National Institutes of Health
National Institute of Environmental Health Sciences

MASTER PLAN

Research Triangle Park, North Carolina

Revised Final Draft: March 2012

US Department of Health and Human Services
National Institutes of Health
Office of Research Facilities Development and Operations
Division of Facilities Planning

National Institutes of Health
National Institute of Environmental Health Sciences

PREPARED FOR:
DIVISION OF FACILITIES PLANNING
OFFICE OF RESEARCH FACILITIES DEVELOPMENT AND OPERATIONS

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MASTER PLAN DOCUMENT ORGANIZATION

The Master Plan document describes the overall concept and its implementation recommendations, together with the background that led to its development. The document is organized into eleven sections, as follows:

1. **Executive Summary**. The goals and highlights of the Plan are described, with a summary of architecture, landscape, circulation, utility frameworks and recommended implementation phasing.
2. **Background.** The Master Plan is an update of the original Plan of 1971, and this section describes the need and goals for a new Plan in the context of the existing campus, its mission and history. The Master Plan process is outlined.
3. **Key Findings of Phase 1.** An evaluation phase preceded the Master Plan development, in which the site, buildings, space utilization and needs were assessed. Alternative planning concepts were explored and evaluated. A Phase 1 document supplements this summary.
4. **Program for Growth and Change.** The space program section describes the components and square footage needs on which the Master Plan is based. The program was developed to accommodate current space shortfall and the projected needs for 10-year, 15-year and 20-year periods, based on historic patterns, current usage and NIEHS/NIH goals.
5. **Master Plan – Concept and Architectural Framework.** The Master Plan concept is presented at two levels, the overall campus development and the more focused approach to the campus center. Included in this section is the land use plan, as well as the conceptual framework for the buildings, open space, circulation and parking, and the renovation of Building 101. A sustainable development approach is outlined.
6. **Master Plan – Landscape and Stormwater Framework.** The site and landscape zones are identified and their function and key features are described. A natural stormwater management program is outlined in detail
7. **Master Plan – Circulation Framework.** The recommended campus road system is based on existing patterns, anticipated future employee needs and the existing and local roadway system around campus. This section includes a campus traffic analysis, traffic management plan, parking recommendations and security improvements to circulation.
8. **Master Plan – Utility Framework.** The existing utilities would need to be extended and improved to accommodate Master Plan growth/change, and this section outlines an approach and phased implementation that corresponds to phased building development.
9. **Building 101 Improvements.** The existing Building 101 is an important component of the Master Plan concept, and the improvements presented are three-fold: functional changes that integrate new buildings; improvements to employee amenities that enhance the working environment; and physical upgrades for long-term maintenance and to meet sustainability goals. The linking of new buildings to Building 101 is illustrated.
10. **Implementation Planning**. The Master Plan growth and improvements are envisioned as incremental development, and this section recommends phases for new buildings and site improvements. Although three phases are indicated, there is considerable implementation flexibility.
11. **Design Guidelines.** The design guidelines define important basic principles of organization and design, in order to ensure a cohesive whole and to allow the entire Master Plan to be incrementally realized. The guidelines are organized into five categories: Open space; Architecture; Landscape Architecture; Circulation; and Parking.

TABLE OF CONTENTS

LIST OF EXHIBITS

1. Executive Summary

2. Background

3. Key Findings from Phase 1

4. Program for Growth and Change

5. Master Plan: Concept and Architectural Framework

6. Master Plan: Landscape and Stormwater Framework

7. Master Plan: Circulation Framework

8. Master Plan: Utility Framework

9. Master Plan: Building 101 Improvements

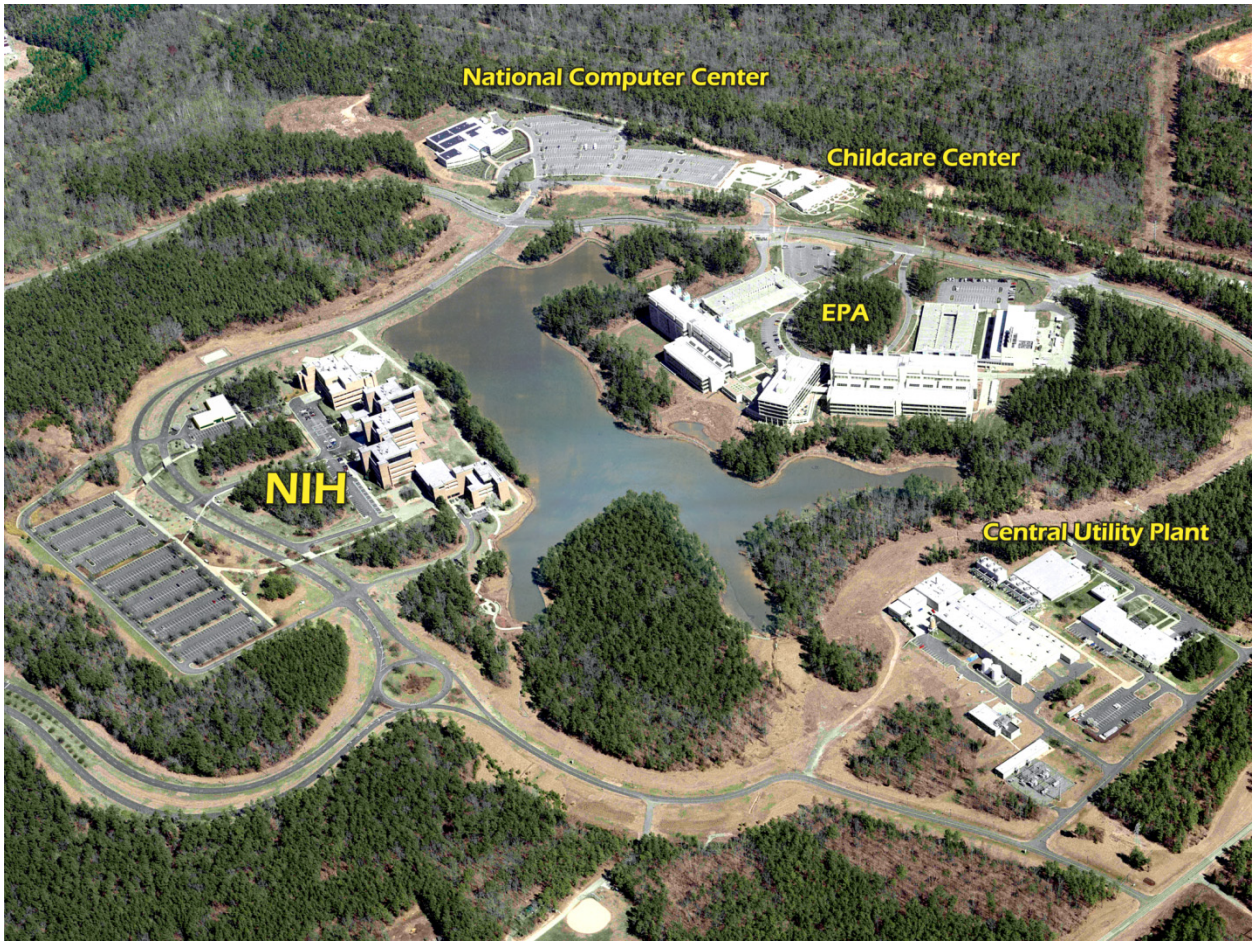
10. Implementation Planning

11. Design Guidelines

1.

EXECUTIVE SUMMARY

Existing Campus



Information on the Plan is available at http://www.orf.od.nih.gov/Planning or by contacting:

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1. EXECUTIVE SUMMARY

The National Institutes of Health (NIH) is an agency of the Department of Health and Human Services (HHS), which is the federal government's lead department in medical and behavioral science research. Each agency is required to have a physical Master Plan for its sites, reflecting both the anticipated special needs of the user group and the impact of its activities on the surrounding community. HHS's Master Plans are used both to define needed physical facilities and advance the agency's mission-related goals. HHS requires agencies to update their Master Plans every five years to address changed conditions or new requirements.

The NIH campus at Research Triangle Park, North Carolina (NIH-RTP), one of NIH's six government-owned campuses in the US, is a beautiful, landscaped site, which shares a small lake with the U.S. Environmental Protection Agency. The campus is home to the National Institute of Environmental Health Sciences (NIEHS), one of the 27 Institutes or Centers that comprise NIH. T*he* NIEHS *vision is to prevent disease and improve human health by using environmental sciences to understand human biology and disease.*[1] NIH-RTP houses almost 1,500 research scientists, administrators and support personnel in nine campus buildings, and an additional 268 personnel in leased spaces. The site contains over one million gross square feet of space.

The current Master Plan for NIH-RTP was prepared more than 30 years ago. In October 2006, NIH retained Metropolitan Architects and Planners, an architectural planning and design firm located in Alexandria, Virginia, to assist it in creating a new Master Plan for the campus. From the beginning, NIH and NIEHS leaders were clear in their expectations for the new Plan. NIH-RTP needed a modern 21st Century campus that would attract leading researchers and assist it in training the next generation of environmental health scientists if it wanted to keep pace with the rapid growth occurring in the Research Triangle Park area and the leading biotechnology and research center RTP had become over the last 40 years.

This Master Plan was commissioned to evaluate the space needs and facilities at RTP that support the research functions and provide NIH-RTP with services and amenities comparable to other NIH campuses. Two other factors also were pivotal in proceeding with the update: space pressure on the campus caused by the evolving nature of research and the related growth, both recent and anticipated, in personnel and programs; and planned new buildings to be integrated into the campus, including a clinical research center and visitor center.

The Master Plan represents both a vision for physical development of the RTP campus and a twenty-year phased implementation plan. In addition to meeting practical physical needs, the Plan supports NIH's underlying mission of supporting and encouraging collaborative scientific research. Five primary goals guided the Master Plan development and served as the yardstick for evaluating alternative development concepts.

1. Create a lively campus – a vibrant place that reflects the round-the-clock activity and the collaborative nature of scientific research
2. Provide appropriate facilities – labs, offices and support that meet advanced scientific needs, including expanded core facilities, flexible and reliable engineering systems, upgraded labs, a state-of-the-art conference center and the consolidation of all local NIH staff on campus
3. Increase employee amenities on site – facilities that encourage staff interaction and enhance the working environment
4. Expand community outreach – a campus that provides opportunities for interaction with EPA, area universities and research centers
5. Create an environmentally responsible campus – buildings and site improvements that incorporate green design principles and practices

[1] October 5, 2007; NIEHS website www.niehs.nih.gov

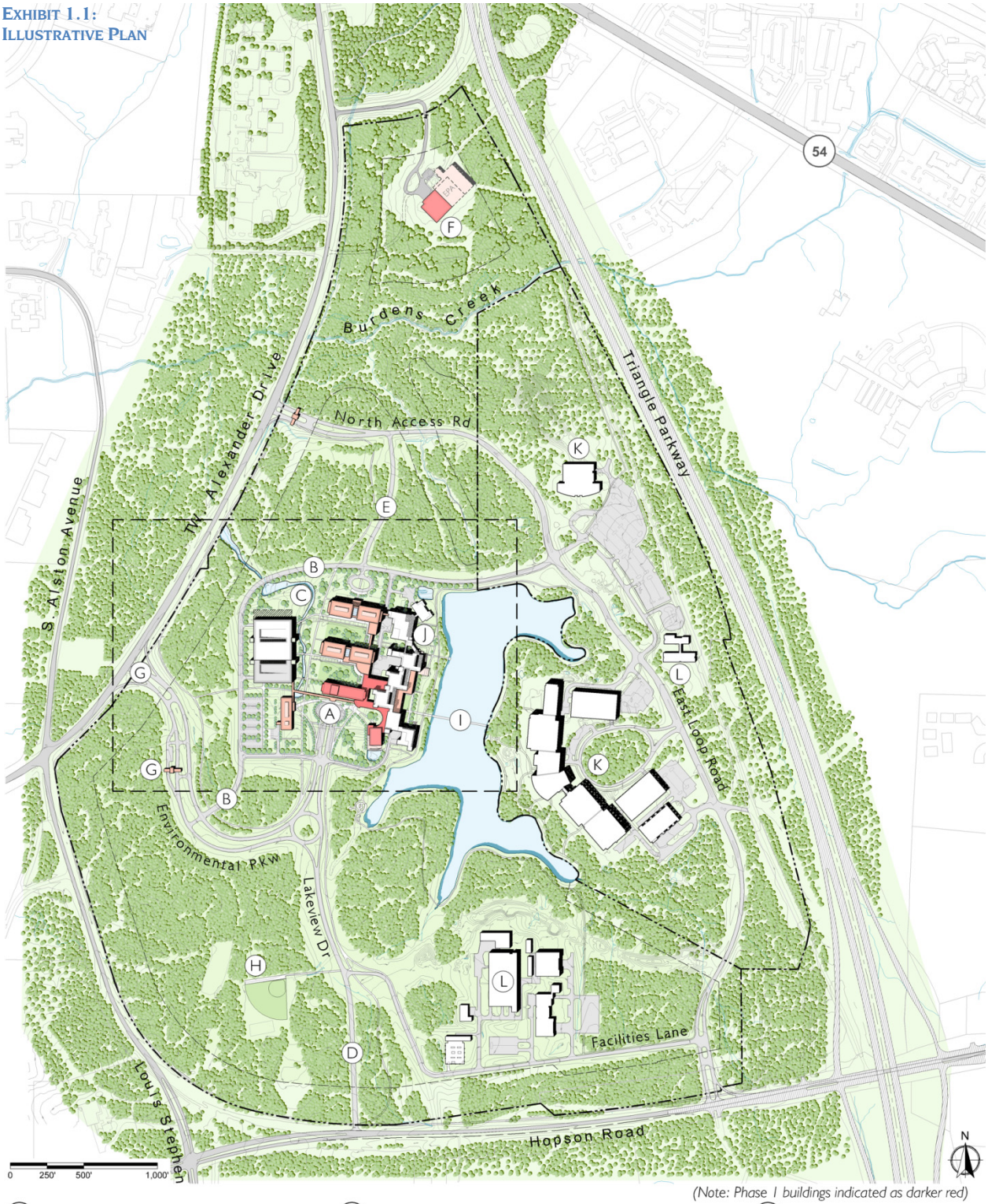
1.1 MASTER PLAN SUMMARY: HIGHLIGHTS

As part of HHS policy, NIH is expected to develop a master plan for all its sites and establish a framework for long-range planning, development and utilization of resources. These master plans, which are living documents, are required to be updated every five years to reflect new priorities or altered mission or circumstances.

