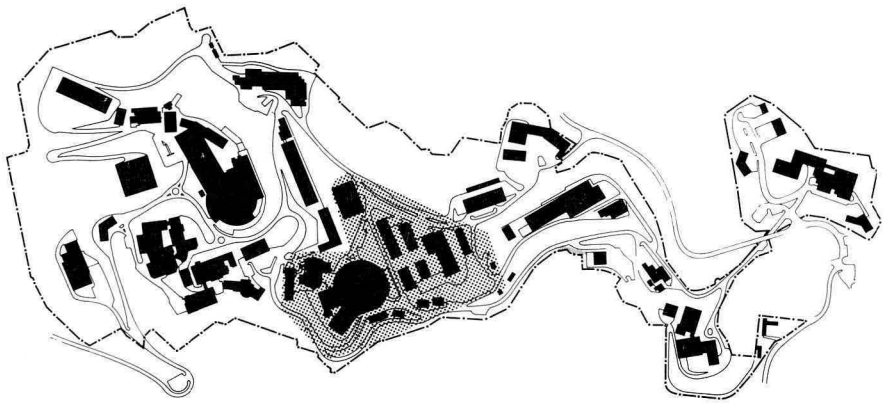


Figure 5-6. Bevalac Accelerator Complex.

Light Source Research and Engineering Area



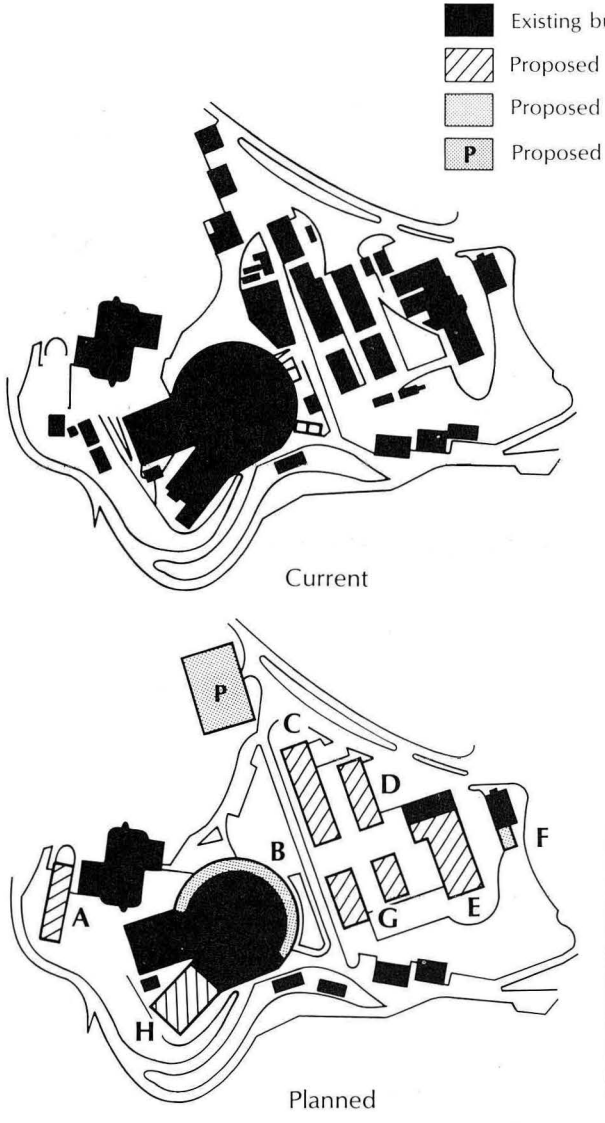
This area, also known as Old Town or The Original Laboratory Site, is to be renovated and reconstructed to allow the efficient and safe conduct of research and the design and fabrication of advanced electrical and mechanical systems. These changes would include: rehabilitation of the domed 184-Inch Cyclotron building constructed in 1939, which will be enlarged to house the Advanced Light Source; completion of the Advanced Materials Laboratory; and redevelopment of engineering facilities by removal and replacement of obsolete buildings. These changes could ultimately result in an increase of building space from 364,900 gsf to a maximum of 459,000 gsf and an increase in population from 624 to a maximum of 1,040 (Table 5-7). The plan also includes provisions for a parking structure for about 300 cars.

Although a higher building density will create increased pedestrian and vehicular traffic, open space will be enlarged to improve circulation, aesthetic qualities, and the site amenities (Figure 5-7). Redevelopment of this area will include construction of many new vehicle service routes and separate footpaths and sidewalks to enhance safety. The employee recreation/exercise course is nearby, and the cafeteria is a short distance away. Additional landscaping and a new pathway system are planned. Several paved surfaces will be converted to landscaped areas. Most trees will be preserved, and additional trees will be planted.

Table 5-7. Light Source Research and Engineering Area.[a]

Category/Project	Area (gsf)	Staff (heads)
Existing Buildings	364,900	624
Additions/Replacements		
A 29 Replacement	16,200	30
B ALS–Mezzanine Addition	29,000	200
C CRE Laboratory	49,800	145
D Mech. Eng. Replacement	46,400	100
E Elec. Eng. Replacement	60,000	160
F 26 Addition	2,000	5
G Laboratory Replacements	30,000	80
H Reconstruction	—	—
Subtotal	233,400	720
Planned Removals	139,300	304
Net Total	**459,000**	**1,040**

[a]Area and staffing plans are for general estimating purposes only.



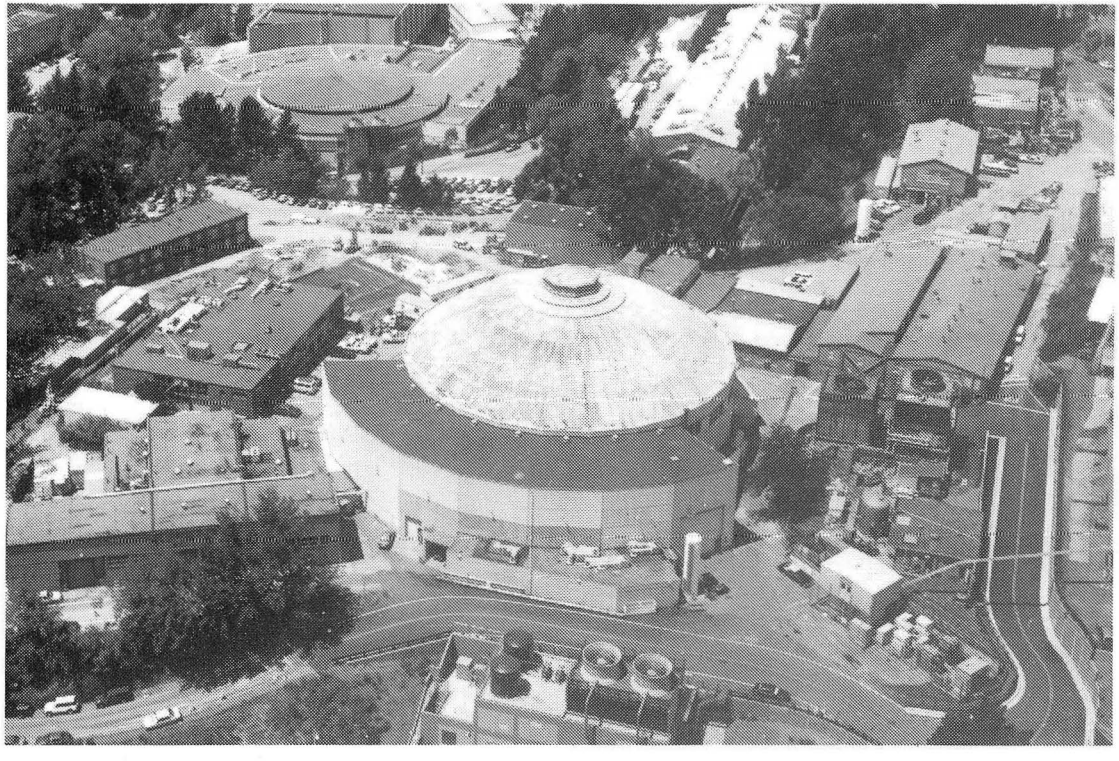
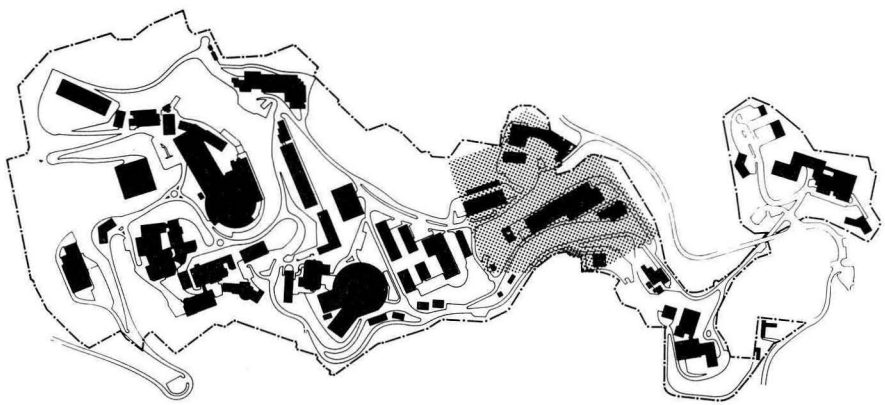


Figure 5-7. Light Source Research and Engineering Area.

Shop and Support Facilities Area



The Grizzly Peak Gate access to Centennial Drive provides access to the Shop and Support Facilities Area, which is being redeveloped as a supply and loading area. Support and service functions have been relocated from scientific functional areas, and this consolidation trend will continue.

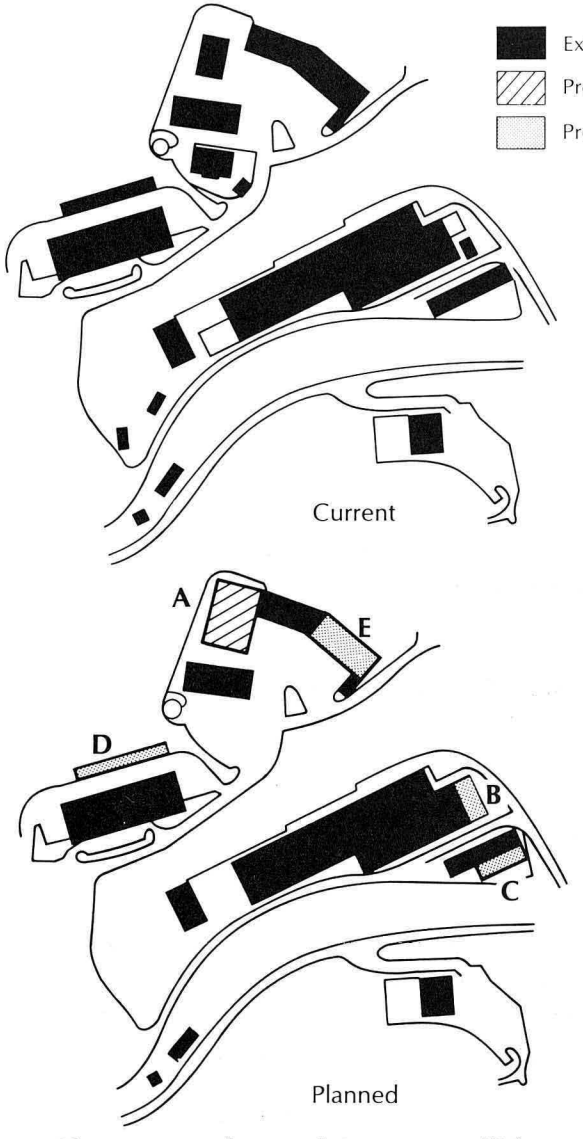
The proposed construction of the Support Services Facility would further consolidate materiel-supply and support functions. Maintenance and construction support and field-research-vehicle staging are being relocated from on-street parking to the more-secluded off-street Chicken Creek staging area (Figure 5-8). Both the Craft Stores Building and the Supply Services Building have been designed for future second-floor additions. This area provides space for 315 personnel at present; this is projected to increase to 450 in the future. Building space will increase from 157,600 to 210,200 gsf (see Table 5-8).

Surrounding landscaping will be preserved. Reforestation of the Chicken Creek staging area has been completed and will be maintained. No other changes to the landscaping in this area are planned, although a slope-stabilization project is planned to the north of the Mechanical Shops.

Table 5-8. Shop and Support Facilities Area.[a]

Category/Project	Area (gsf)	Staff (heads)
Existing Buildings	157,600	315
Additions/Replacements		
A Support Services Fac.	42,000	130
B 77 Addition	2,400	10
C 77A Addition	10,000	20
D 78 2nd-Floor Addition	5,400	5
E 69 2nd-Floor Addition	4,000	5
Subtotal	63,800	170
Planned Removals	11,200	35
Net Total	**210,200**	**450**

[a]Area and staffing plans are for general estimating purposes only.



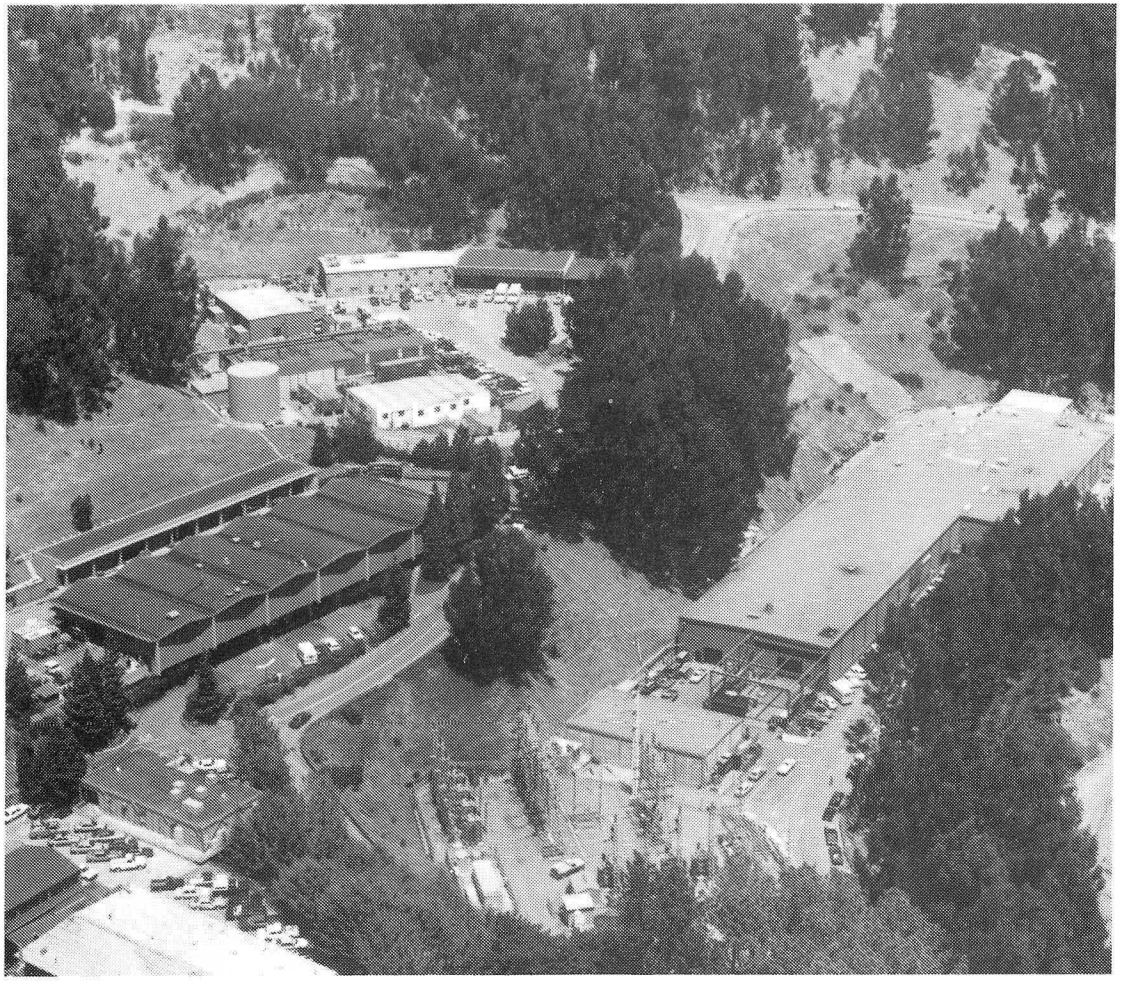
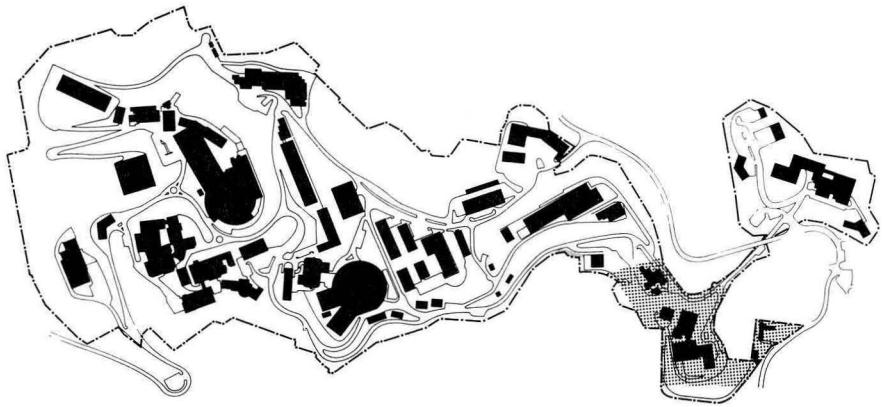


Figure 5-8. Shop and Support Facilities Area.