The RTP Master Plan would provide for an additional 1,000 employees on the site over 20 years, with approximately 565,000 gross square feet (gsf) of expansion space, and 490,000 gsf of parking structure. The Plan offers a framework upon which NIH could accomplish its goals of creating a lively campus with appropriate facilities for scientific needs, and emphasizes functional relationships and collaboration, employee amenities, and sustainable practices. Developed by exploring and evaluating alternatives, the Plan clusters new buildings around the existing Building 101 complex, creating a compact campus. Scientific facilities would be easily linked, and employees would have greater opportunities for collaboration and informal interaction. The improved campus setting would enhance the working environment at NIH, encourage employee interaction, and provide a sense of place and pride in the institution. Highlights are as follows:

- **Welcoming entry.** The campus heart has a recognizable "front door" welcoming visitors to the campus and creating a center and destination for employee amenities and shared functions, linked to the new and existing facilities.
- **Campus as a place.** Building and campus setting are joined to create and preserve those characteristics that distinguish NIH-RTP as a place, with nature and natural light brought into the buildings, and outdoor spaces easily accessible for use. The lake is a central organizing element, and roads are removed from the heart of the campus to create people-friendly places.
- **Growth is anticipated.** New facilities and expansion of approximately 565,000 gsf (±230,000 NASF) are planned, to accommodate a projected user population of almost 2,500 people over the next 20 years.
- **Consolidation of NIH on-campus.** Offices and warehouse functions located in leased space are brought to campus when leases expire.
- **Compact campus development.** Development is clustered to create a compact campus with interconnectedness between buildings. As a result, the campus would become more convenient for scientists and promote greater interaction.
- **Flexible, incremental growth.** The Plan allows facilities to be added incrementally, as needed and financed when federal funding permits, while being linked to an established circulation and utility network.
- **Building 101 Improvements.** Functional changes and physical upgrades to 101 address aging infrastructure and energy issues, as well as improve internal circulation, shared service and employee amenities.
- **Natural and sustainable campus.** The Plan emphasizes natural and sustainable landscapes, introducing a comprehensive stormwater management strategy and the protection of sloped areas, significant tree stands, and visual buffers. New buildings are oriented for the best natural daylighting and sun exposure. Future development minimizes impact on the natural site features and open space.
- **Shared campus.** The Plan promotes collaboration with EPA, incorporating a planned pedestrian bridge across the lake. NIH and EPA are developing a shared warehouse to be located at the north end of the campus.
- **Coordinated road network.** Responding to the new Triangle Parkway, an additional entrance would be provided from Hopson Road. The main entrance from T.W. Alexander would remain, and a visitor screening center would be added. A modified campus loop road network would allow for changes in security requirements.
- **Structured parking.** Most surface parking would be incrementally replaced with structured parking, contributing to open space preservation and stormwater management, as well as employee convenience.

EXHIBIT 1.1:
ILLUSTRATIVE PLAN



(Note: Phase 1 buildings indicated as darker red)

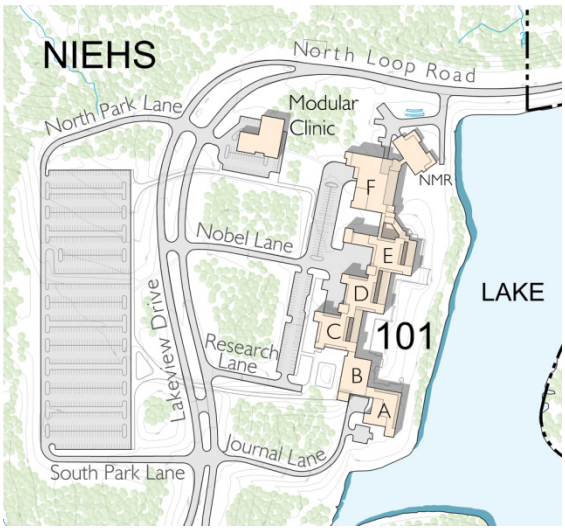
- (A) Campus Center
- (B) New circulation connector
- (C) New stormwater detention feature
- (D) New employee entrance
- (E) New north entrance
- (F) Warehouse - shared with EPA
- (G) Main entrance and visitor center
- (H) Open space, recreation & future development
- (I) Bridge to EPA
- (J) Building 101
- (K) EPA facilities
- (L) NIH/EPA shared facilities

1.2 Campus Center Features

The Rall Building, commonly called Building 101, is the focus of scientific research today and houses over 80% of the on-campus space in seven building modules, interconnected to create a linear complex. The two southern-most modules, A and B, contain administrative offices, cafeteria and other shared functions. Modules C, D, E and F, and the MRI Building are used primarily as research laboratories, with the on-site animal facilities below C, D and E. Module B is the current main entrance to the complex.

One fundamental Master Plan concept is the concentration of new development in the Campus Center adjacent to Building 101, linking new to old and focusing activity and campus development to a single pedestrian-oriented neighborhood. Growth is concentrated on the west side of Building 101, with several new buildings integrated with the existing complex, and separated by user-friendly outdoor spaces. The concept strengthens the pedestrian realm of the campus, and integrates the natural features of the site with new outdoor spaces. The Campus Center plan can be constructed in a series of incremental steps over the 20-year plan horizon. The Plan minimizes changes to existing structures during the course of its development, and each step is an opportunity to improve the whole-campus environment.

Existing Campus Center



The planned facilities and common spaces would create lively gathering places, and a distinctive entrance and campus image. This establishes a compact campus with closely-linked program elements, centered around the existing Building 101. A new, multi-level lobby near the B Module would be the campus hub, linking buildings, and concentrating shared common spaces to create a gathering place. New buildings are clustered around open spaces, which give each its own outdoor space and identity. A new circulation spine, perpendicular to the existing linear circulation spine in Building 101, would connect the Campus Center with the parking structure and lots. Building 101 would be renovated, especially on the ground floor, with circulation and amenities facing the lake. The program for these buildings is based on NIH needs and priorities today, but the physical organization remains valid if there are shifts in the program functions or the timing of planned elements.

Key features of the Campus Center Master Plan framework include the following:

- Entry to the building complex is established in an open space framed by new buildings on three sides, partially open to views of the lake, and facing south to the sun. This would be the primary entrance for staff and visitors, and include an automobile drop-off to the main building entries and short-term visitor parking.
- Lakeview Drive is removed from the Campus Center to create a new pedestrian environment and to become a key organizing feature for the stormwater management plan. Removal of this road allows for easier pedestrian circulation and reduces the security concern of vehicles within the center of the campus. The existing utility corridor runs parallel with Lakeview Drive, and it should remain in place when the road is removed.
- Building 101 is opened up to the lake view, with a windowed one-story addition that organizes the circulation and provides natural light to meeting areas and shared employee functions. Outdoor events can occur on an adjacent lawn.
- The campus is organized around outdoor quadrangles that blend the natural site with designed spaces.

- The plan calls for three blocks of new buildings to the west of Building 101. These buildings would be lower in height than Building 101, breaking up its large-scale, institutional character. The building locations are organized for efficient service and circulation, and for optimal solar orientation to utilize natural lighting for employee comfort and energy conservation. The long building dimensions face north and south, which are the easiest orientations to utilize when bringing in daylight. Their lower height and orientation minimize the blockage of light and views to Building 101.Natural light also would enter the landscape courtyards because of the low building heights.
- Another visitor entrance at the north end of the central campus is introduced in a later phase of the Master Plan. As buildings are added, it would provide balanced employee access from parking and better opportunities for facilities flexibility.
- Parking structures replace most of the surface parking as the campus grows; minimizing the impervious site area and keeping employee parking convenient to the campus buildings.

Exhibit 1.2 Campus Center

A, B, C, D, E, F, NMR: Existing Building 101 complex

(Note: Phase 1 buildings indicated as darker red)

1. Office building
2. Animal facility expansion
3. New main entry, lobby and elevator
4. Conf. facilities w/ fitness center below
5. Loading court
6. New entrance plaza/campus outdoor
7. New drop-off / visitor parking
8. Research Building 1 (Labs)
9. Research Building 2 (Labs)
10. Employee amenity space/ food serv.
11. Bldg. 101 ground FL. improvements
12. Visitor's center / Entry
13. Research Clinic
14. Ex. surface parking modified
15. New road link
16. Covered walkway
17. Phase 1 parking structure
18. Phase 2&3 parking structure
19. Storm water collection / rain garden
20. New north auto drop-off phase 3
21. New north access road
22. Parking expansion if higher growth
23. Lakefront landscape enhancements
24. Science quad

1.3 Building 101 Improvements

Building 101 continues to be an important campus component, housing a significant portion of the scientific research space, even at full Master Plan build-out. Improvements to the complex fall into two categories: 1) functional improvements to the pedestrian and service circulation, and the location / amount of employee amenities and shared services; and 2) physical improvements to address aging systems, energy efficiency, emergency power capacity and fire safety upgrades.

1.4 Landscape and Open Space

The campus is blessed with beautiful rolling natural terrain beneath a dense woodland canopy of native evergreen and deciduous vegetation, with streams, open areas and lake views. The natural resources and outdoor opportunities are important to NIH and serve as the core of the landscape plan. The compact nature of the Master Plan preserves the natural landscape, creates civic open spaces and frames natural settings. Key landscape components include:

- Preservation of the natural landscape and its integration into the heart of the campus at the two new science quadrangles between the new research and office buildings. These quadrangles would retain existing trees and blend the natural landscape into the more structured, passive recreation and sitting areas.
- A new "Eco-commons" in the area currently occupied by Lakeview Drive, between Building 101 and the surface parking lot, would help in stormwater management and reduce the amount of mowed lawns. The Eco-commons would replace the loop road with a more naturalized landscape and vegetated swales, while retaining accessibility to the utilities currently located in this area. Additional bioretention areas would be located near the lake.
- Lakefront landscape enhancements would create a more natural lake edge, with riparian and water's edge plantings. A lawn area would be created lakeside, and a recreational area introduced east of E and F Modules, for basketball, volleyball, or other activities.
- An entry plaza on the south end of campus welcomes visitors to NIH. It provides short-term and handicapped accessible parking, and is the principal open space through which NIH employees pass on a daily basis. The plaza orientation keeps building entrances and outdoor gathering areas south facing and in the sun. Existing trees are located in a sloped area west of Module A, which would frame the south and east sides of the entry space. As the Master Plan matures, a landscaped entrance area would be introduced at the north end.
- Sustainability is a focus for landscape, as well as for buildings. Recommendations include minimizing mowed and maintenance-intensive areas; introducing native plants; using collected rainwater for limited irrigation; optimizing stormwater management; and using permeable paving and recycled site materials.

1.5 Utility Framework

A Central Utility Plant (CUP) serves both NIH and EPA, with the following systems: chilled water (CHW), high temperature hot water (HTHW), electric power, potable water, fire suppression water, sanitary sewer, and storm sewer. NIH has commissioned a separate Master Utilities Plan (MUP), which includes a comprehensive evaluation of the existing systems and planning for future capacity and central requirements. The MUP development process has been running parallel with this Master Plan and the team has supplied program information to the MUP team for inclusion in their evaluation.

Specific to the campus building development, this Master Plan outlines future utility loads, load phasing, and the location of the site utility connections to the new NIH facilities. It finds that the projected NIH growth will not require any physical expansion to the CUP buildings and the current distribution capacity for CHW and HTHW is also adequate to absorb future programmatic increases. However, the CHW plant equipment, the

HTHW generation capacity, and the electrical distribution system will need a phased upgrade and or replacement in the next 20 years. Additionally, for increased reliability and redundancy of these critical systems, the Plan recommends the completion of the originally planned campus-wide CHW and HTHW loop, which now services NIH and EPA separately.

1.6 Circulation and Parking

The circulation plan maintains most existing roadways, and phases in modifications to create two types of roads – a more formal entry parkway and less formal employee and service roadways. Lakeview Drive/North Loop Road are rerouted as the campus grows and removed from the heart of the campus. Parking structures, accommodating 1,400 spaces, are built in phased construction on the existing main surface lot, minimizing site disruption and the amount of new impervious coverage. Campus trails and bicycle paths are fully integrated with the landscape and development plans.

There are three active gates to the combined NIH-RTP and EPA campus, with two access entries from T.W. Alexander Drive to the west, and one access entry from Hopson Road to the south. An additional access point on Hopson Road is planned and is expected to serve a significant portion of site traffic.

A new visitor screening center is planned for the main entrance drive at T.W. Alexander Drive. The Plan is responsive to the campus security measures being reviewed and coordinated by NIH. Possible vehicle control points are indicated. Roadways are shown with 100' setbacks from the buildings, and the plan calls for the phased removal of parking adjacent to buildings. An important consideration in the plan is the ability for visitors to attend conferences and campus meetings without having to surmount overly burdensome security requirements.