Materials and Chemistry Research Area



This area includes the new Surface Science and Catalysis Laboratory, the National Center for Electron Microscopy, and the Materials and Molecular Research Building (Figure 5-9). A site is also reserved for a future materials sciences building between the National Center for Electron Microscopy and Surface Science and Catalysis Laboratory. The LRDP provides for improved parking and support for the new buildings and an extension to the high-bay wing of the Materials and Molecular Research Building.

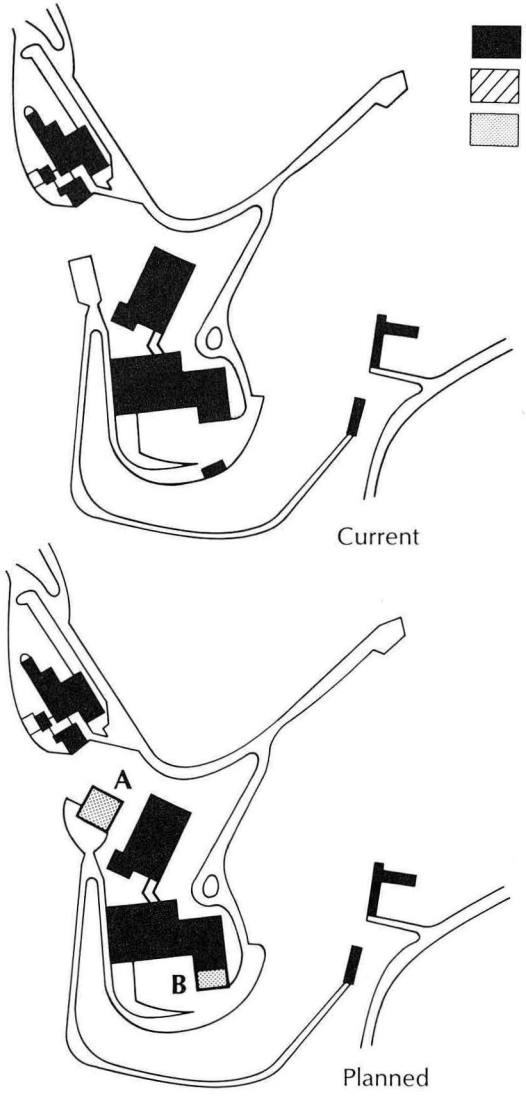
The current 126,900 gsf increases to 157,900, and the population increases from 279 to 360 (Table 5-9).

No trees will be removed. However, additions are planned to the existing landscaping, which will be preserved. Buildings are designed to take advantage of the Bay views afforded by the Strawberry Canyon view corridor.

Table 5-9. Materials and Chemistry Research Area.[a]

Category/Project	Area (gsf)	Staff (heads)
Existing Buildings	126,900	279
Additions/Replacements		
A Future Mat. Bldg.	30,000	90
B 62 High-Bay Addition	2,200	5
Subtotal	32,200	95
Planned Removals	1,200	14
Net Total	**157,900**	**360**

[a]Area and staffing plans are for general estimating purposes only.



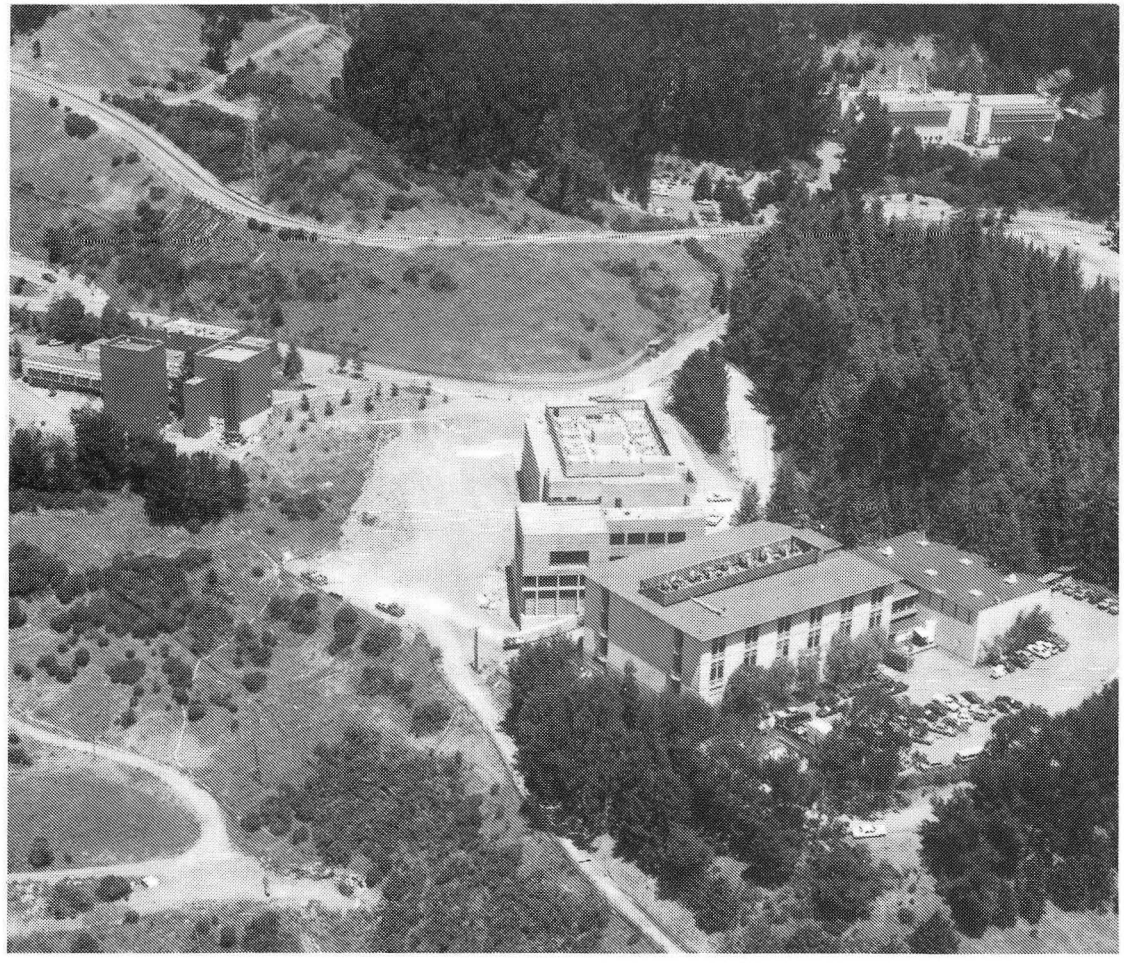
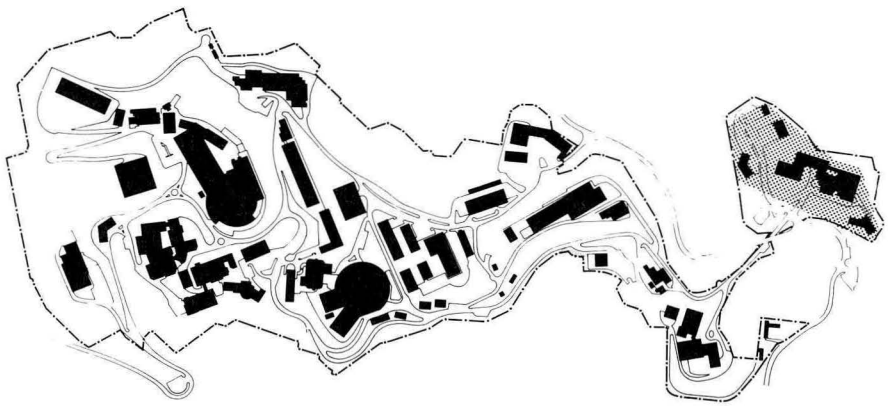


Figure 5-9. Materials and Chemistry Research Area.

Life Sciences Research Area



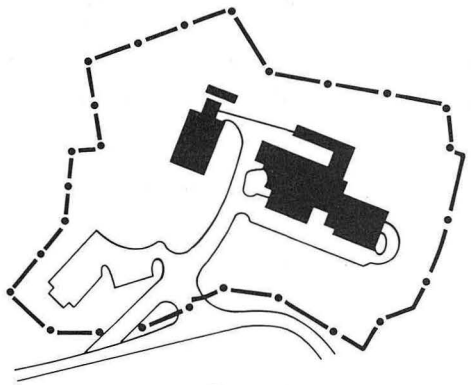
Essentials of this plan are: (a) retention of the existing Biological Research Laboratory and the Cell Culture Laboratory; (b) increase in the buildable-site area, primarily to accommodate the proposed Human Genome Laboratory, the proposed Cell Culture Laboratory II, and other future extensions to the life sciences research building; and (c) construction of a waste-handling facility and materiel-reclamation area (Figure 5-10). The plan allows for an increase in building space from 54,400 gsf to a maximum of 139,100 gsf and an increase in population from 37 to a maximum of 170 (see Table 5-10). Parking, traffic circulation, and necessary related services are also incorporated.

The proposed Human Genome Laboratory is to be located in the area between the University Botanical Garden and the existing Biological Research Laboratory. This building was approved by The Regents in 1980 but not constructed due to lack of funding. The Cell Culture Laboratory II would be located north of the existing Cell Culture Laboratory. The waste handling facility and materiel-handling area would be located in a terraced valley to the north. The total developed area will increase from six to ten acres (included in the 1962 Plan). All sites are screened from view from Centennial Drive and will be buffered by existing vegetation and added plantings. The natural beauty of the Strawberry Canyon setting will be maintained.

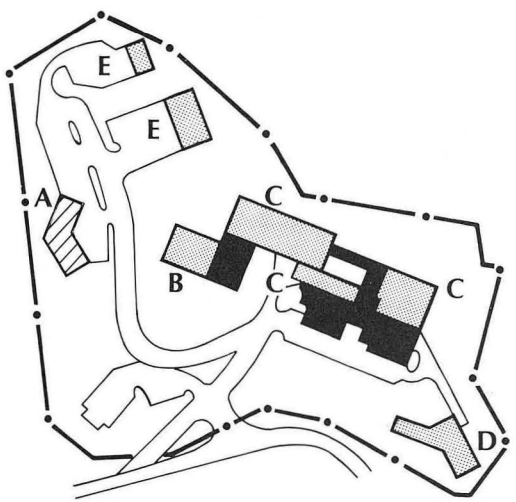
Table 5-10. Life Sciences Research Area.[a]

Category/Project	Area (gsf)	Staff (heads)
Existing Buildings	54,400	37
Additions/Replacements		
A Waste Handling	12,300	10
B Cell Culture Lab. II	7,000	10
C Life Science Additions	32,700	35
D Human Genome Lab.	23,200	60
E Future Building Sites	10,000	15
Subtotal	85,200	130
Planned Removals	500	3
Net Total	**139,100**	**170**

[a]Area and staffing plans are for general estimating purposes only.



Current



Planned

Existing buildings

Proposed replacement buildings

Proposed addition

Figure 5-10. Life Sciences Research Area.

Transportation and Parking

Current Status

The Laboratory operates both on-site and off-site bus services to supplement pedestrian movement, to reduce the use of personal vehicles, and to encourage employee use of existing mass transit. The on-site buses and the pedestrian paths provide reasonably quick access to all main-site buildings and reduce on-site vehicular traffic. The off-site buses connect LBL to the downtown Berkeley Station of the Bay Area Rapid Transit system (BART) and AC Transit bus lines.

In June 1986, about 6,960 vehicle trips per day were made to LBL (Table 5-11). The majority of Laboratory employees and visiting scientists use automobiles to get to and from work. However, the cost of automobile operation and the difficulty of parking at LBL have led many commuters to seek alternatives. The Laboratory has encouraged this trend by establishing the off-site bus service and by aiding in the formation of car pools and van pools and encouraging their use by allocating parking space for pool vehicles.

At present, parking demand in the densely populated areas at LBL generally exceeds the space locally available, necessitating use of more-distant parking within the Laboratory site. Temporary office and storage buildings have been located in parking lots, further reducing available parking. With an estimated population of 2,844 on the main site and an overall parking supply of 1,580 spaces, there are 1.80 persons per parking space, or 0.53 spaces per person. Current construction projects will provide 250 new spaces, while the demand will increase by 138, lowering the persons per space to 1.74.

In older areas of the site (primarily Old Town) some of the roads, parking lots, and

Table 5-11. Transportation and Parking Characteristics.

Characteristic	Current	Future
Parking		
Spaces	1,581	2,410
Population/space ratio	1.80	1.70
Vehicle Traffic (trips/day)		
Blackberry Gate	4,400	6,200
Grizzly Peak Gate	610	1,250
Strawberry Gate	1,950	2,510
Off-site Shuttle Service		
Trips/day	70	82
Passenger capacity/day	2,870	3,300
Passengers carried/day	1,350	1,950
Use (%)	47	59
On-site Shuttle Service		
Trips/day	98	110
Passenger capacity/day	1,862	2,090
Passengers carried/day	925	1,330
Use (%)	50	64

pedestrian walkways are substandard with varied, narrow, and indirect vehicular and pedestrian access. Motor-vehicle movement on site can be difficult because of the steep grades and sharp curves in many locations. This can contribute to traffic delays, for example, when a heavy truck is slowly climbing the main entrance road, where curves make passing impractical. Long-range traffic management plans call for improving pedestrian paths and roads and reducing vehicle use.

Future

Measures to minimize on-street parking, reduce vehicle congestion, and improve access and circulation are important elements in the LRDP. Road widening, primarily along Cyclotron Road, will facilitate the movement of buses and trucks and will also improve safety for bicyclists and pedestrians. Plans allow for improving east-end supply services by extending the operating hours of the Grizzly Peak Gate to enhance access to the shop and service areas, if necessary.

Continued operation of the on-site and off-site buses is an essential element of the plan to minimize traffic and to optimize access to facilities (Table 5-11). The shuttle-bus system provides a 10-minute service interval to all stops within the Laboratory and to the Campus perimeter, AC Transit bus stops, and the Berkeley BART station. This service is to be retained and staging areas improved. In addition, van- and car-pool incentives are to be maintained. LBL will collaborate with Berkeley TRIP (Transit Ridesharing and Parking) in taking actions to reduce congestion and improve access circulation.

Consolidating supply functions and extending hours of the Grizzly Peak Gate on Centennial Drive will reduce on-site traffic to and along Cyclotron Road. In the Light Source Research and Engineering Area replacement of some existing facilities with higher-density buildings would contribute to increased pedestrian and vehicular traffic. In these cases shuttle-bus access, footpaths, and sidewalks are included as a part of construction projects. Proposed parking structures in Blackberry Canyon and adjacent to the Upper Hill Road would be located at the perimeter of functional areas to minimize vehicle use near buildings. These structures would provide a total of 710 additional spaces.

To avoid potential problems caused by any future increases in traffic and demand for parking, the Laboratory is combining the LBL Staff Transportation Committee and the LBL Parking Committee into the Transportation System Management (TSM) Committee. A traffic and parking consultant will perform an assessment, provide quantifiable goals for controlling vehicular traffic, design a comprehensive program to realize the goals, and develop a monitoring and evaluation plan. TSM goals could include: reduce drive-alone vehicles and increase use of car and van pools, decrease traffic during peak hours through

increased use of flextime work schedules, increase use of mass transit through on-site sales of BART tickets, increase walk-in traffic through construction of pedestrian gates, and decrease on-road parking.

Utilities and Communications

Many of the Laboratory's utility systems were initially sized to serve the Laboratory's large accelerators, and they have the capacity to fulfill present and future power, gas, water, cooling, and waste requirements. However, segments and load centers in the utility systems are aged and require rehabilitation to improve flexibility and reliability. The utilities that are undergoing rehabilitation include natural gas, domestic water, cooling water, low-conductivity water, electrical power, sanitary sewer, compressed air, storm drainage, standby and backup electricity, and alarm and security systems. New building construction will require some new utility corridors to link existing east- and west-site utilities. New corridors will be required within the Light Source Research and Engineering Area, and extensions are needed to the Life Sciences Research Area. In general, these will include electric service as well as water, sanitary sewer, gas lines, and storm drains.

The long-range rehabilitation of the 12-kV electrical-power distribution system is based on the need to improve the reliability and operational flexibility of the system. This plan proposes to replace aging and hazardous electrical switching equipment and cables. The existing single-service radial distribution system will be expanded to a double-bus distribution system. To achieve this, the existing central double-bus system at the Grizzly main substation will be extended to five centrally located switching stations. From the switching stations double feeder circuits will be extended to building and laboratory facilities. This arrangement will limit any electrical system failures to fewer facilities, reduce planned outage times, enhance preventive-maintenance activities, and permit the selection of the most economical electricity source by the users.

New buildings and other energy-using facilities will incorporate energy-conservation features that meet or exceed applicable federal energy-use reduction goals and performance standards. Life-cycle cost-effective designs will be incorporated, whenever possible. Major facilities such as new cooling towers, building HVAC and lighting systems, and boilers will be optimized and placed under the Automated Energy Management System. Also, the gas and electrical utility supply will be monitored and metered to provide the Laboratory with a data base for identifying energy waste and establishing priorities for potential energy conservation projects.

Rehabilitation of mechanical utilities is required at several locations for city-water,

cooling-water, compressed-air, natural-gas, storm-drain, sanitary-sewer, and acid-waste systems. Portions of the outdated potable-water pipe will be replaced, as well as valves, backflow preventers, fire-sprinkler risers, and obsolete fire hydrants. The cooling-water system in several buildings will be rehabilitated. An East Site Fire Protection and Water Supply project will provide the Laboratory with a 300,000-gallon water tank for fire protection. Security improvements will include extension of the card-key system and improvements to the fire-alarm system network.