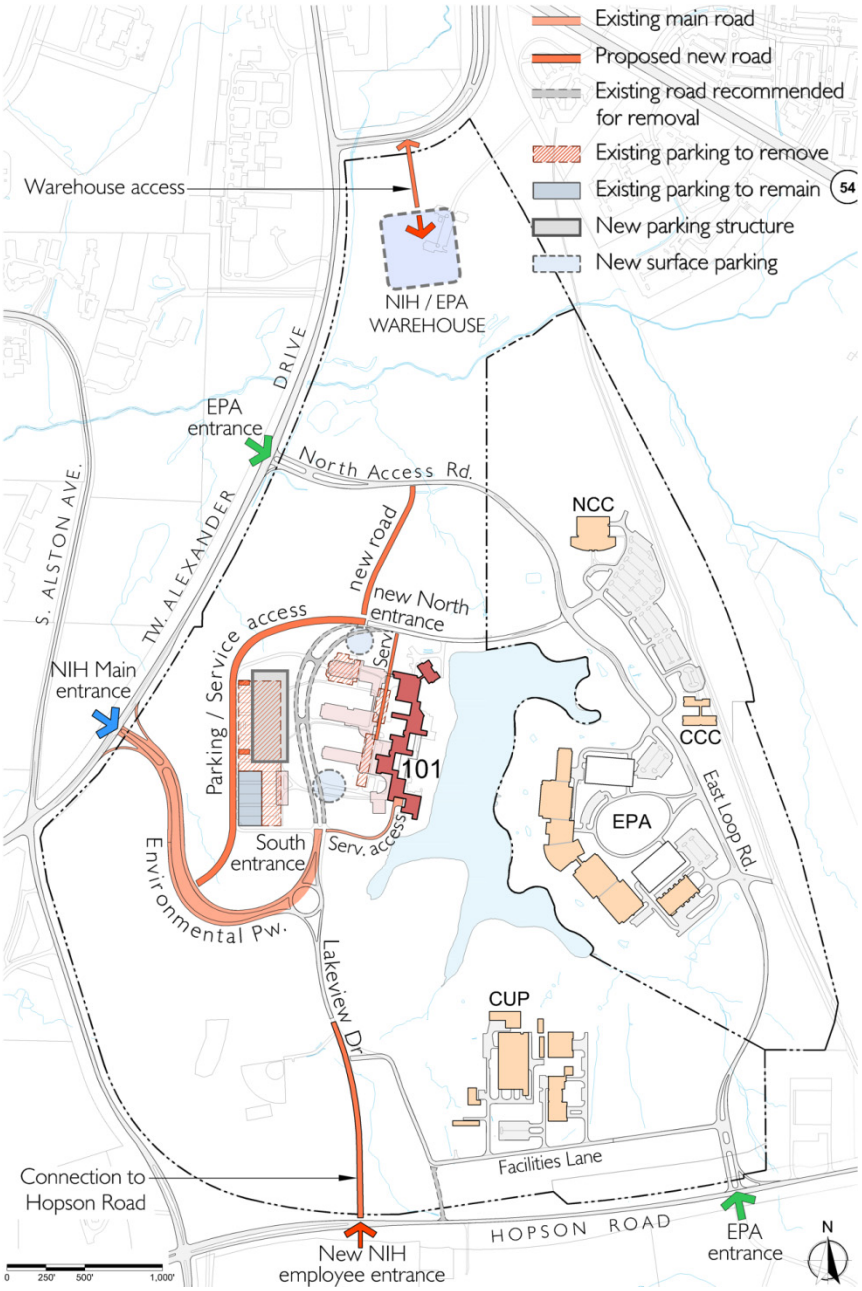


Exhibit 1.3: Planned Changes to Circulation and Parking

1.7 MASTER PLAN IMPLEMENTATION

The Master Plan is a look into the future - a structured approach to building and renovation to meet anticipated needs. Twenty years is the timeframe for this NIH-RTP Master Plan, and the changes have been prioritized and structured into three development phases.

As with any institution, NIH-RTP's program growth and construction are dependent on many factors – e.g. funding, direction of scientific research, NIH mission and agency-wide priorities. The Master Plan needs to be thought of as a living document, setting a framework that remains flexible and sensitive to the timing and composition of specific projects. Furthermore, the Master Plan guides future development; it does not represent the pre-approval of any individual facilities project nor the particular needs of specific programs to be accommodated on the campus. The financing of such projects and programs must be addressed within the annual HHS budget processes and the HHS Capital Investment Review Board mechanisms.

The Master Plan is designed to accept gradual changes and to appear "complete" at the end of each phase or significant addition.

- Phase 1 includes space and functional needs prioritized by NIH, and establishes the core elements of the Campus Center concept. Phase 1 concentrates budget spending on immediate needs, a new entrance and related circulation improvements, and defers major circulation and other site improvements until later phases. A new office building frames the entry plaza and integrates NIH-RTP personnel housed in leased space back onto campus. Core elements included in Phase 1 are vivarium expansion, visitor screening center, conference center and other employee amenities. The first module of structured parking is added to support the returning office occupants. A warehouse to be shared with EPA is included in this phase, to replace the leased space. An additional campus entrance at Hopson Road is added in anticipation of the changes in traffic resulting from the new Triangle Parkway.
- Phase 2 accommodates both space shortfalls and ten-year growth in research facilities, office space and related support, with a new research building. It extends Building 101's functional and circulation improvements with a lakeside addition and ground floor renovation. A permanent clinical research building replaces the modular one, and completes the enclosure of the Campus Center entry plaza. The second module of the parking structure is introduced, along with a partial realignment of the North Loop Road. Landscape changes are introduced, and the stormwater management plan extends to additional areas of the campus.
- Phase 3 includes additional research building(s) to house growth in personnel and programs. Vivarium expansion is planned with the research building. More parking is constructed, and the existing loop road is completely removed from the center of the campus. With the new buildings, a north lobby and entrance plaza are constructed, Landscape improvements include a realized stormwater management plan, recreation space and completion of the naturalized landscape plan.

EXHIBIT 1.4: SUMMARY OF FACILITY IMPLEMENTATION

Phase 1	Phase 2	Phase 3
5 to 10 Years	10 to 15 years	20 Years
Buildings		
Campus Center New entry lobby/circulation Conference Facilities/Fitness Employee Amenities (interim 101)	Lakeside Addition/ 101 renovation	Amenity/Food Service Expansion with Research Building 2
Animal Facility (Vivarium) Expansion	Research Building 1 Lab Growth, Shortfall / ancillary Office growth/shortfall & support New Clinical Research Building [1] Remove Modular Clinic	Research Building 2 Lab Growth,/ ancillary Office growth & support Animal Facility (Vivarium) Expansion
New Office Building [3] replaces leased facility temporary quarters for shortfall		
Structured Parking	Structured Parking	Structured Parking
Visitor Center	--	
Warehouse (with EPA)	--	--
Bldg. 101 general improvements	Bldg. 101 general improvements	Bldg. 101 general improvements
Landscape, Site & Utilities		
New Pedestrian Drop-off at 101 Add vehicular entrance at Hopson Rd.	Partial North Loop Road Re-alignment Pedestrian Bridge to EPA	Final North Loop Road Re-alignment New North Entrance/Drop-off
Replace visitor/ADA parking	Modify surface parking	Modify surface parking
Main Entrance plaza & plantings	Landscaped Service Quad Lakefront Landscape /terraced lawn	Landscaped Science Quad Sports area by the lake Site-wide sustainable landscape
Stormwater bioretention	Stormwater bioretention	Vegetated swale and bioretention
Chilled/hot water mains extended New piping for buildings	Chilled/hot water mains extended New piping for buildings	New piping for buildings
Replace CHW and HTHW equipment and upgrade electrical as per MUP recommendations[2]	Replace CHW and HTHW equipment and upgrade electrical as per MUP recommendations[2]	Replace CHW and HTHW equipment and upgrade electrical as per MUP recommendations[2]
Electrical transformers/switchgear	Electrical transformers/switchgear	
--	--	Potable water main relocated
Sanitary sewer—new north/south sewer	Extend sewer	Extend sewer
Master Utility Plan (MUP) upgrade[2]	Master Utility Plan (MUP) upgrade[2]	

[1] A permanent clinical research center is planned for Phase 2, replacing the modular clinic

[2] The Master Utility Plan (MUP) for the NIH-RTP campus has been prepared and submitted separately by Sud Associates. Upgrades to the mechanical/electrical equipment in the Central Utility Plant (CUP) would be an outcome of that study.

[3] Early Action Item. This Master Plan plans for the office currently in leased space to return to campus when the lease is ended (2018). This goal requires that planning begin immediately.

1.8 MASTER PLAN SPACE SUMMARY

A program of projected space needs was developed with NIH/NIEHS participation, analysis of current space use and NIH guidelines. The base program for Offices, Research and Support spaces was in the order of 527,000 gross square feet. Realization of this space program would require phased construction of new facilities over a 20-year period. To provide the projected space, the actual square footage of construction is larger due additional space that would be needed to integrate the new buildings with the Building 101 complex and link the circulation and services. In addition to the space for circulation the Master Plan also provides for structured parking.

Exhibit 1.5 provides a comparison of existing space to the 20 year projected growth by types of space, the extent of space release and construction, and Exhibit 1.6 gives a cumulative build out at the end of each phase.

EXHIBIT 1.5: SPACE PROGRAM AND BUILD-OUT SUMMARY

	PROGRAM			IMPLEMENTATION		CAMPUS SPACE in 20 years
	Existing GSF	Master Plan GSF	Program Difference	Release[1] RSF[3]	Construct[2] GSF	
Office, Research, and Support						
Office/Support (incl. CUP Office)	191,000	274,200	83,200	-73,500	156,700	274,200
Lab & Cores	616,200	872,400	256,200	0	256,200	872,400
Vivarium	115,300	195,300	80,000	0	80,000	195,300
Clinical Research	14,100	50,000	35,900	-14,100	50,000	50,000
Amenities/Other	32,300	85,300	53,000	0	53,000	85,300
Warehouse	24,200	25,000	800	-24,200	25,000 [4]	25,000
CUP (Support only)	155,900	155,900	0	0	0	155,900
Sub-Total	1,149,000	1,658,100	509,100	-111,800	620,900	1,658,100
Additional Program						
Integration/links	0	55,000	55,000	0	55,000 [5]	55,000
Parking Structures	0	490,000	490,000	0	490,000	490,000
Sub-Total	0	545,000	545,000	0	545,000	545,000
TOTAL	1,149,000	2,203,100	1,054,100	-111,800	1,165,900	2,203,100

Notes:

[1] Release = Leased space to be given up, plus temporary facility to be removed (Clinical Research)
[2] Construct = Program facilities to be built plus estimated space to integrate and link the new buildings to existing
[3] RSF = Rentable square feet
[4] Shared warehouse with EPA at total 68,000 GSF
[5] Additional allowance for integration (links / circulation) of buildings within the campus.

EXHIBIT 1.6: SPACE SUMMARY – CUMULATIVE TOTALS BY PHASE

	Existing GSF	Phase 1 GSF	Phase 2 GSF	Phase 3 GSF	Total GSF	Notes
		Cumulative Total	Cumulative Total	Cumulative Total	End of Phase 3	
On-campus						Office growth built with
Office – in 101	78,600	78,600	78,600	78,600	78,600	Research Buildings
Office – in 102-108	17,300	17,300	17,300	19,400	19,400	
Office – New ,w/amenities	-	99,600	99,600	99,600	99,600	w/ extramural council rm
Lab & Cores – in 101	616,200	616,200	616,200	616,200	616,200	
Vivarium	115,300	155,300	155,300	195,300	195,300	
Research Buildings – New	-	-	144,400	313,700	313,700	labs, office growth, support, amenities
Support – General, in 101	21,600	31,500	31,500	31,500	31,500	see research buildings
Common Amenities in 101	32,300	72,900	72,900	72,900	72,900	see research buildings
Support - 102-108	155,900	155,900	155,900	155,900	155,900	
Clinical Res. - Modular	14,100	14,100	removed	-	-	Perm replaces modular
Clinical Res. – Perm.	-	-	50,000	50,000	50,000	
Warehouse - new	-	25,000	25,000	25,000	25,000	
Office, Research and Support - Subtotal	**1,051,300**	**1,266,400**	**1,446,700**	**1,658,100**	**1,658,100**	
Other Master Plan Space						
Design Integration	-	15,000	25,000	35,000	35,000	
Pedestrian Link in 101	-	-	20,000	20,000	20,000	
Parking Structure – New	-	150,500	273,000	490,000	490,000	
On-Campus – Total	**1,051,300**	**1,431,900**	**1,764,700**	**2,203,100**	**2,203,100**	
Off-campus (leased)						
Office + common sup.	73,500	released	-	-	-	New replaces leased
Warehouse	24,200	released	-	-	-	New replaces leased
subtotal	97,700	-	-	-	-	
Master Plan Program – Total	**1,149,000**	**1,431,900**	**1,764,700**	**2,203,100**	**2,203,100**	

Construction Summary

	Phase 1 GSF	Phase 2 GSF	Phase 3 GSF	These numbers are not cumulative
Total Construction	380,600	346,900	438,400	1,165,900 total
Total Released / Removed	97,700	14,100	0	111,800

All numbers are rounded

2.

BACKGROUND

2. BACKGROUND

2.1 INTRODUCTION

The National Institutes of Health (NIH), an agency of the United States Department of Health and Human Services (HHS), is the primary government agency responsible for conducting and supporting bio-medical and health research within the United States and around the world. Approximately 80% of its $28 billion annual appropriation is awarded as competitive grants to various colleges, universities, and researchers. The remaining funds are utilized to staff over 35,000 employees in several of its campuses and to support research within its facilities.

Its scientists conduct basic, bio-medical and clinical research in particular diseases and subject areas in support of specific Institute missions. These Institutes utilize and operate specialized research and clinical laboratories, animal facilities, training facilities and advanced medical imaging centers. The NIH has six campuses on 1,346 acres with an inventory of 281 buildings containing about 15.7 million square feet of owned space. Approximately 10.5 million square feet of this space, or 67%, comprises the research facilities, while the remainder is utilized for administrative and infrastructure functions. The leased space of about 3.8 million square feet is over and above the statistics cited.

The National Institute of Environmental Health Sciences (NIEHS), one of the 27 Institutes and Centers that comprises the NIH, is the primary occupant of the NIH Campus at Research Triangle Park (RTP), North Carolina. Its Division of Intramural Research (DIR) conducts research on environmentally associated diseases and intervention and prevention studies to reduce effects of exposures to hazardous environments. Recently NIEHS has embarked on strengthening its translational and clinical research programs. Its Strategic Plan calls for a model that focuses on team research and availability of high technology facilities to train the next generation of environmental health scientists.

In addition to DIR, the Division of Extramural Research and Training (DERT) is responsible for funding and monitoring a substantial portfolio of NIEHS research funds provided to various universities and organizations to conduct research in disciplines related to environmental health sciences.

2.2 Authorization and Applicability

The NIH-RTP Draft Master Plan has been prepared in accordance with HHS Facilities Program Manual (Volume 1), Section 3.1 Facility Master Planning and Section 3.2 Environmental Impact Analysis Procedures. The Environmental Assessment (EA) document has been separately submitted.

2.3 NIEHS Mission, NIH Organizations and Employee Census at RTP

NIEHS is the primary Institute located in Research Triangle Park (RTP), North Carolina. It is supported by several NIH Headquarters (NIH-HQ) components under the aegis of Office of Director (HQ-OD) that report to Bethesda, Maryland.

A. Mission Statement - NIEHS

The mission of the NIEHS *is to reduce the burden of human illness and disability, by understanding how the environment influences the development and progression of human disease. To have the greatest impact on preventing disease and improving human health, the* NIEHS *focuses on enhancing the understanding of environmental triggers of chronic diseases, developing prevention and intervention strategies to reduce adverse health effects of hazardous exposures, and providing information to decision makers to reduce uncertainty associated with risk.*

B. Organizational Structure of NIH Components at RTP

The NIEHS is currently organized in six units called Offices and Divisions. These are further divided into sub-units called Programs, Laboratories, and Branches. The Office of the Director (OD), provides leadership, coordinates initiatives, and oversees the scientific research, administration, and communications for the NIEHS and National Toxicology Program (NTP). It is supported by the Office of Deputy Director (ODD), the Office of Management (OM), the Division of Intramural Research (DIR), and the Division of Extramural Research and Training (DERT).

In addition to the NIEHS, there are components of HQ-OD organizations that provide support to the Institute in Extramural Activities, Human Resources, Equal Opportunity, and Facility Operations. These consist of the Division of Extramural Activities Support of Office of Extramural Research(OER-DEAS); Division of Extramural Information Systems (OER-DEIS); Office of Human Resources of Office of Management(OM-OHR), Office of Equal Opportunity and Diversity Management (OEODM), and Office of Director – NIEHS Liaison as well as Division of Property Management (DPM) of Office of Research Facilities (ORF).

C. NIH-RTP Census 2007

NIEHS: In 2007 the NIEHS had about 1500 personnel including researchers, fellowship appointments, federal employees, contractors, funded vacancies and volunteers located in on-campus and off-campus facilities. About 1190 employees or 80% of the 2007 census was assigned to DIR, approximately 90 employees or 6% represented DERT and OTR, and the remaining 220 employees were distributed amongst OD and OM.

HQ-OD: The NIEHS staffing was augmented with personnel associated with HQ-OD components. It appears that around 2003, during a major NIH reorganization, reporting responsibility of a few NIEHS functions was transferred to HQ-OD in Bethesda MD. HQ-OD had about 60 employees with an additional 180 operations support contractors in RTP.

The total employee population in 2007 at RTP, both on and off campus, was 1,740.

EXHIBIT 2.1: CURRENT ORGANIZATIONAL STRUCTURE - NIEHS

EXHIBIT 2.2: HQ-OD COMPONENTS AT RTP

2.4 History of the NIH-RTP Campus Development

The National Institutes of Health (NIH) maintains a campus of 377 acres within the Research Triangle Park (RTP), Durham County – called the National Institute of Environmental Health Sciences (NIEHS) – one of the 27 Institutes and Centers that comprise NIH.

NIEHS carries out pioneering research to identify and evaluate the effects of environmental factors on human health. It has been an integral part of NIH since its inception in 1966. It is the principal federal agency conducting biomedical research on the effects of potentially toxic elements in the environment on human health.

In 1967, the United States Surgeon General (USG) acquired a 509-acre site located in RTP (a 7,000 acre tract), Durham County, North Carolina, for the establishment of the National Environmental Health Research Center (NEHRC). The 509-acre site was, until 1974, called the United States Public Health Service (USPHS) Research Park. It was deeded to the USG in 1967 as the permanent home for the Division of Environmental Health Sciences, which was elevated to the status of an Institute in January 1969 and then became known as the National Institute of Environmental Health Sciences or NIEHS.

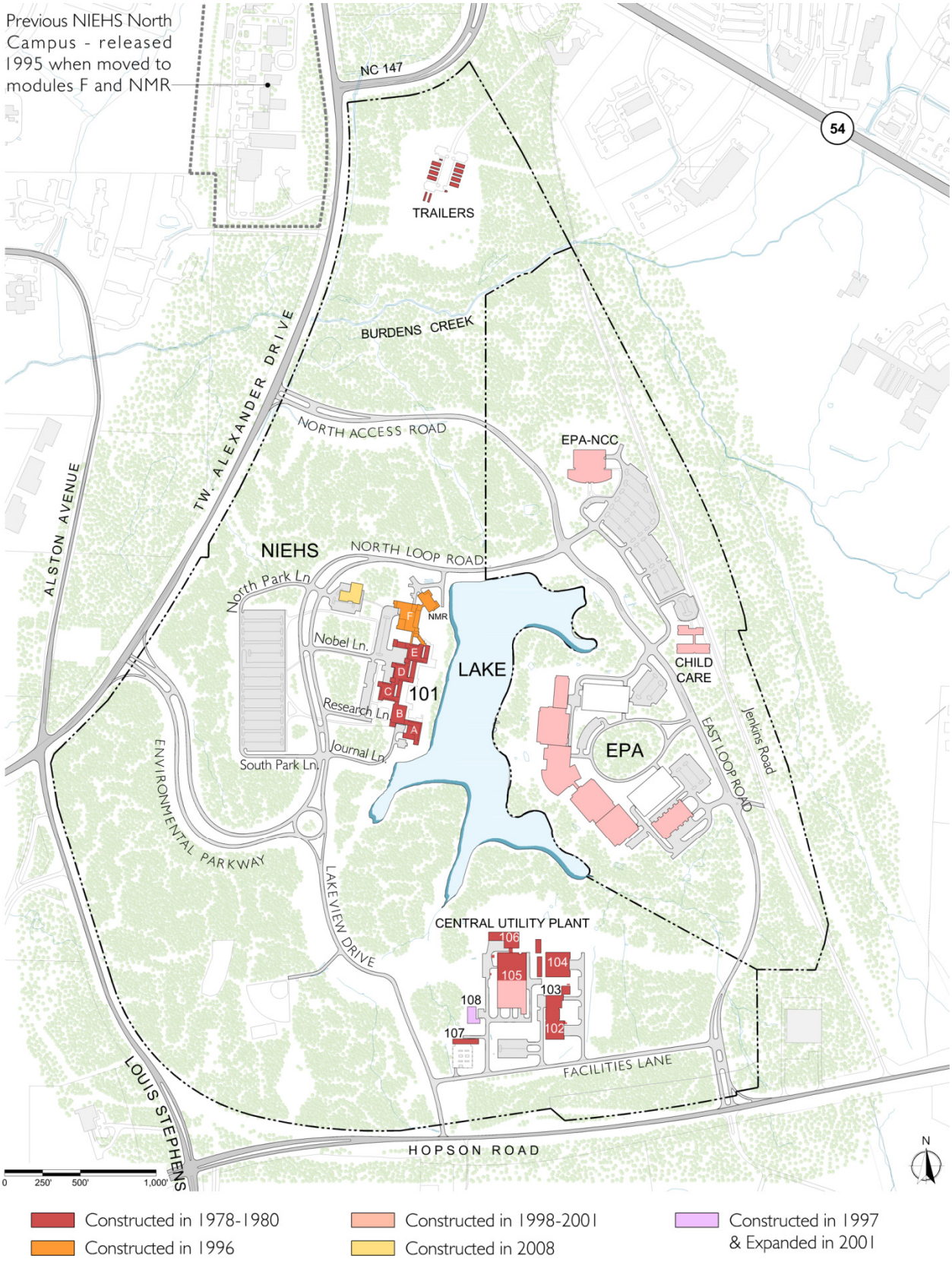
A master plan for the entire 509-acre site was developed in 1971, followed by an Environmental Impact Statement, which was completed in 1976. The original master plan envisioned four Research Centers, a Community Center and a Support Services area – organized around a 28-acre lake and connected by a loop road. Two of the four Research Centers were identified for initial occupancy and included the then National Environmental Health Sciences Center (NEHSC) which later became the NIEHS and the Air Pollution Control Office (ACPO) of the Environmental Protection Agency (EPA). The development framework for the addition of the two remaining Research Centers was identified so that the "USPHS Research Park" could grow in a continuous and orderly manner.

Construction of the primary NIEHS building, the David Rall Building (also called Building 101), began in 1976-77 along with the support buildings of the Central Utility Plant. The original campus consisted of 625,000 gross square feet (gsf) of laboratory, vivarium, and office space and 160,000 gsf of utility and infrastructure support structures. These facilities were completed in 1980.

In addition to the Government-owned facilities on the RTP campus, the NIH continued to lease additional laboratory space north of the campus until the mid-1990's. A 234,000 gsf laboratory addition to the Building 101 and a Nuclear Magnetic Resonance (NMR) unit (also referred to as Magnetic Resonance Imaging (MRI)), were completed in 1996, after which NIH consolidated all of its RTP area research facilities on campus. The character of the core NIH campus has remained unchanged since then. Building 108, as waste handling facility, was constructed in 1997-98 and then expanded in 2001 for EPA. In 2008, a modular clinic of 14,145 gross square feet was constructed.

Over time the original site of 509 acres has expanded to 515 acres due to minor adjustments to the campus boundaries as negotiated with the Research Triangle Foundation (RTF). EPA now occupies 138 acres to the north and east of the lake, while the remaining 377 acres belong to NIH.

EXHIBIT 2.3: RTP SITE DEVELOPMENT



2.5 Original NIH-RTP Master Plan – 1971

The 1971 Master Plan identified a series of buildable areas within the site, based on an analysis of slope, soils, and setbacks required by zoning, and called for a lake to become the central focal area between these buildable areas.

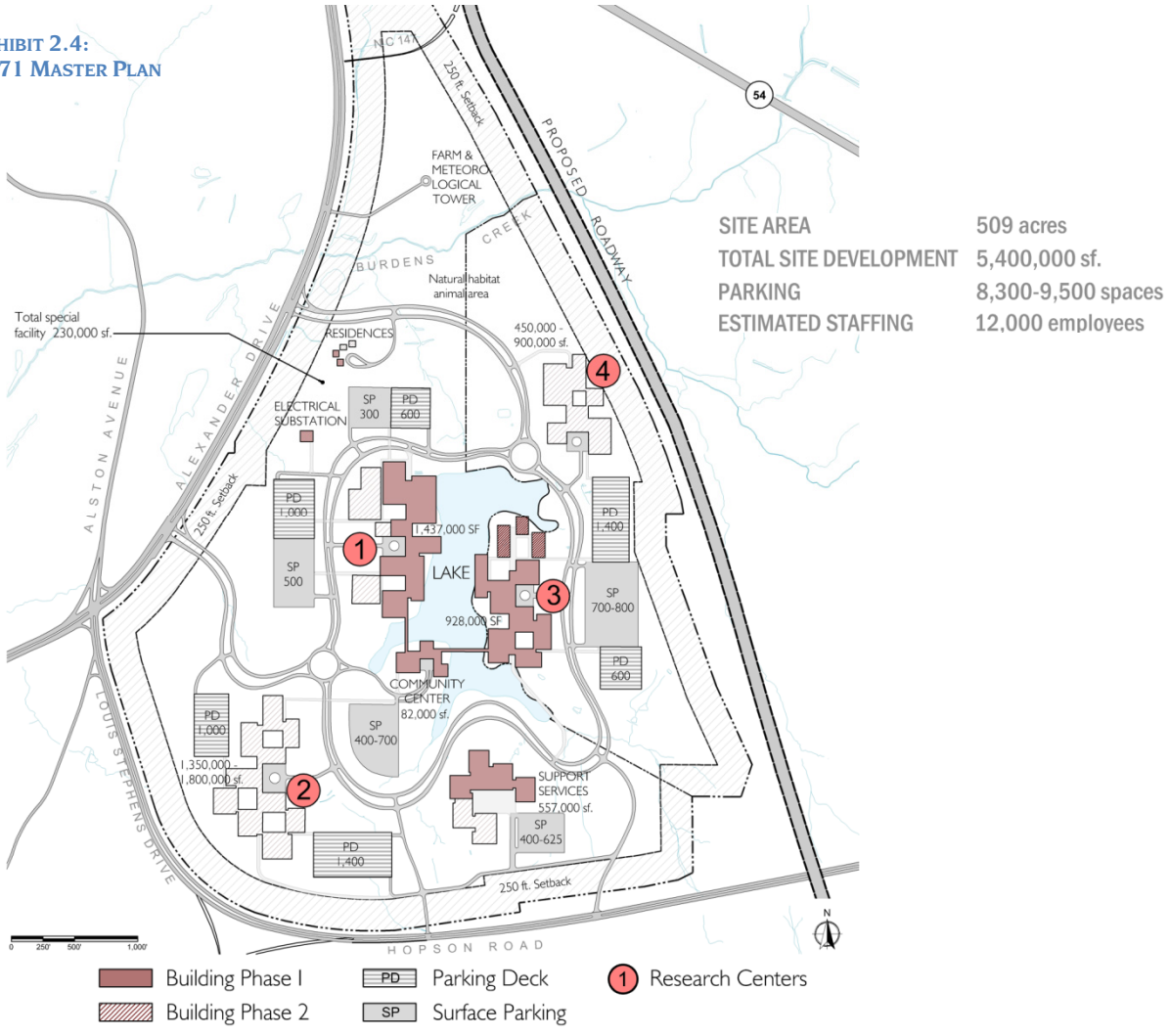
The design concept followed a concentric pattern around the lake, with two research centers and a community center all grouped on the edges of the lake. This inner ring of development was surrounded by a roadway loop. Two additional research centers, support services and parking were to be located outside the loop. A buffer zone or setback was planned along the periphery of the site.