The existing distributed computing network offers access to a large-scale, interactive, high-speed computing resource, including shared archival mass-storage, satellite computers, and workstations. The internal LBL data-transmission network is to be expanded, and a new Integrated Communications System is being implemented to replace and upgrade all existing telephone and data-communications equipment. This will allow LBL to take maximum economic advantage of the restructured telecommunications industry. The integrated system will include support in voice communication, data switching, and networking and is connected to national and international computer networks.

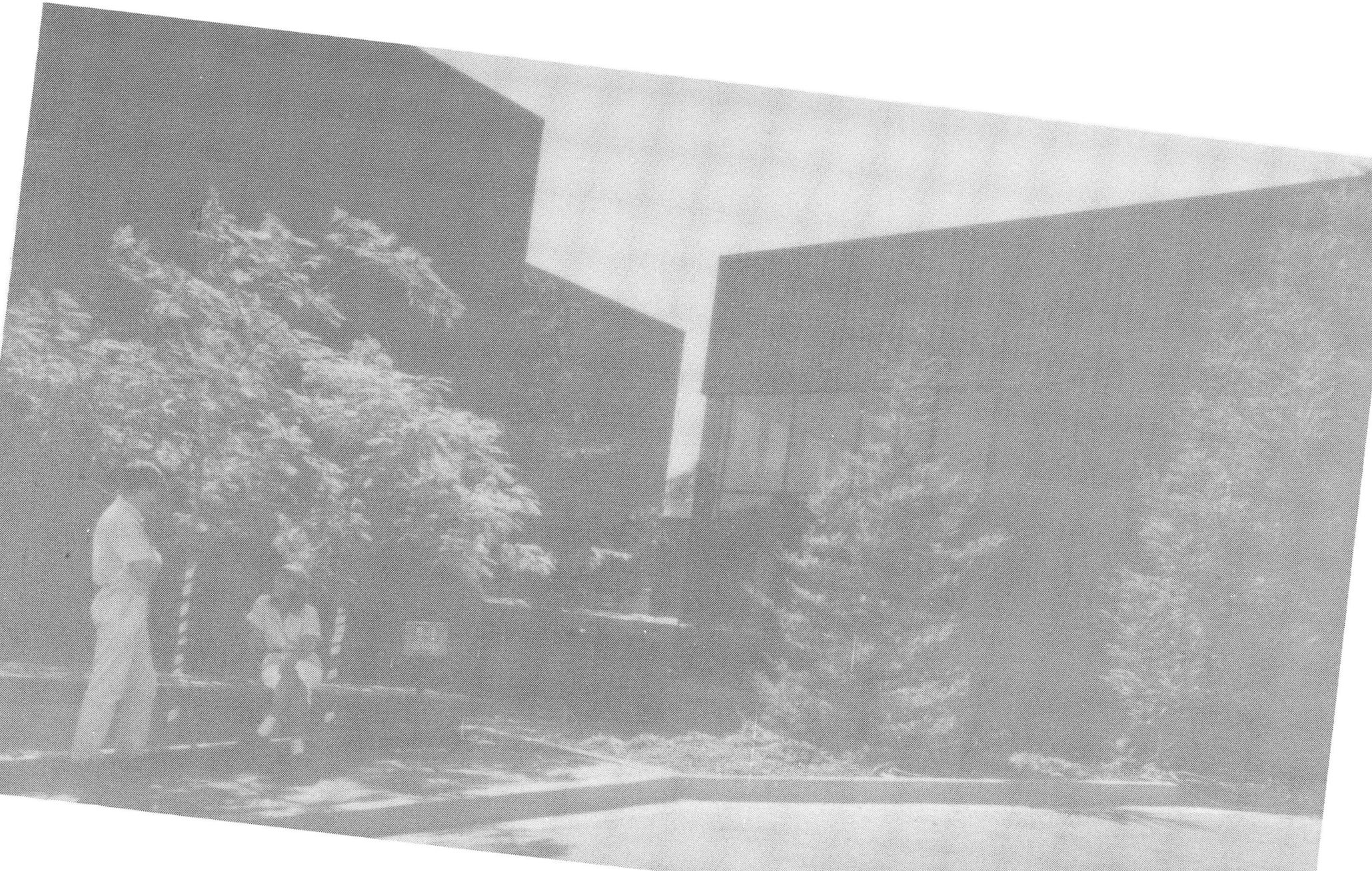
Fire, Safety, and Emergency Preparedness

The Laboratory meets with University officials responsible for the UC Hill Fire Management Plan to ensure proper coordination of efforts to protect the LBL site and adjoining areas. LBL is committed to support the University with personnel and equipment during periodic preventative burns. LBL's fire-management plan includes the planting of fire-resistant vegetation in the landscape buffer areas. Irrigation sprinklers are operated on selected LBL hillsides during the dry season to lower the fire risk and to maintain the fire-resistant plantings. In the early 1980's the Laboratory began retrofitting its older buildings with fire-sprinkler systems, and this program is nearly complete. New buildings are designed with appropriate fire-suppression systems, and all buildings contain fire-detection equipment that signals a central fire-alarm system when heat or smoke is detected.

Safety improvements include projects to further reduce seismic risks, stabilize several slopes, and improve safety and access for handicapped persons. The slope-stabilization projects are for localized soil masses above the Bevatron and adjacent to the Grizzly Peak Gate. These areas would be stablized by a retaining structure with tiebacks to basement rock. Safety improvements scheduled for construction include improved lighting, water-storage systems, water-supply connections, and various monitoring systems.

LBL has a Master Emergency Plan for dealing with disasters such as earthquakes or fires. Three Command Centers have been established and equipped with fault-tolerant telecommunications, and LBL Fire, Medical, Protective Services, Plant Engineering, Maintenance, and Environmental Health and Safety personnel are trained and equipped to respond to local emergencies. Each building has an Emergency Team headed by the building manager, and earthquake and fire drills are held periodically.

Substantial work has been done to strengthen older LBL structures to resist seismic forces, and designs for new buildings incorporate appropriate seismic-safety features. The LBL Safety Review Committee, with its various subcommittees, reviews Laboratory support services to ensure that the proper level of emergency preparedness is maintained.



6. CONCLUSIONS

The 1987 LBL LRDP is the product of continuing Laboratory planning processes. Based on existing and anticipated research programs and site contraints, the LRDP provides land-use and site-redevelopment guidelines and reserves building locations for future programs. The plan takes advantage of LBL's location and its surrounding environment, providing a basis for flexible response to future research needs.

The plan's primary benefits are consolidation and redevelopment to provide locations reserved for future research activities to allow the Laboratory to remain at the forefront of scientific research and training. Implementation of the plan will reduce costs through consolidation of activities and improvements in energy efficiency and will minimize hazards to the public and employees by isolating waste operations; by improving roadways, parking, and pedestrian paths; and by consolidating related functions.

Architectural and landscape guidelines ensure the creation of a good working environment and enhance compatibility with the surrounding community, and transportation services minimize traffic congestion.

Consolidation Within Planning Areas

Related functions are consolidated to improve efficiency and reduce vehicle use on site. The primary consolidations needed are for engineering services and materiel supply. This consolidation requires moving mechanical and electrical engineers to locations near instrument fabrication and assembly. Constructing mechanical- and electrical-engineering building replacement projects will allow for this consolidation and will meet current research support requirements. Materiel supply services are now dispersed in several areas of the Laboratory. Relocation will improve manpower use and operational efficiencies. In summary, improvements to the functional areas include the following.

- *88-Inch Cyclotron*: improvements to the utility systems and addition of a second-floor area reserved for potential growth;
- *Central Research and Administration Area*: consolidation of general-purpose administrative functions through second-floor additions to two buildings, additions to the cafeteria and to conference facilities, laboratory rehabilitation, and a biological isotope facility;
- *Bevalac Accelerator Complex*: upgrades to the synchrotron, provision for the extension of experimental areas, and reservation of space for a particle storage ring and a building for accelerator design and development;
- *Light Source Research and Engineering Area*: redevelopment for buildings now more than 40 years old, construction of new light-duty laboratories, consolidation of engineering support services, and relocation of storage from this high-use area;
- *Shop and Support Facilities Area*: some expansion of engineering shops and consolidation of materiel-management services from other areas of the Laboratory;
- *Materials and Chemistry Research Area*: reservation of space for building additions and parking; and

- *Life Sciences Research Area*: reserved for additional Laboratory buildings and for extension of the east canyon as a site for a corporation yard, including waste-handling and reclamation activities.

Redevelopment and Rehabilitation

Although the average age of existing buildings at the LBL main site is 28 years, buildings at the original Laboratory site were constructed 40 to 45 years ago. In order to maintain and improve the efficiency and productivity of research programs and support operations, substandard buildings are to be renovated and obsolete and deteriorated structures replaced. These redevelopment plans are focused on buildings adjacent to the Light Source to complement new photon-related research, other scientific programs, and general-purpose engineering and technical support.