The four research centers were to have individual identities, yet share a common image by being connected by the focal point of the lake. The lake was justified as an aesthetic focal element, a stormwater management system, a source of irrigation water, and an emergency source of water for fire protection.

The 1971 Master Plan included provisions for phasing the development of the research centers while the planned parking decks could be constructed over the initial surface parking as expansion took place.

For the entire site, the 1971 Master Plan and 1976 EIS called for a total of approximately 5.4 million gross square feet of construction, and parking for 8,300 to 9,500 cars. This build out was to be located in four individual research centers, the community center, and the support services area.

Exhibit 2.4:
1971 Master Plan



2.6 Current Built Environment

Much of the 1971 Plan was constructed as planned, especially the buildings, parking and roads on the western (NIH) side of the lake. However, the site today does not achieve the degree of community and shared integration that was part of the original design concept. A shared community center planned for the lakefront was not built, nor were the bridges linking it to NIH and EPA. Two of the four research centers planned for the site have been built, and the original site for the third center has been used for EPA's National Computer Center.

The continuous loop road was not realized as designed; site connectivity is achieved via a utility road that runs past the Central Utility Plant (CUP). The 1971 plan called for a utilities loop that followed the road around the lake, but currently there are two separate utility legs individually serving NIH and EPA.

The NIH campus consists of two distinct clusters - Building 101, which is located west of the lake; and the CUP located south of the lake. Building 101 which consists of two administrative modules (A and B) and four laboratory modules (C, D, E, and F), and a Nuclear Magnetic Resonance (NMR) unit have a total of 863,917 gross square feet. The vivarium, located in the basement of Modules C, D, and E, has retained its original size without any expansion, even though the laboratory space was increased with the addition of module F and the NMR unit. The CUP consists of 7 buildings numbered 102 through 108 – Offices and Support, Chemical Storage, Warehouse and Information Technology, Utility Plant, Incinerator, Electrical Switchgear and Waste Handling. The total built space on campus is approximately 1,051,000 gross square feet. The area for trailers is not included in this number.

Between 1998 and 2001 the Environmental Protection Agency built its main Administrative/ Laboratory building and its National Computer Center on the sites originally identified as Centers 3 and 4. In addition, a third building, the Child Care Center was also constructed on EPA's site as a shared facility for the two agencies. The total development on the EPA site is about 1.2 million gsf.

The current construction on both the campuses is about 40% of the 1971 master plan development capacity and about 29% of the parking capacity. Today, the site has a total of about 2.24 million gross square feet of development, 2,814 parking spaces in structured and surface parking lots, and approximately 3,700 employees. (NIH has reduced its parking inventory by 16 spaces at the modular clinic.)

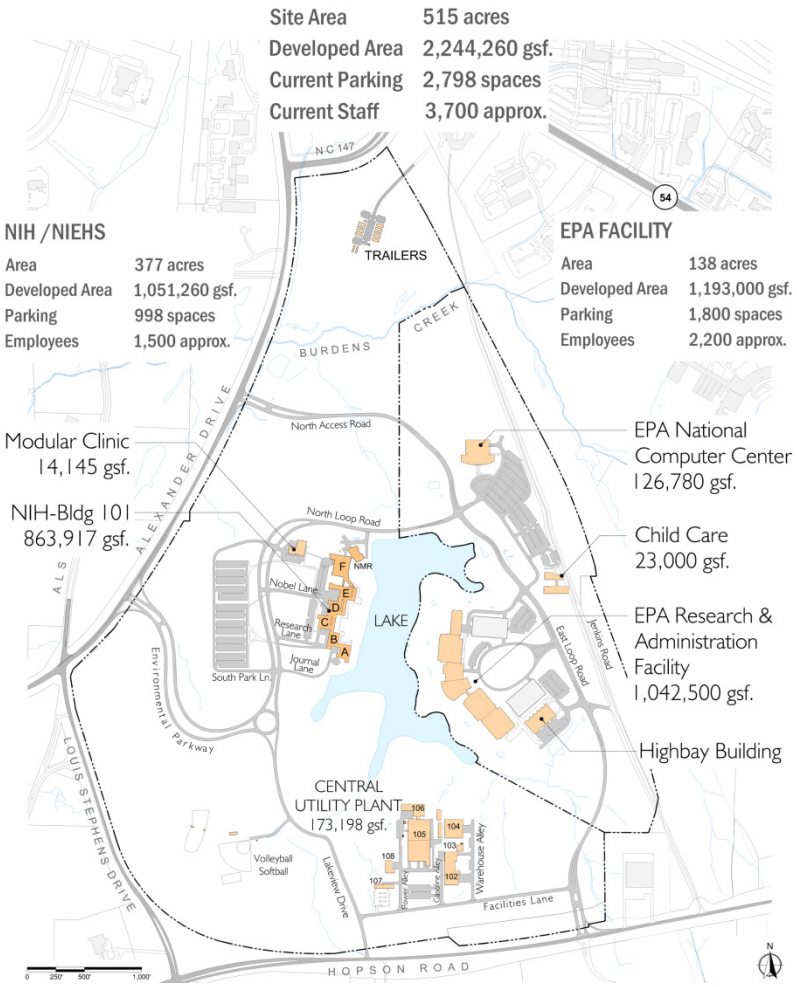


Exhibit 2.5: Current Development

2.7 Landscape Master Plan, 2001

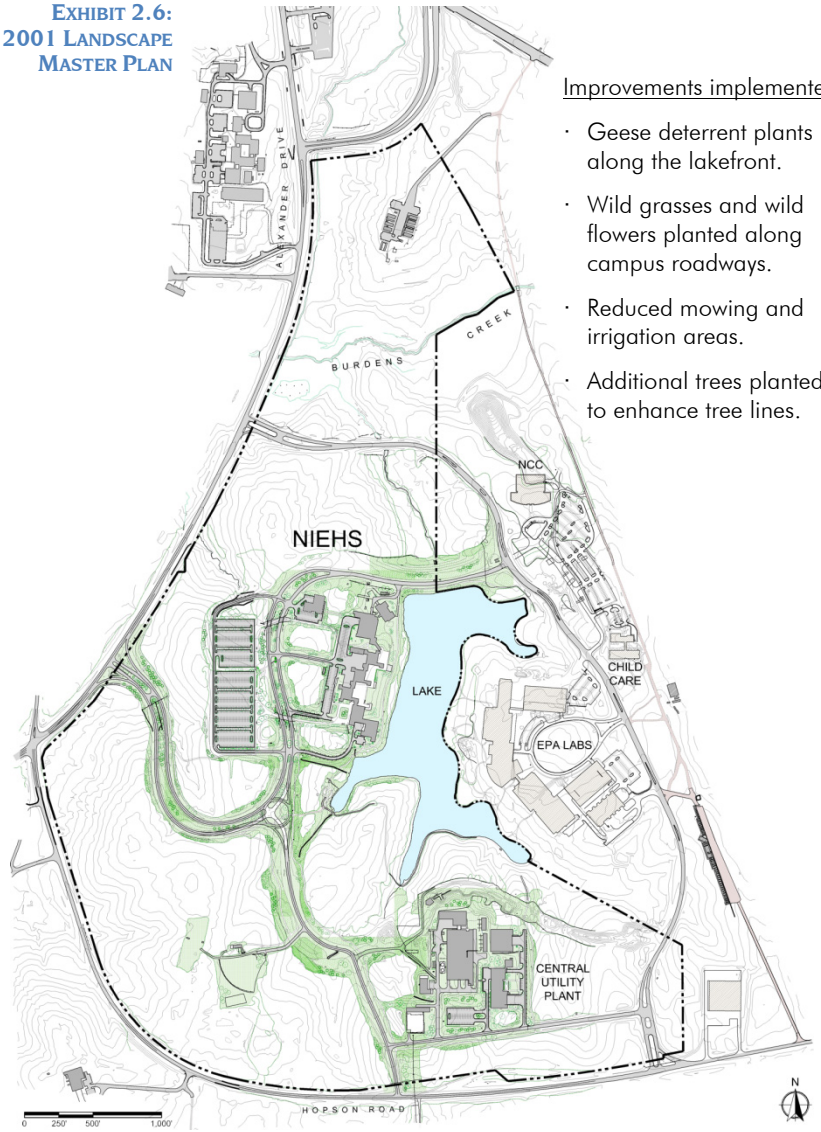
In 2001 NIH-RTP developed a campus Landscape Master Plan that recommended additions or improvements to several of the significant landscape features found on site, including the main campus entrance at Alexander Drive, the pedestrian tunnels, the softball field area, the trail system, and the lakefront by Building 101.

The conceptual framework of the plan divided the site into zones that are distinct in landscape type or habitat, plant material, and type and degree of maintenance required. The Landscape Master Plan recommended native ground cover throughout the site, primarily with a goal to reduce maintenance obligations and improve plant and animal habitat. Targeted landscaped areas were suggested along with "edge treatments" that help transition with existing wooded area.

The plan recommended new plantings along the main NIH entrance from T.W. Alexander Drive, creating a doorway with evergreen masses, mowed areas and a prominent sign. Realignment of the pedestrian walks and enhanced landscaping on the area adjoining walks were suggested for directing the pedestrian movement. The plan called for improvements to the landscape between Building 101 and the lakefront, with potentially re-grading of this area, increasing shade, and enhancing the views. It also suggests new tree and shrub plantings in the open area between the lake and Modules A, B, C, D, and E, and suggested a serpentine path connecting the terrace with the lakefront with a pergola, a seating area and a boardwalk at the water's edge. Enhanced landscaping was recommended for the traffic circle on Environmental Parkway as well as the memorial garden. The plan suggested the effective removal of vegetation from the ball field area, to provide greater exposure, and addition of new seating steps and shaded areas. Plantings to screen the parking lots and transformers along with the potential for a landscape terrace were identified for the CUP area. Some enhancements to the NIH entry from Hopson Road were also identified.

The Landscape Master Plan did not provide a specific implementation program for the suggested improvements; instead, it suggested pairing them with other construction projects, allowing flexibility to suit NIH's need and funding. Selected landscape improvements were implemented.

Exhibit 2.6: 2001 Landscape Master Plan



Improvements implemented:

- Geese deterrent plants along the lakefront.
- Wild grasses and wild flowers planted along campus roadways.
- Reduced mowing and irrigation areas.
- Additional trees planted to enhance tree lines.

2.8 NEED FOR A NEW MASTER PLAN

The existing Master Plan for the NIH campus in Research Triangle Park, North Carolina was developed in 1971 and has not been updated or revised for the last three decades. The Department of Health and Human Services (HHS) requires that all its constituent campuses have an updated master plan containing near and long term recommendations on the use and development of the site. HHS also requires that these plans be updated on a regular basis. The Master Plan is expected to identify new requirements, facility deficiencies, and development needs over time on NIH's campuses to support the mission and research and development functions of NIH and its Institutes. It also serves as a tool to prioritize projects and judiciously allocate limited capital funds for new construction, repairs and modernization.

The master plans for NIH sites establish a framework for long-range planning, development and utilization of NIH resources. These master plans - which are ever-changing - are required to be updated every five years to reflect new priorities or altered mission/ circumstances and are used to project funding needs in the out years and accomplish the goals established in NIEHS' Strategic Plan. Besides, the need for a Master Plan has also become critical for the following reasons:

- The NIEHS has experienced a steady increase in its staffing since 1996 without any commensurate facilities expansion. The utilization rate in its laboratories and offices on campus is high and its facilities are congested.
- Several spaces originally designed for meeting rooms and amenities within the laboratories are now being used for research. This has resulted in reduction of amenity spaces to a bare minimum.
- The size and operations of the animal facilities has remained static since the original construction in 1980, even after research laboratories were expanded in 1996. The space shortage is critical and NIEHS has requested expansion of its animal space inventory.
- As part of its Strategic Plan, NIEHS is focusing on Clinical Research in Environmental Health Sciences. A modular outpatient modular clinic of 14,145 gross sq ft has been constructed. A permanent in-patient Clinical facility is planned to replace it on campus as the program is more established.
- Construction of the Triangle Parkway was initiated with its commissioning expected towards the end of 2011. It was anticipated that it would impact/alter the commuting patterns of about 60% of NIH employees, requiring examination of an alternative entrance to the site.
- In spite of owning a large campus at RTP, NIH continues to lease office and warehouse space off-campus. Consolidation of its fragmented organizations on campus, together with improvement of its operations, are NIH priorities.
- The NIH campus is in the process of implementing several security improvements, and considering the construction of a Visitors' Center, securing the Central Utility Plant (CUP) and installation of barriers.

In October, 2006, Metropolitan Architects & Planners, Inc. and Gruzen Samton, LLP were commissioned to prepare a new master plan for NIH-RTP.

2.9 NIH-RTP MASTER PLANNING PROCESS

The NIH established a Master Plan Management Structure at the beginning of the project. It is comprised of a Master Planning Steering Committee (MPSC) and the Master Plan Project Team (MPPT). The MPSC members consisted of the leadership from the Office of Research Facilities (ORF) and the NIEHS. The NIEHS advised the MPPT throughout the process of developing the Master Plan and the NEPA document while MPSC provided technical guidance and direction.

The development of the Master Plan for the NIH-RTP campus was structured to be accomplished in two phases. The first phase of the planning process was an evaluation of the existing campus, identification of planning issues, establishment of projected requirements, and exploration of physical frameworks for campus growth. Three concepts were developed, of which one was selected through discussions and iterations with NIH.

Phase 2 further refined the selected concept by examining multiple physical development alternatives that considered the relationships between the main and the service entrances, potential building expansions, creation of open areas and courts, circulation linkages to the existing building, landscape, stormwater plans, security and other sustainable criteria. These alternatives with their advantages and disadvantages were presented to the NIH employees and leadership to finalize a Master Plan concept. The findings became the core of the Master Plan strategies and the guide to its phasing and implementation strategies.

The NIH-RTP campus Master Plan was initiated by meeting the NIH leadership and comprehending the site and building specific issues related to the campus. The NIEHS had published its 2006-2011 Strategic Plan that provided insight into its future mission. A vision paper for the Master Plan that included the planning objectives and goals was developed and endorsed by NIH.

Data on the existing NIH/NIEHS organizational structure, employee census and available building plans was collected. A detailed facility analysis was conducted that established utilization rates for laboratories, offices and support areas. These were compared to the NIH guidelines for respective spaces and space shortfall was established. This was augmented with a functional and conditions analysis of the existing Building 101.

Parallel to the facilities analysis, multiple meetings and interviews with Program Directors and NIH/NIEHS employees and scientists were conducted. A comprehensive understanding of functional and operational limitations was gained that helped prepare survey instruments for responses. In addition to the NIH employees, meetings were held with representatives of surrounding communities and local and state officials.

Several questionnaires targeting a wide range of required planning information were developed. These were distributed amongst NIEHS Program Directors and employees as well as NIH personnel responsible for facility operations.

Based on the interviews, survey responses, and future research requirements, the projected personnel growth and program requirements for the next five, ten and twenty years were established. The data was reviewed and approved by the Division of Facilities Planning (DFP), NIEHS leadership, and the RTP Master Plan Steering Committee.

Based on the space projections, three master plan concepts were developed exploring different approaches to accommodate the projected requirements. These concepts were presented to NIEHS employees, its leadership, and the Steering Committee. One of the three concepts was selected which was further developed to formulate the final Master Plan document.

During the course of the master planning process, there were two presentations given to all employees, a community meeting was conducted, and the concepts were presented to Owners and Tenants Association of Research Triangle Park. The DFP and the consultants engaged and apprised several local government bodies during the Master Plan development process, including the Durham County Planning Department, North Carolina Department of Transportation, North Carolina Turnpike Authority, and the Council of Governments.

EXHIBIT 2.7: KEY ACTIVITIES AND EVENTS

Project Initiation and meetings with NIH/NIEHS leadership	Oct 2006
Data Collection and Analysis	Nov 2006 to Jan 2007
Program Development • All hands presentation	Feb 2007 to Apr 2007 • Mar 30, 2007
Development of Alternatives	May 2007 to Aug 2007
Steering Committee Presentation	Sep 2007
Transportation Study	Sep 2007 to Nov 2007
Meeting with NIH, EPA, NCDOT, NCTA, FHA	Dec 4, 2007
Briefing to Durham City/County Planning	Dec 4, 2007
Presentation of 3 Planning Concepts to NIEHS Senior Staff/Scientists	Dec 5, 2007
Phase 1 Final report	Dec 2007
Refinement of the selected concept	Jan 2008 to Feb 2008
Initiation of Combined EPA/NIH Warehouse feasibility study	Mar 2008
Presentation of selected Concept alternatives to NIEHS Senior Staff/Scientists	Mar 13, 2008
Presentation for RTP Owners and Tenants Association	Mar 13, 2008
Initiation of scoping for an EA	Apr 2008
All hands presentation	May 1, 2008
Steering Committee Presentation	May 6, 2008
Preliminary Draft Master Plan	Jul 2008 to Aug 2008
NIH Comments on Preliminary Draft	Sep 2008 to Oct 2008
Draft Master Plan submission	Dec 2008
HHS Capital Investment Review Board Review	Jan 2009
Realignment of the Master Plan concept at the request of the new Director	Sep 2009
Revised Draft Master Plan Submission	Jan 2010
HHS Capital Investment Review Board Review	Feb 24, 2010

2.10 MASTER PLAN GOALS

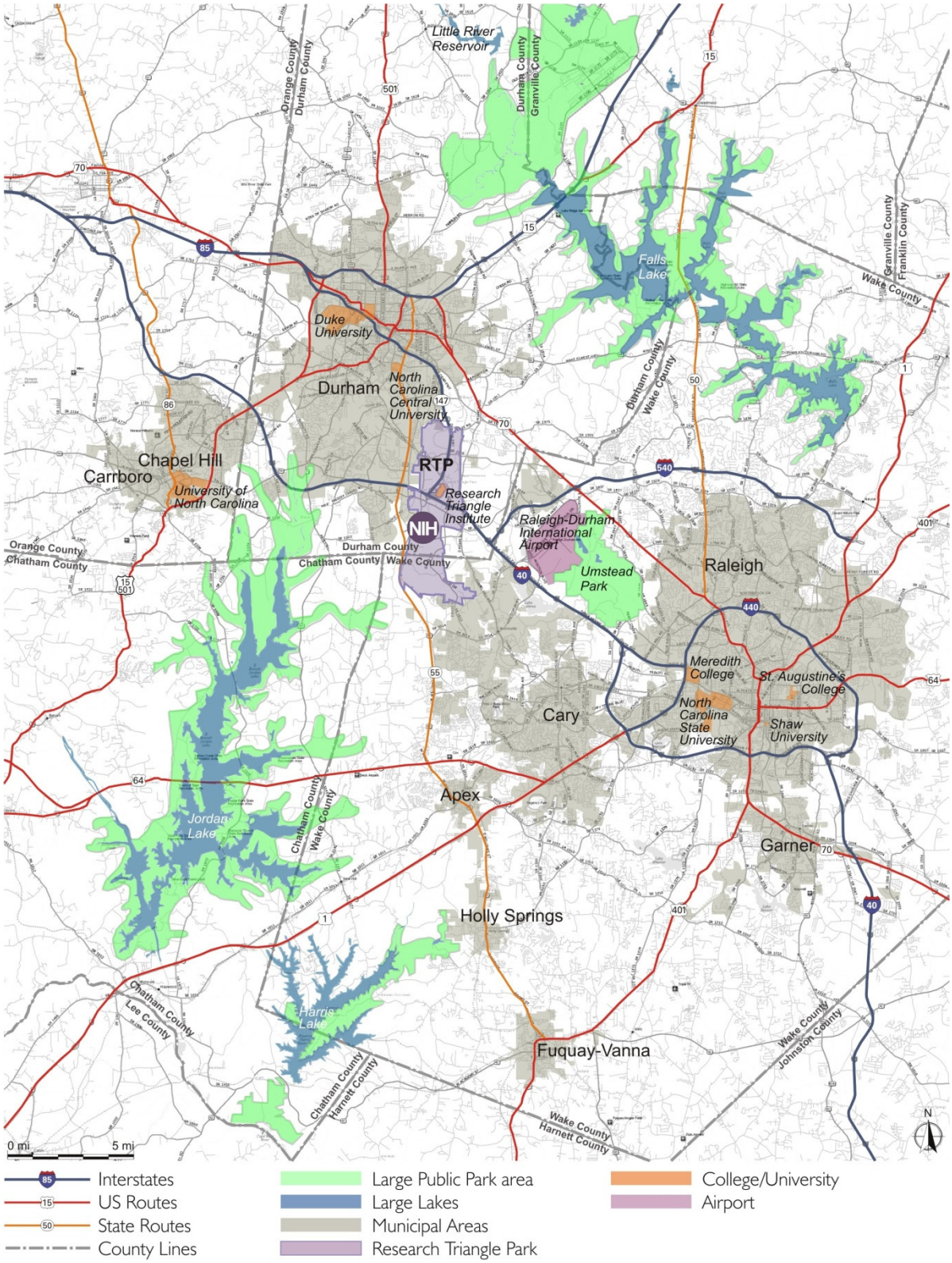
The Master Plan reflects NIH goals for the physical development of the RTP campus and for a flexible plan for implementation. In addition to meeting practical physical needs, the Plan needs to support NIH's mission of advancing and encouraging collaborative scientific research. At the commencement of the master planning process, a vision statement for the NIH RTP campus identified key parameters that would influence the short and long term development of the RTP Campus, its infrastructure, open space and future buildings. The NIEHS leadership, in its meetings with the master planning team, provided the founding premises and direction. The views of Office of Research Facilities (ORF) staff were important in defining facility conditions and policies relevant to ongoing and planned activities on the site. A summary of the vision statement is as follows:

1. **Create a Lively Campus**
    a. An active and vibrant campus that reflects the nature of research - a 'round-the-clock' activity that fosters scientific collaboration and is bolstered by frequent interactions among scientists.
    b. Functions and facilities that promote staff interactions after normal office hours, including support and activity spaces.
2. **Provide Appropriate Facilities for Scientific Needs**
    a. Upgraded existing facilities that support team-based research, including adaptation for additional team spaces, mix of open and enclosed team-based labs, and provision of shared resources.
    b. Flexible lab spaces, engineering systems and interiors to meet churn requirements, including potential conversion to generic labs. Construction of additional optimal sized labs. Expansion of core facilities, including vivarium, to support new requirements for basic and clinical research.
    c. Reliable engineering systems, including adequate fail-safe redundant back-up systems for critical research equipment and designated areas.
    d. Sizing and siting of a permanent clinical facility.
    e. Availability of state-of-the-art conferencing facilities with multi-user access to interactive communication systems. Enhance NIH's ability to host scientific conferences in-house.
    f. Consolidation of existing leased space to an on-campus location, for better program management, greater interaction among scientists, reduced costs, and improved employee morale.
3. **Increase Employee Amenities on Campus**
    a. A suitably sized and equipped fitness center for the population of the NIH campus.
    b. Encouraging staff interaction with the creation of employee lounges and incidental meeting spaces throughout the campus.
    c. Improvement of the campus facilities to be fully compliant with all ADA accessibility requirements.
4. **Expand Community Outreach**
    a. Opportunities and facilities to foster interaction between NIH and regional scientific colleagues, including biotech companies within RTP and area universities and research centers.
    b. Stronger links and opportunities for improved interaction with EPA scientists.
5. **Create a Sustainable Campus**
    a. Buildings and site improvements that transform NIH-RTP into a "green" environmentally responsible campus by incorporating green design principles and practices.
    b. Opportunities for employing and establishing sustainable features and practices.

3.

KEY FINDINGS FROM PHASE 1

Exhibit 3.1: Regional Overview



3. KEY FINDINGS FROM PHASE 1

Phase 1 of the NIH-RTP Master Plan was an assessment of the conditions of the site, buildings and its environs and an analysis of the current as well as projected needs and requirements. The findings were used in developing alternative planning concepts and recommendations for NIH-RTP. A summary of the key Phase 1 findings is included in the following pages.

3.1 REGIONAL OVERVIEW

The NIH Campus is part of the Research Triangle Region (RTR), which is strategically located within the Raleigh Durham region in the east-central North Carolina Piedmont. RTR is located approximately 160 miles from Charlotte, 265 miles from Washington, D.C., and 150 miles from Richmond, Virginia.

RTR has several renowned corporate as well as governmental organizations that are engaged in research and development in pharmaceuticals, biological agents/infectious diseases, agricultural biotechnology, pervasive computing, advanced medical care, analytical instrumentation, nano-scale technologies, and informatics. It also includes several educational institutions including North Carolina State University, Duke University, and the University of North Carolina at Chapel Hill, all within 30 minutes of the NIH Campus.

RTR is rapidly developing. Because of the rapid growth in the region, open space, protection of watersheds, and the establishment of regional bicycle and pedestrian trails have emerged as significant planning issues. Regional and local planning efforts are focused on attempts to control sprawl, and the attendant air pollution, resource waste and land consumption that sprawl generates.

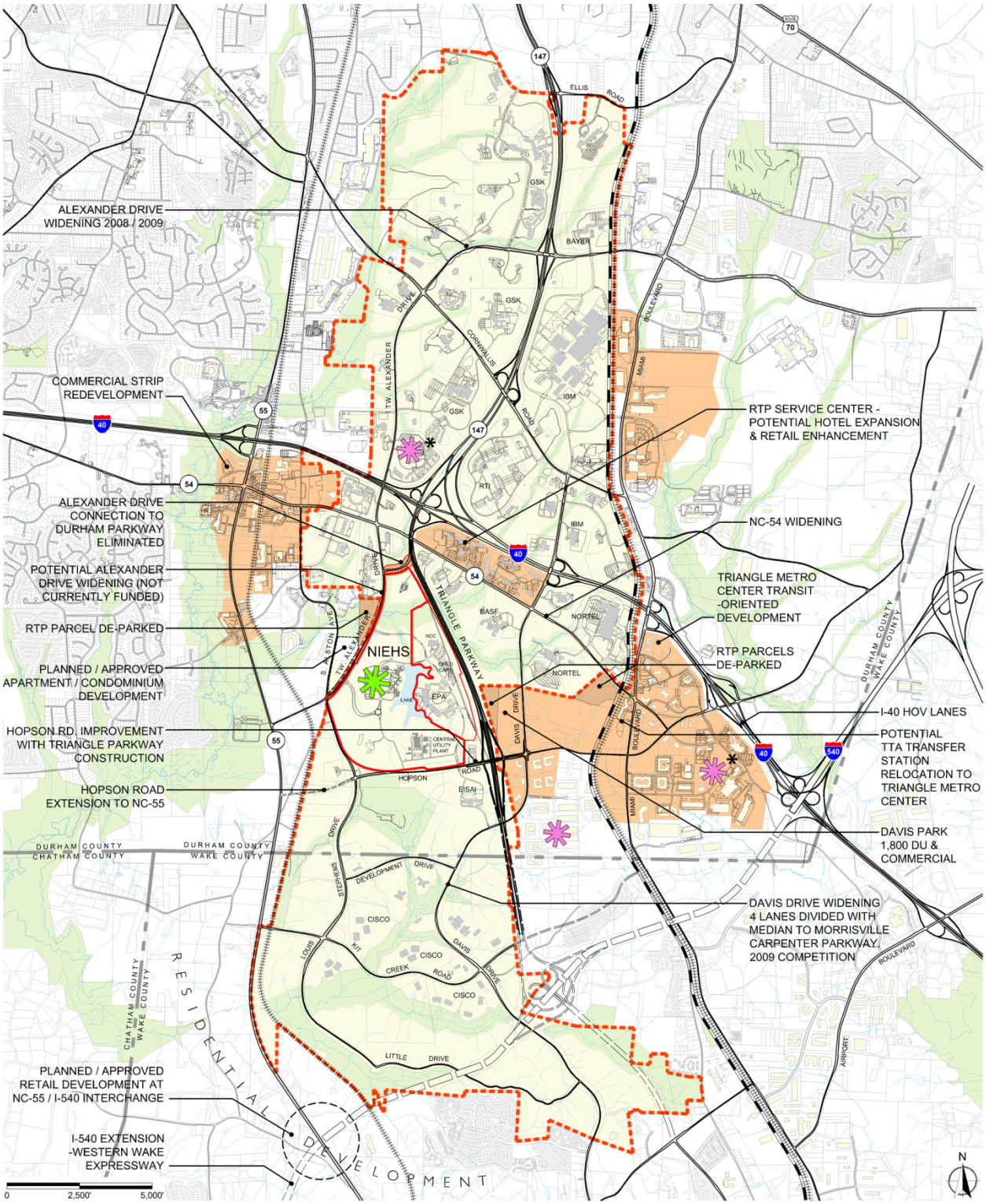
RTR is well connected to the rest of the state and the country through a network of interstate and state highways. The Raleigh Durham International Airport is located within the region. RTR is served by two major freight railway services. Triangle Transit Authority (TTA) provides regional public transportation, providing bus service connecting the cities in the RTR with the local bus systems and Research Triangle Park (RTP). Each of the RTR's four largest cities (Raleigh, Durham, Chapel Hill and Cary) offer local bus services within its boundaries and to the surrounding areas. The RTR is also served by passenger rail service (provided by Amtrak) and two nationwide bus lines (Carolina Trailways and Greyhound Trailways).