Improvements to Utilities

Specific improvements include widening the Cyclotron Road access from Hearst Avenue to improve safety for bicyclists and pedestrians and to bring the roadway up to current design standards. The Laboratory's other roadways are to be widened, and the eastern access improved. The kiosk and gate areas are to be upgraded to enhance traffic flow and safety.

The utility network is to be rehabilitated to replace deteriorated sections and to centralize service systems. Improved high-voltage transmission and switching systems are to be installed to minimize outages and to take advantage of cost-effective electricity service. The Integrated Communications System will provide the necessary quality of service and reserve capacity for both voice and data communications to accommodate the Laboratory's future needs.

The transportation and service system is to be improved by the access and roadway improvements described above and through site improvements and policies to minimize vehicle use (see TSM discussion in Chapter 5), control access, and optimize land use. Business-hour trips from the Laboratory are reduced by current on-site recreational facilities and services (cafeteria, banking, sales of postage stamps and public-transit monthly passes), and more such facilities and services will be provided in the future. The on-site and off-site shuttle-bus service will be maintained to minimize the personal use of vehicles, and shuttle-bus support areas will be improved. Areas reserved for additional parking structures are at the perimeter of functional areas, and additional pedestrian paths are planned to reduce vehicle use and improve safety. Car-pool, van-pool, and shuttle-bus incentives are an important element of the transportation plan.

Maintenance of Buffer Zones

The perimeter of the Laboratory will be enhanced through additional landscaping to augment the natural beauty of the area and to act as a buffer to the Campus, to residential areas, and to the Lawrence Hall of Science and the UCB Botanical Garden. The buffer areas are managed with the following objectives: (1) maintain esthetic and environmental values; (2) stabilize slopes and manage rainwater runoff; (3) reduce fire hazards; and (4) visually screen facilities. Landscape planting zones will sustain and augment the shrub, grassland, and forested, areas of the hillside to unify the site visually and to provide a buffer between functional areas, buildings, and adjacent properties.

Improvement Program

LBL's future facilities requirements fall into three general categories: (1) replacement of shops and utilities to meet support requirements; (2) replacements for, and additions to, multipurpose buildings and offices; and (3) advanced and specialized research facilities for specific programmatic needs. About 71,000 gsf of LBL's current office space is in temporary buildings, and

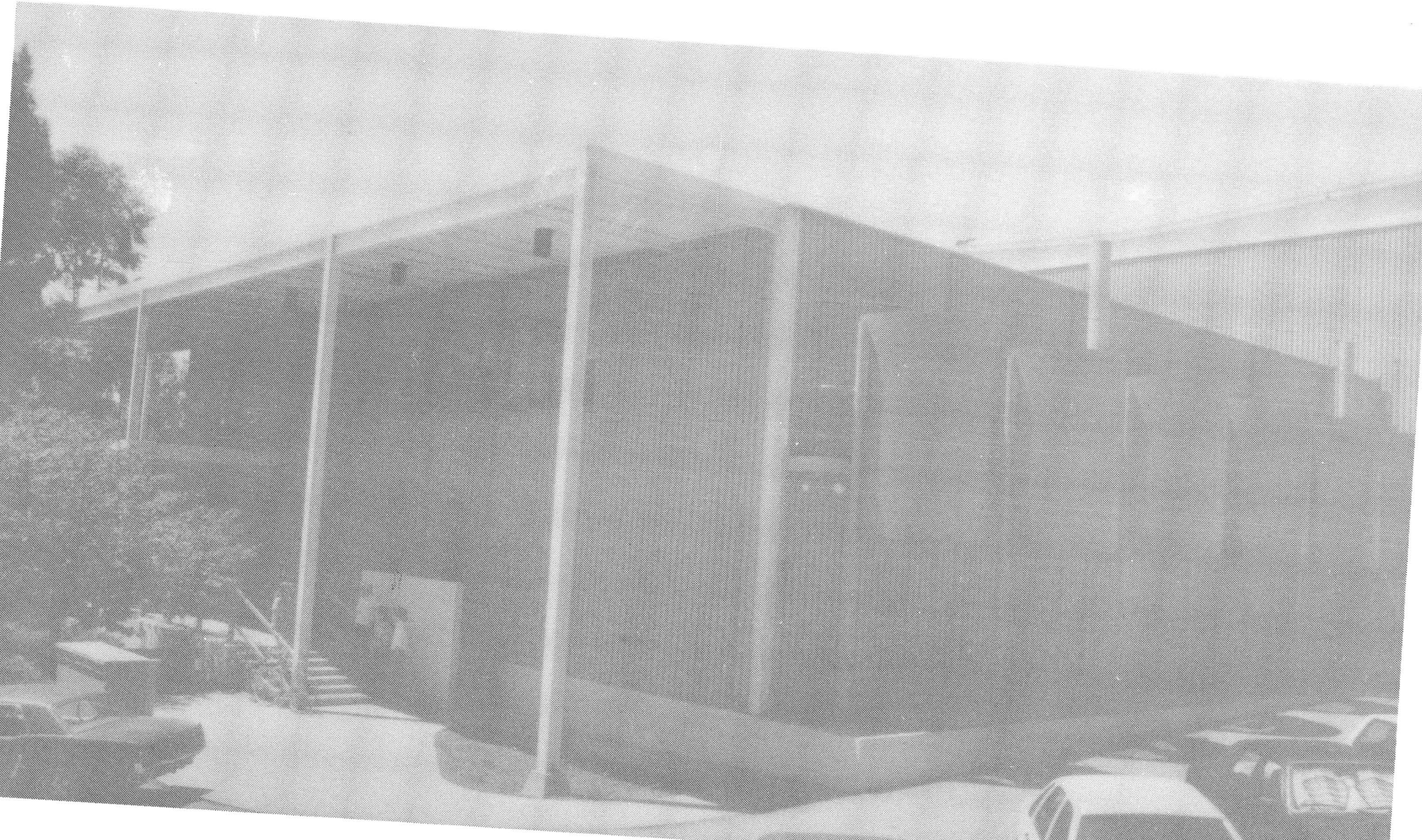
significant amounts are in World War II structures scheduled for removal or in off-site leased space. To meet current and anticipated research and support requirements, the LRDP identifies facilities for removal, replacement, or addition (see Appendix C).

- *The plan reserves approximately 59,800 gsf for the replacement of engineering, shop, and materiel-supply facilities.* This includes mechanical- and electrical-engineering building replacement projects, materiel-storage buildings, and additions to fabrication facilities. In addition, the plan identifies utilities rehabilitation and improvement needs, primarily for electrical, gas, water, and sewage systems.
- *The plan reserves sites for additions to, or replacements for, approximately 318,500 gsf of multipurpose facilities.* Included are provisions for office space, computer and communications facilities, cafeteria facilities, conference rooms, and other general-purpose buildings. Some of this reserved space is safety related, for medical services and waste handling.
- *The plan reserves sites for future construction (approximately 235,300 gsf) for specialized facilities and specific research-program needs.* The major programmatic space needs are for accelerator-development heavy-duty-laboratory facilities and for laboratories for energy conservation and renewable-resources energy research, for life-sciences research in support of biotechnology-related initiatives, and for research related to chemistry and materials science.

Improvements to the aged and obsolescent multipurpose and shop facilities call for the rehabilitation of 788,500 gsf of existing on-site structures. However, 224,225 gsf of buildings, many in the Light Source Area, are obsolete structures that cannot be upgraded to meet existing standards and are designated for removal. In addition to the improvements indicated above, sites are identified for two parking garages, providing a total of 700 spaces.

Reserve for Future Growth

The plan reserves site locations for buildings for future growth to an ultimate total of 1,996,200 gsf of Laboratory space. This represents an approximately 404,800-gsf (25-percent) potential increase from the current Laboratory size (including current construction). Near-term projects emphasize rehabilitation and replacement and consolidation of functions for activities occurring both on site and off. The Laboratory anticipates that changes in population will be slow and that the reserve for growth will be adequate for research needs into the next century.



APPENDICES

APPENDIX A

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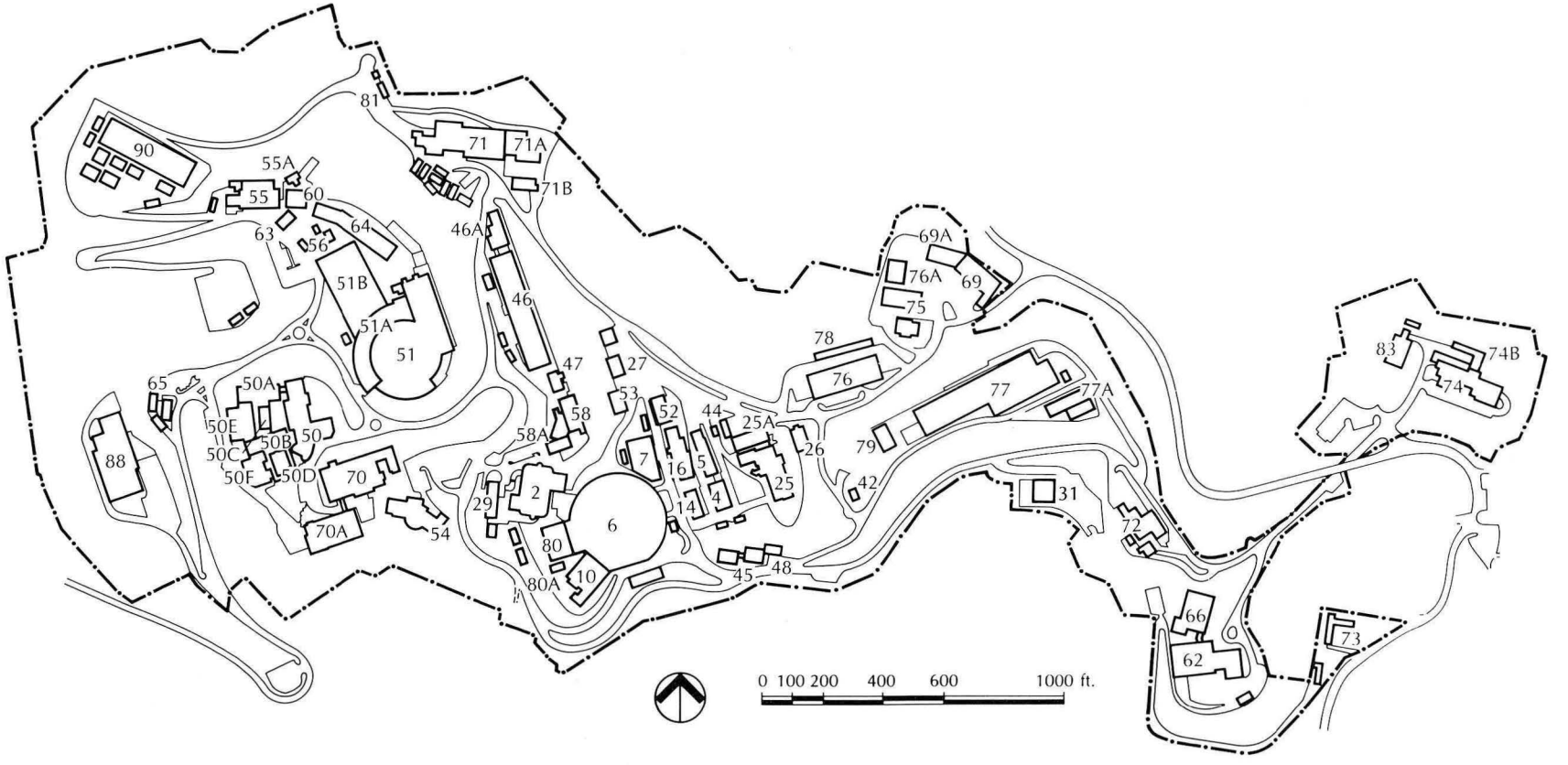
APPENDIX B

Lawrence Berkeley Laboratory Buildings



APPENDIX B

Existing LBL Buildings and Rehabilitation Status

Building Number	Building Name/Description	Area (sq ft)	Date Contructed	Rehab Status[a]
88-Inch Cyclotron Facilities Area				
88	88-Inch Cyclotron	52,200	1960	1
	Miscellaneous Structures	1,500		
	Total[b]	**53,700**		
Central Research and Administration Area				
50	Physics & AFRD	47,421	1949	2
50A	Physics & Dir. Office	67,822	1962	2
50B	Physics & Comp. Center	64,989	1967	2
50C	Office Building	2,988	1980	1
50D	Office Building	5,010	1979	1
50E	Office Building	10,150	1984	1
50F	Office Building	8,300	1985	1
54	Cafeteria	11,662	1950	2
55	Research Medicine	18,641	1951	1
55A	NMR Building	1,535	1985	1
55A	Office Trailer	517	1978	3
65	Admin. Computing	3,306	1952	3
65A	Office Trailer	1,425	1978	3
65B	Office Trailer	1,385	1987	3
67B	Office Trailer	1,189	1978	3
67C	Office Trailer	1,189	1978	3
67E	Office Trailer	290	1972	3

[a]Rehabilitation Status
1 = Adequate
2 = Substandard, can be made adequate
3 = Substandard, cannot be made adequate
[b]Totals are rounded to nearest hundred.

Existing LBL Buildings and Rehabilitation Status

Building Number	Building Name/Description	Area (sq ft)	Date Contructed	Rehab Status[a]
70	NSD, ASD, ESD	62,253	1955	2
70A	MCSD & NSD	67,934	1961	2
90	Admin. & Research	88,861	1960	2
90A	Office Trailer	1,440	1977	3
90B	Office Trailer	1,622	1977	3
90C	Office Trailer	1,183	1977	3
90D	Office Trailer	192	1977	3
90E	Office Trailer	188	1977	3
90F	Office Trailer	2,461	1979	3
90G	Office Trailer	1,847	1978	3
90H	Office Trailer	1,846	1978	3
90J	Office Trailer	2,840	1978	3
90K	Office Trailer	2,882	1978	3
90P	Office Trailer	2,130	1979	3
90Q	Office Trailer	425	1979	3
90R	Utility Shack	160	1978	3
	Miscellaneous Structures	1,617		
	Total[b]	**487,700**		
Bevalac Accelerator Complex				
46	Accel. Dev. & Elec.	45,780	1949	2
46A	Real Time Systems Group	5,504	1977	1
46B	Office Trailer	1,260	1979	3
46C	Office Trailer	1,022	1977	3
46D	Office Trailer	786	1984	3
47	Advan. Accel. Studies	6,132	1957	3

[a]Rehabilitation Status
1 = Adequate
2 = Substandard, can be made adequate
3 = Substandard, cannot be made adequate
[b]Totals are rounded to nearest hundred.

Existing LBL Buildings and Rehabilitation Status

Building Number	Building Name/Description	Area (sq ft)	Date Contructed	Rehab Status[a]
47A	Office Trailer	360	1973	3
51	Bevalac	39,156	1950	2
51A	Bevalac Annex	72,666	1950	2
51B	Particle Beam Hall	42,075	1962	1
56	Cryogenic Facility	1,148	1976	3
58	Accelerator R&D	9,545	1950	3
58A	Accelerator R&D Lab.	11,484	1969	1
60	Physics High Bay	3,400	1980	1
63	Accelerator Division	2,611	1963	3
64	Accelerator Research	22,995	1951	2
64A	Bevatron Riggers Trailer	515	1968	3
71	SuperHILAC	53,827	1956	1
71A	SuperHILAC Rectifier	3,500	1965	1
71B	SuperHILAC Annex	7,187	1956	1
71C	Office Trailer	511	1968	3
71D	Office Trailer	511	1970	3
71E	Office Trailer	511	1973	3
71F	Office Trailer	511	1974	3
71G	Office Trailer	511	1974	3
71H	Office Trailer	1,416	1971	3
71J	Office Trailer	1,239	1978	3
71K	Office Trailer	484	1978	3
81	Liquid Gas Storage	1,124	1968	1
	Miscellaneous Structures	8,429		
	Total[b]	**346,200**		

[a]Rehabilitation Status
1 = Adequate
2 = Substandard, can be made adequate
3 = Substandard, cannot be made adequate
[b]Totals are rounded to nearest hundred.

Existing LBL Buildings and Rehabilitation Status

Building Number	Building Name/Description	Area (sq ft)	Date Contructed	Rehab Status[a]
Light Source Research and Engineering Area				
2	Advan. Mat. Laboratory	81,000	1988	1
4	Magnetic Fusion Energy	9,894	1944	3
5	Magnetic Fusion Energy	7,115	1943	3
6	Advanced Light Source	83,600	1987[c]	1
7	Stores & Elec. Shop	27,027	1943	3
7A	Radio Repair Shack	120	1974	3
7B	Office Trailer	473	1977	3
7C	Office Trailer	473	1977	3
7E	Office Trailer	1,040	1977	3
9	Exper. Staging	6,277	1944	3
10	Bio. Res. Photo Lab.	16,433	1944	3
12	Central Stores Annex	3,018	1944	3
14	Lab. Building	4,200	1944	3
16	Magn. Fusion Engy. Lab.	10,854	1943	3
16A	Power Supply House	339	1960	3
17	Solar Refrig. & Salvage	1,717	1949	3
25	Mech. Technology	20,466	1947	3
25A	Elec. Development	7,335	1963	2
26	Medical Services	6,741	1964	2
27	Cable Shop	3,288	1948	3
29	Instr. & Bio. Research	10,576	1947	3
29A	Office Trailer	1,768	1978	3
29B	Office Trailer	1,420	1978	3
29C	Office Trailer	1,420	1978	3
29D	Rest Room Trailer	283	1978	3

[a]Rehabilitation Status
1 = Adequate
2 = Substandard, can be made adequate
3 = Substandard, cannot be made adequate
[c]The Advanced Light Source is scheduled for completion in 1992.