Home to 20% of North Carolina's population, RTR is made up of 13 counties, including four mid-size cities – Raleigh, Durham, Cary, and Chapel Hill – and approximately 60 smaller cities and towns[1]. Based on the US Census Bureau criteria, two Metropolitan Statistical Areas (MSA) are located within the region: Raleigh-Cary MSA, including Wake, Franklin, and Johnston counties; and, Durham MSA, including Durham, Chatham, Person, Orange, and Lee counties. The two MSAs together form the Raleigh-Durham-Cary Combined Statistical Area (CSA). The population of the RTR, estimated at 1.8 million in 2005 – a figure that doubled in 25 years – is projected to increase to 2.9 million by 2030[1]. The region's work force increased by more than 31 percent in the 1990s[2]. In 2007, RTR had 52,686 public and private establishments, employing 902,778 people, and paying total wages of over $39.9 billion annually[1].

RTP falls under the jurisdiction of two Metropolitan Planning Organizations (MPOs) – the Durham-Chapel Hill-Carrboro MPO (DCHCMPO) and the Capital Area MPO (CAMPO). The population projections for DCHCMPO indicate a 59% increase from 414,628 in 2005 to 660,075 in 2035. The employment is projected to grow by 76% in the same period from 234,747 to 412,706[3]. The CAMPO population is projected to grow by 117% from 894,444 in 2005 to 1,942,825 in 2035 with an employment growth of 96% or from 470,645 to 924,347[3].

[1] Retrieved from the Research Triangle Region (RTR) website at: http://www.researchtriangle.org/ [Retrieved December 2008]
[2] Labor Force by Place of Residence data available at http://linc.state.nc.us/ provided by the Employment Security Commission.
[3] Retrieved from DCHC MPO and CAMPO websites at http://www.dchcmpo.org/ and http://www.campo-nc.us/ [Retrieved December, 2008]

EXHIBIT 3.2: RTP & SURROUNDING CONTEXT



* *NIH consolidated its two off-site offices into a single facility in January 2009*

3.2 Research Triangle Park (RTP) and Surrounding Context

Research Triangle Park (RTP), the nation's largest research park, is managed by Research Triangle Foundation (RTF) and covers almost 7,000 acres of land. The Research Triangle Foundation, established in 1959, founded RTP with the intention of increasing economic opportunities for the citizens of North Carolina by establishing a place where educators, researchers, and businesses could come together as collaborative partners. RTP, developing incrementally since its inception, now includes a series of individual, corporate and institutional campuses, ranging in size from 8 acres to 600 acres, and totaling over 20 million gross square feet of development.

Located approximately equidistant from Raleigh, Durham, and Chapel Hill, in a wooded setting, the general character of RTP is tree-lined and landscaped, with low density, self-contained institutional campuses. This character of the RTP is valued by the larger community as well as the institutions within RTP and is not anticipated to change.

The RTP had over 157 organizations in 2007 which included research and development companies, institutions, and government agencies. RTP's corporate facilities are mostly in the fields of technology, pharmaceutical, biotechnology, and health sectors, and include the likes of Glaxo Smith-Kline (, IBM, Cisco Systems, Bayer, BASF, Nortel and Sony/Ericsson. It also has a significant governmental and institutional presence that includes NIH's neighbors, The United States Environmental Protection Agency's Office of Research and Development (ORD) and the Office of Air and Radiation (OAR).

In 2007, the full-time workforce at RTP was more than 39,000. This is expected to grow to about 85,000 over the next 20 years as the park builds out its remaining space and employment increases in the existing companies.

RTP still has approximately 630 acres in undeveloped sites which will attract new corporate offices and R&D establishments. Also, many of the older properties are expected to be re-developed, including the commercial core on NC54.

Within a four-mile radius of RTP, there are nearly 41,000 existing or planned residential units, 13 million square feet of built space in technology and business parks, and an additional 15,000 acres under development for office, commercial, and industrial use. An increasing number of dining, retail, and residential projects are being developed in and around the Park.

East of RTP, primary land uses are commercial and light industrial. Additional office and strip retail are being developed in this area, while an existing commercial office node, adjacent to NIH, is in the process of expansion. Davis Park, a new development of townhouses, apartments, retail and office, is emerging on both sides of Davis Drive. A regional rail transit system connecting Raleigh to Durham is planned to run along the east side of RTP. This project is currently on hold due to funding issues. Mixed-use, high-intensity development is anticipated in the area surrounding the future transit station, which would include residential, commercial, and retail space in a traditional neighborhood design, or transit-oriented pattern.

Residential uses predominate south and southwest of RTP in an area of former farmland that is rapidly suburbanizing. Many of these emerging developments will be traditional neighborhood or "new urbanist" in style, generally including smaller lots, a mix of house types and sizes, and community-oriented parks and open spaces.

Durham County consists of relatively fully-developed suburban residential areas and intermittent low rise commercial strips to the west and north of RTP. The Durham Unified Development Ordinance calls for industrial uses, research and development in this area, with some additional low density residential development.

3.3 RTP Campus Site Characteristics

NIH has a beautiful campus, characterized by a forested and gently rolling landscape surrounding a small lake. The 1971 Master Plan was developed around the site's natural features, assets and constraints and this study analyzed these elements for opportunities and constraints to future development. The following are the salient natural features of the campus:

A. Soils

The NIH-RTP campus contains a mix of soils which vary in drainage characteristics and the vegetation it supports:

- The White Store soils are moderately well-drained soils with firm clayey subsoil, suitable for the growth of loblolly pine, eastern red cedar, short leaf pine, and white oak.
- The Chewacla and Wehadkee soils, often poorly drained because of their location in flood plains, are suitable for various oak species as well as loblolly pines, sweet gums, and yellow-poplars.
- The Cartecay and Chewacla soils also face the possibility of flooding and support similar tree species as the Chewacla and Wehadkee soils.
- Creedmoor soils feature gentle slopes and are moderately drained making them suitable for the broadleaf and needle leaf trees.
- Gullied Soils are not suitable for any trees due to rapid runoff and extreme erosion problems.
- The Pinkston fine sandy loam soils are characteristically well-drained and are more suitable for a variety of pine species.

Exhibit 3.3: Soil Types

Ch-Chewacla and Wehadkee
Cc-Cartecay and Chewacla
CrB-Creedmore Sandy Loam, 2 to 6% Slopes
WsB-White Store Sandy Loam, 2 to 6% Slopes
WsC-White Store Sandy Loam, 6 to 10% Slopes
WsE-White Store Sandy Loam, 10 to 25% Slopes
Gu-Gullied Land, clayey materials
PfE-Pinkston fine Sandy Loam, 10 to 25% Slopes
PfC-Pinkston fine Sandy Loam, 2 to 10% Slopes

1971 USPHS Research Park Master Plan states that soil analysis borings taken on the site indicated an ability to accommodate buildings with conventional foundations (such as spread footings) throughout the campus. Multistory buildings with basements could be built around the shoulders of the hills, and buildings with partial basements could be sustained on the top of the hills. The Plan recommended that specific borings and analyses be conducted when individual buildings are designed[1].

[1] Master Plan, USPHS Research Park, North Carolina, 1971, page 58

B. Vegetation

An analysis of digital aerial photos from *Google Earth* shows that vegetation on the NIH-RTP campus is comprised of four categories: Alluvial Forest, Hardwood Forest, Mixed Forest, and Pine/Evergreen.

Areas where hardwood/mixed forests dominate the tree stands should not be developed in order to preserve wildlife habitats, maintain ecological diversity, and help protect against erosion and flooding[1].

The alluvial forests serve as buffers to the streams[2], reducing erosion and non-point source pollutants from entering the natural streams.

Pine and evergreen forests are better suited for development than the other forests listed above due to their rapid growth and their ability to reforest on once-disturbed areas of land.

Cultivated vegetation on the site includes both specimen trees and masses of shrubs. Specimen trees are scattered throughout the campus, clustered primarily along major roadways and along the edges of buildings and parking lots. Shrub masses frame the edges of the easternmost parking lot, line portions of roadways at intersections and sit adjacent to buildings in some locations.

The 1971 Master Plan notes that the tree species vary according to the topography. Loblolly pines and red cedars, reaching up to heights of 40 feet, can be found in level areas. In hilly areas with steeper slopes, mixed oaks, hickories, tulip poplars, and dogwoods can be found, with the larger trees as tall as 50 feet.[3] The ravines include the larger, hardwood species, such as sweet gum, sycamores, and tulip poplars. Many of these species reach up to 90 feet in height.

The current tree coverage accounts for approximately 220 acres or 58% of the NIH-RTP site.

EXHIBIT 3.4: VEGETATION TYPES

C. Topography

The rolling topography on the site creates a wide range of hills and valleys. The contours within the site were analyzed to determine various slope percentages. Durham County code restricts development on areas steeper than 25% slopes (See Exhibit 3.17). There is over a 100-foot elevation change within the site, with a high point of 363 feet at the southern edge of the NIH-RTP campus and a low point of approximately 260 feet in the northern portion of the site.

[1] McCoy, Rachel. "Bottom land hardwood forests: restoration and management." *Green Horizons Newsletter*. Volume 8, Number 3, Summer 2004. http://agebb.missouri.edu/agforest/archives/v8n3/gh4.htm
[2] Hamilton, Rick A. and Moorman, Christopher. "Developing Wildlife-Friendly Pine Plantations." Woodland Owner Notes. North Carolina Cooperative Extension Service. http://www.ces.ncsu.edu/nreos/forest/pdf/WON/won38.pdf
[3] Master Plan, USPHS Research Park, North Carolina, 1971, page 58

D. Water Features

The key water features on the site, as illustrated on Exhibit 3.17, are as follows:

- **Watershed**: The site is located near the boundary between two major watersheds. While it officially falls within the Upper Cape Fear River Basin, the Upper Neuse River Basin boundary is located less than two miles to the east. A portion of the site falls within a North Carolina Division of Water Quality designated water supply watershed protection area (classified as WS-IV), and lies approximately four miles east of an area designated as a water supply watershed critical area. The streams located within the Cape Fear basin—Little, New Hope, Third Fork, Crooked, and Northeast Creeks—drain into Jordan Reservoir, which provides water supply for the jurisdictions of Apex and Cary and is considered a potential future water supply for Durham.
- **Surface Water**: The lake at the heart of the site is the most significant surface water feature. It also serves as the primary stormwater management facility on the site. The site is bisected at its northern end by Burdens Creek, which flows east to west through the site. An unnamed surface stream flows north from the lake and drains into Burdens Creek. The site also includes various intermittent streams, many of which include below-ground portions. North and east of the lake, the site includes scattered ponds and stormwater management facilities. These water bodies include numerous detention ponds and catch basins located between the lake and the EPA buildings and several ponds in the vicinity of Burdens Creek.
- **Flood Plains**: The 100-year flood plain runs along Burdens Creek, along the stream north from the lake to Burdens Creek, along Two Bottle Creek, north of Burdens Creek and along the site's western boundary. The 100-year flood plain contains a designated Zone AE regulatory floodway[1] which includes the stream channel and portion of the overbanks that must be kept free from encroachment in order to discharge the one-percent-annual-chance flood without increasing flood levels by more than a foot. The 500-year flood zone encompasses the lake and the streams running into the lake at its southeast and southwest corners.
- **Wetlands**: A search of the National Wetlands Inventory (NWI) of the U.S. Fish and Wildlife Service revealed no wetlands located either on the NIH-RTP campus or its vicinity though field observations identified potential wetland areas on the campus. While general locations of these areas have been noted on Exhibit 3.17, further field research is necessary to determine the status, classification and boundaries of these areas.

E. Existing Site Development and Tree Cover

This chart summarizes the developed and undeveloped areas on the site.

EXHIBIT 3.5: EXISTING SITE DEVELOPMENT (CHART)

	Areas (sf.)	(acres)	(%)
Building Footprint[1]	310,400	7.13	1.90
Terraces / Pavings	23,900	0.55	0.15
Roads, Driveways	670,600	15.39	4.08
Parking	353,200	8.11	2.15
Trails/Paths	72,300	1.66	0.44
Total Developed Areas	*1,443,800*	*33.14*	*8.79*
Landscaped lawns	154,900	3.56	0.94
Setbacks[2]	4,123,500	94.66	25.11
Forest / Tree[2]	9,192,000	211.02	55.97
Open space	486,200	11.15	2.96
Total undeveloped area	*13,943,200*	*320.09*	*84.90*
Lake	*1,035,200*	*23.76*	*6.30*
Total NIH-RTP Site Area	16,422,200	377.00	100.00

[1] Area for trailers is not included

[2] About 9 acres of trees are within the setbacks; therefore total tree cover is 220 acres or 58% of site.