Existing LBL Buildings and Rehabilitation Status

Building Number	Building Name/Description	Area (sq ft)	Date Contructed	Rehab Status[a]
37	Utilities & Service	1,024	1987	1
40	Elect. Warehouse	994	1947	3
41	Computer Aided Drftg.	994	1948	3
44	Ind. Air Poll. Annex	800	1956	3
44A	Office Trailer	480	1979	3
44B	Office Trailer	1,420	1979	3
45	Fire Apparatus	3,278	1970	1
48	Fire Station	4,221	1981	1
52	Magn. Fusion Energy	6,737	1943	3
52B	Magn. Fus. Engy. Trailer	1,180	1979	3
53	Accel. Development	6,806	1949	3
53B	Office Trailer	511	1972	3
80	Center for X-Ray Optics	25,841	1954	2
80A	Telephone Services	947	1977	1
	Miscellaneous Structures	2,748		
	Total[b]	**364,900**		
Shop and Support Facilities Area				
31	Chicken Creek Staging Area	6,060	1987	1
33C	Grizzly Peak Gatehouse	80	1965	1
42	Earth Scien. Field Ser.	1,215	1942	3
68	Pump House	500	1979	1
69	Supply Services	17,159	1967	1
75	Radio. Iso. Services	8,545	1961	1
75A	Waste Compactor	4,000	1967	3
75B	Env. Hlth. & Saf. Trailer	4,681	1979	3
76	Constr. & Maint.	26,862	1964	1
77	Mechanical Shops	66,762	1963	2
77A	Ultrahigh Vacuum	9,600	1987	1

[a]Rehabilitation Status
1 = Adequate
2 = Substandard, can be made adequate
3 = Substandard, cannot be made adequate
[b]Totals are rounded to nearest hundred.

Existing LBL Buildings and Rehabilitation Status

Building Number	Building Name/Description	Area (sq ft)	Date Contructed	Rehab Status[a]
77G	Office Trailer	710	1976	3
78	Craft Stores	5,373	1965	1
79	Metal Stores	4,278	1965	1
	Miscellaneous Structures	1,775		
	Total[b]	**157,600**		
Materials and Chemistry Research Area				
62	MCSD	55,658	1965	2
62A	MCSD Trailer	1,189	1978	3
66	SSCL	47,500	1987	1
72	NCEM	5,308	1961	1
72A	ARM	2,532	1978	1
72B	ARM Support Lab.	4,383	1984	1
72C	ARM Support Lab.	5,600	1984	1
73	Atms. Aerosol Res.	4,304	1961	2
	Miscellaneous Structures	426		
	Total[b]	**126,900**		
Life Sciences Research Area				
33A	Strawberry Canyon Gate	52	1965	1
74	Biomedical Labs.	43,033	1962	2
74B	Biomedical Lab. Annex	3,752	1969	1
83	Cell Culture Lab.	6,875	1979	1
83A	Biomedical Trailer	493	1965	3
	Miscellaneous Structures	195		
	Total[b]	**54,400**		

[a]Rehabilitation Status
1 = Adequate
2 = Substandard, can be made adequate
3 = Substandard, cannot be made adequate
[b]Totals are rounded to nearest hundred.

APPENDIX C

LBL Long Range Development Plan Space Distribution (gsf).[a]

Areas and Buildings	Existing	Construction Type[b]	Construction gsf	Removals Bldg. No.	Removals gsf	Net gsf
88-INCH CYCLOTRON FACILITIES AREA						
88 2nd-Floor Addition		R	8,600			
Total	**53,700**		**8,600**			**62,300**
CENTRAL RESEARCH & ADMINISTRATION AREA						
50 E & F 2nd-Floor Additions		M	18,400	90 trlrs	17,630	
54 Addition (Cafeteria)		M	1,900	55 A	520	
Biomed Isotope Facility		R	3,800	67 trlr	2,670	
65 Replacement		M	7,000	65	3,300	
Conference Center		M	10,000	65 A trlr	1,430	
				65 B trlr	1,400	
Total	**487,700**		**41,100**		**27,000**	**501,800**
BEVALAC ACCELERATOR COMPLEX						
58 Addition		R	1,700	47,47 A	6,490	
Accelerator & Fusion Research Division Building		M	54,600	63	2,611	
71 Addition		R	12,000	46 B–D	3,086	
51 B Extension		R	15,000	58	9,545	
47–58 Replacement		M	59,500	71 trlrs	6,205	
60 Addition		M	3,400	56	1,148	
71 B 3rd-Floor Addition		R	3,100	64 A	515	
Total	**346,200**		**149,300**		**29,600**	**465,900**

[a]Draft data, independently rounded.
[b]Building Type Summary: 235,300 Research (R); 318,500 Multipurpose Facilities (M); 59,800 Shops (S)

LBL Long Range Development Plan Space Distribution (gsf).[a]
[continued]

Areas and Buildings	Existing	Construction Type[b]	Construction gsf	Removals Bldg. No.	Removals gsf	Net gsf
LIGHT SOURCE RESEARCH & ENGINEERING AREA						
CRE Laboratory		R	49,800	16,16 A	11,193	
Mechanical Engineering Replacement		M	46,400	52 A,B	1,696	
Electrical Engineering Replacement I		M	30,000	5	7,115	
Electrical Engineering Replacement II		M	30,000	25	20,466	
Laboratory Building (West of Building 6)		R	16,200	29+trlr	15,467	
Laboratory Buildings (East of Building 6)		R	30,000	4,4 A	10,027	
26 Addition		M	2,000	14	4,219	
ALS Mezzanine Addition		M	29,000	6 (Partial)	5,900	
				7+trlr	27,560	
				9	6,277	
				12,17	4,735	
				27	3,288	
				37,37 A	1,205	
				40,41	1,988	
				43,48 A	1,243	
				44 Comp.	2,700	
				52	6,737	
				53 A,B	7,509	
Total	**364,900**		**233,400**		**139,300**	**459,000**
SHOP & SUPPORT FACILITIES AREA						
Support Services Facility		S	42,000	75 A	4,064	
77 Addition		S	2,400	75 B	4,681	
Future site		S	10,000	77 G	710	
78 Addition		S	5,400	77 H	576	
69 Addition		M	4,000	42	1,215	
Total	**157,600**		**63,800**		**11,200**	**210,200**

[a]Draft data, independently rounded.
[b]Building Type Summary: 235,300 Research (R); 318,500 Multipurpose Facilities (M); 59,800 Shops (S)

LBL Long Range Development Plan Space Distribution (gsf).[a]
[continued]

Areas and Buildings	Existing	Construction Type[b]	Construction gsf	Removals Bldg. No.	Removals gsf	Net gsf
MATERIALS & CHEMISTRY RESEARCH AREA						
Future Materials Building		R	30,000	62 A	1,200	
62 High-Bay Addition		R	2,200			
Total	**126,900**		**32,200**		**1,200**	**157,900**
LIFE SCIENCES RESEARCH AREA						
Waste Handling Facility		M	12,300	83 A	500	
Cell Culture Lab. II		R	7,000			
Life Sciences Additions		R	32,700			
Human Genome Lab.		R	23,200			
Future Sites		M	10,000			
Total	**54,400**		**85,200**		**500**	**139,100**
Grand Total	**1,591,400**		**613,600**		**208,800**	**1,996,200**

[a]Draft data, independently rounded.
[b]Building Type Summary: 235,300 Research (R); 318,500 Multipurpose Facilities (M); 59,800 Shops (S)

APPENDIX D

Acronyms & Abbreviations

AC	Alameda County
AFRD	Accelerator & Fusion Research Division (LBL)
ALS	Advanced Light Source
AML	Advanced Materials Laboratory
ARM	Atomic Resolution Microscope (LBL)
ASD	Applied Science Division (LBL)
BART	Bay Area Rapid Transit
CEQA	California Environmental Quality Act
CRE	Conservation & Renewable Energy
DOE	U.S. Department of Energy
EBMUD	East Bay Municipal Utility District
EIR	Environmental Impact Report
ESD	Earth Sciences Division (LBL)
FTE	full-time-equivalent (employee)
gsf	gross square feet
HILAC	Heavy Ion Linear Accelerator
HVAC	Heating, Ventilation, and Air Conditioning
LBL	Lawrence Berkeley Laboratory
LRDP	Long Range Development Plan
MCSD	Materials & Chemical Sciences Division (LBL)
NCEM	National Center for Electron Microscopy (LBL)
NMR	Nuclear magnetic resonance
NSD	Nuclear Science Division (LBL)
R&D	Research & Development
RFS	Richmond Field Station (of the University of California, Berkeley)
SEAC	Scientific & Educational Advisory Committee (UC)
SSCL	Surface Science and Catalysis Laboratory
TRiP	Transit Ridesharing and Parking (UC/City of Berkeley)
TSM	Transportation System Management
UC	University of California
UCB	University of California, Berkeley
UHV	ultrahigh vacuum

APPENDIX E

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