[1] Regulatory floodways are identified by the Federal Emergency Management Administration (FEMA) in its Flood Insurance Rate Map (FIRM), and generally adopted into a community's flood plain management ordinance.

3.4 Visual Character

The visual character of the campus is defined by the site's entry gateways, roadways, and wooded edges along the perimeter of the site, and by the lake at the heart of the site. The campus is an enclave carved out of woods, which in turn create a visual buffer between the campus core and outside development. The once visually insignificant entry gateway along Environmental Parkway was spruced up following the recommendations of the 2001Landscape Master Plan. New plantings along the edges of the existing woodlands were also introduced to help create a more natural transition from the tall trees of the existing wooded areas to the campus open spaces. Consequently, the prominent signage at the entrance, the security and gates, the meandering and wooded entry roadway and the landscaped roundabout now serve to underscore a visitor's sense of arrival from this access point. The pedestrian access tunnels from the parking lot to the building also serve as view corridors through the site. Major roadways in and around the site share the scenic quality created by the wooded areas that frame the edges of the roads similar to the entry roadway. Tree masses also help define outdoor spaces on the site, especially the gathering areas located between campus structures and the lake and the vicinity of the memorial garden. Certain woodland edges are significant in that they frame and filter view sheds and vistas throughout the campus.

The lake serves as the main focal point of the campus, creating open views to the buildings on its edges. A path, approximately two miles long, circles the lake and provides a recreational resource for EPA and NIH employees. This path, along with the gathering area and promenade on the eastern side of the NIH buildings, offer views to and across the lake. Visually and physically, the area north of Burdens Creek is isolated from the rest of the NIH-RTP campus.

Most of the interesting view sheds within the site originate from the east side of Building 101 and from the adjacent gathering spaces, where views to the east and toward the lake are filtered or framed by the woodland edges. The lake and the EPA campus form a striking vista looking northeast from the memorial garden, with the topography, vegetation, water, and the built structures appearing in relative harmony.

3.5 EXISTING VICINITY AND SITE CIRCULATION

An existing transportation analysis was conducted by OR George & Associates, Inc., one of the consultants in the Planning team. The analysis was based on extensive field reconnaissance, comprehensive field data collection, survey of NIH and EPA employees and interaction with staff of the various agencies having jurisdiction over transportation infrastructure serving the NIH-RTP campus area.

A. Existing Road Network and Planned Improvements

- The NIH-RTP campus is centrally located within the Research Triangle Park, which is served by a network of national, state, and local roadways. The major national and state roads are I-40, I-540, NC 54, NC 55 and NC 147. Local roads that connect the site to the major roads are T. W. Alexander Drive, Davis Drive, Hopson Road and Louis Stephens Drive.
- In a traffic survey conducted in September 2007, the analysis indicated that the Average Daily Traffic (ADT) at NC 147 spur was 16,193 vehicles, followed by T. W. Alexander Drive (15,469) and Hopson Road (4,424). The daily traffic volumes on these roads were at acceptable levels.
- The intersections on T.W. Alexander Drive at NC 147 spur and NC 54 had a Level of Service (LOS) of F and E respectively during the daily peak hours.
- At the time the master planning process was initiated, there were several improvements planned to the road network around the site. Critical ones that would impact the NIH-RTP Master Plan were: a) The Triangle Parkway, a toll road along the eastern edge of the EPA site connecting the NC-147 interchange on the north to the I-540 interchange on the South; b) The elimination of NC147 spur to T. W. Alexander Drive after the Triangle Parkway is completed: and c) the construction of a diamond interchange at the intersection of Triangle Parkway and Hopson Road. All of these projects are now completed. Additionally, there have been other improvements to the existing network that included road extensions and widening.
- Section 7 of this report further elaborates on the existing and planned vicinity circulation.

B. NIH-RTP Campus Access

There are three active gates to the combined NIH-RTP/EPA campus, with two access entries from T.W. Alexander Drive to the west, and one access entry from Hopson Road to the south. The main entrance to the NIH-RTP campus is via a gated roadway (Environmental Parkway), which intersects with T.W. Alexander Drive. Two additional access points to the campus were built when the EPA facilities were constructed, and are also used by NIH employees.

Overall, 90 percent of the traffic accessing the NIH-RTP/EPA campus arrived via T.W. Alexander Drive, with 60 percent approaching from the north (via the I-40/NC 147 interchange, NC 54, NC 55, etc.) and 30 percent from the south (via roadways such as NC 55 and Davis Drive). These factors pointed to potentially significant changes in the vehicle distribution patterns with the planned implementation of the Triangle Parkway.

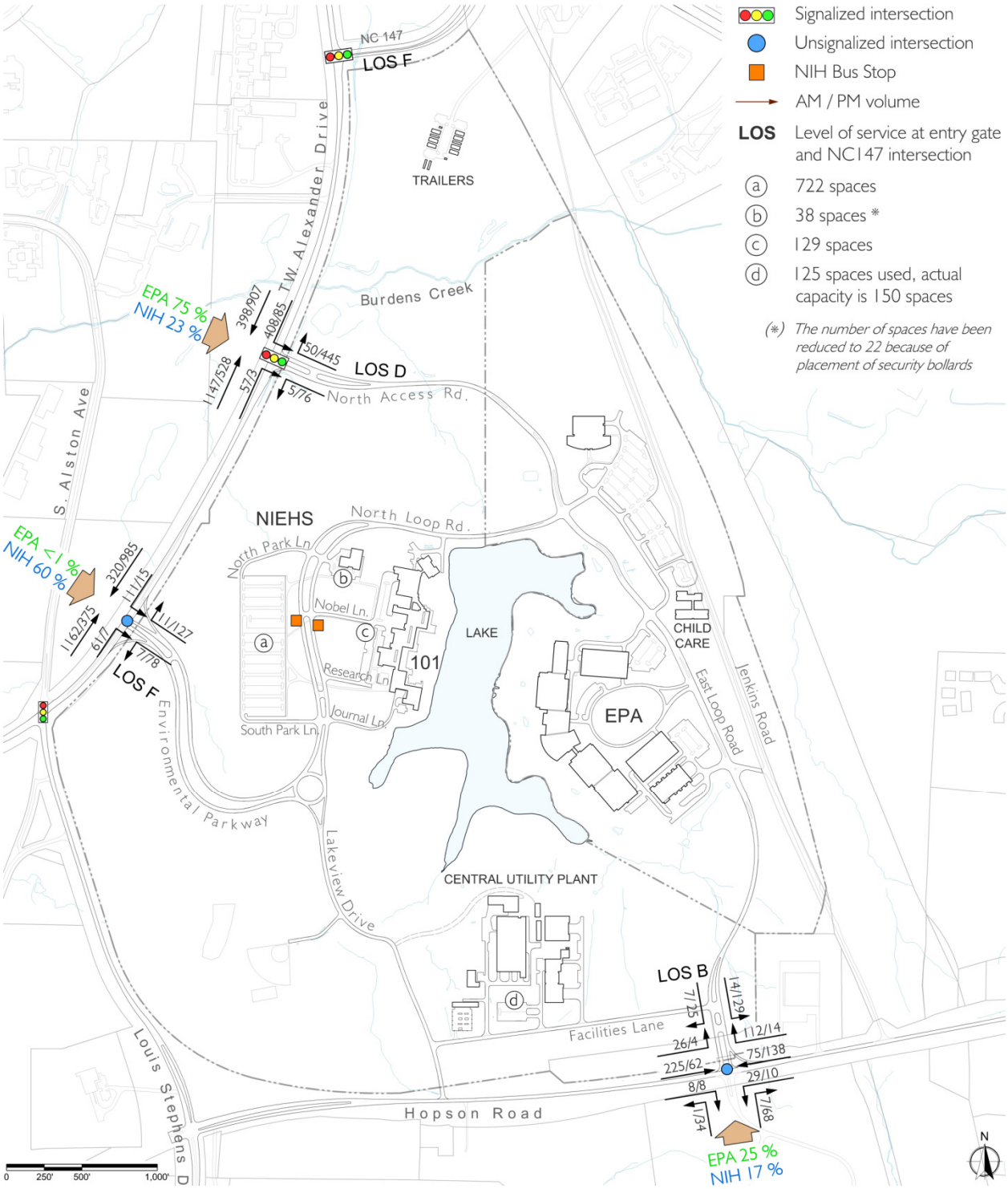
The traffic distribution at the campus gates is noted in the exhibit which shows the peak hour volumes at the three campus gates.

EXHIBIT 3.6: PEAK HOUR VOLUMES AT THE THREE CAMPUS GATES

Campus Access	AM Peak Hour			PM Peak Hour		
	In	Out	Total	In	Out	Total
1. NIH Gate (TW Alexander Drive)	172	18	190	22	206	228
2. EPA Gate (TW Alexander Drive)	465	57	522	88	521	609
3. EPA Gate (Hopson Road)	138	21	159	18	154	172
TOTAL	775	96	871	128	881	1,009

Source: 1971 Master Plan and OR George & Associates, Inc.

EXHIBIT 3.7: EXISTING CIRCULATION AND TRAFFIC VOLUMES



The current peak hour levels of service at all the gates were acceptable except the unsignalized NIH-RTP gate at T.W. Alexander Drive shown to be operating below Durham County's planning standards. Excessive delays are only experienced by those exiting with left-turns onto T.W. Alexander Drive southbound during both the morning and afternoon peak period. The LOS at peaks hours was noted to be F.

C. Campus Circulation

A portion of the original circulation loop as conceived in the master plan was constructed when the NIH campus was originally built, including the main entrance road called Environmental Parkway, the roundabout connecting Environmental Parkway and Lakeview Drive, and the portion of Lakeview Drive north of the roundabout to North Loop Road. South of the roundabout, Lakeview Drive was constructed as a single, two-lane roadway, rather than the four-lane road with median as conceived in the master plan. In addition, the portion of the loop road running between the lake and the CUP was never constructed. An NIH entrance at Hopson Road was constructed, but is currently gated shut, and used very rarely.

EPA facilities constructed on the east side of the lake also made deviations from the 1971 Master Plan circulation system, the most significant being that the main loop roadway on the EPA side of the campus was constructed with a two-lane non-divided cross-section. In addition, the roundabout that was to connect the North Loop Road with the EPA north entrance access road was not constructed, and much of the parking that was to be located outside the loop road was instead located on the inside. The result is a campus circulation system that is functional, but not entirely consistent with the original design intent of the 1971 Master Plan.

Field observations and measurements suggest that the internal roadways are all of acceptable standards in terms of roadway widths and horizontal alignment as well as lateral clearances. These features provide for generally unrestricted sight-distances and visibility for vehicular, pedestrian, and bicycle and transit vehicle movements. It is noted that a system of pedestrian pathways (trails) are provided, but these are generally well-separated from vehicular traffic.

D. Campus Intersections

All intersections within the campus were found to be functioning at a good level of service. Currently most have low volumes or directional traffic. The intersection on the EPA campus at North Loop Road and North Access Road experiences a higher volume of EPA traffic during peak hours because of its connection to the two EPA gates and its proximity to Child Care Center.

E. Parking

The NIH-RTP campus has a supply of 998 existing parking spaces. 722 are in the main parking lot, a long rectangular area running between South Park Lane and North Park Lane. These two roadways connect to Environmental Parkway and North Loop Road respectively. 129 parking spaces are in front of Building 101 mostly reserved for management, visitors, carpool, and the handicapped. 125 spaces are currently utilized in the CUP and the remaining 22 are spaces adjacent to the modular clinic.

E. Transportation Management Program (TMP) and Modal Split

The NIH-RTP campus has a Transportation Management Program (TMP) in place that has helped reduce overall vehicular travel demands through use of various strategies. The survey results from 35% of NIH respondents indicated that 79% of employees accessed the campus in a single occupancy vehicle, 14% in double occupancy, 6% in Vanpools, 6% transit/shuttle services and over 1% walk or bike. The survey results also indicated that 25% of the responders telecommute, although the frequency of days per week/month varied.

F. Pedestrian Circulation

Building 101 on the NIH campus is linked by a collection of trails and sidewalks that encircle the lake and connect it to the main parking lot. In addition there are paths off the Lakeview Drive that give pedestrians access to the ball field and the Central Utility Plant (CUP). However, the campus as yet does not have a well-integrated pedestrian and bicycle system that encourages movement between NIH buildings and the EPA. Pedestrian circulation issues include the movement of employees and visitors amongst the various facilities on site, the facilitation of bicycle commuting, and the use and enjoyment of the natural features and recreation areas of the site by employees and visitors.

Existing Campus Trail System

The principal pedestrian circulation system on the campus is a trail circulating around the lake, and connecting Building 101 along its east side (with the principal connection points being at Module A) with the Memorial Garden. The Memorial Garden includes benches, paving, and landscaped areas. From the Memorial Garden, the lake trail proceeds east across a peninsula at the southern end of the lake, and continues east around the southeast corner of the lake before turning north to intersect with a series of trails connecting the EPA buildings with the lakefront. The trail encircling the lake is about 8,500 linear feet with approximately 4,500 linear feet within the NIH property.

Parking Lot to Building Circulation

Another pedestrian circulation system is the various sidewalks linking Building 101 with the large employee parking lot west of Lakeview Drive. Three sidewalks link this parking lot to Building 101. The most important of these pedestrian links runs parallel and just to the south of Research Lane, and connects the parking lot with the main entrance to Building 101. This pedestrian path is grade-separated from the loop road, passing underneath the loop road near the entrance to Research Lane. The northern pedestrian connection between parking and Building 101 is also grade-separated, passing under the loop road in a landscaped passageway similar to the one on the south. The northern and central pedestrian trails from the parking do not connect to the main entrance of Building 101, and instead provide entry at a access points near the loading docks of the building.

Exhibit 3.8: Existing Pedestrian Network and Trails

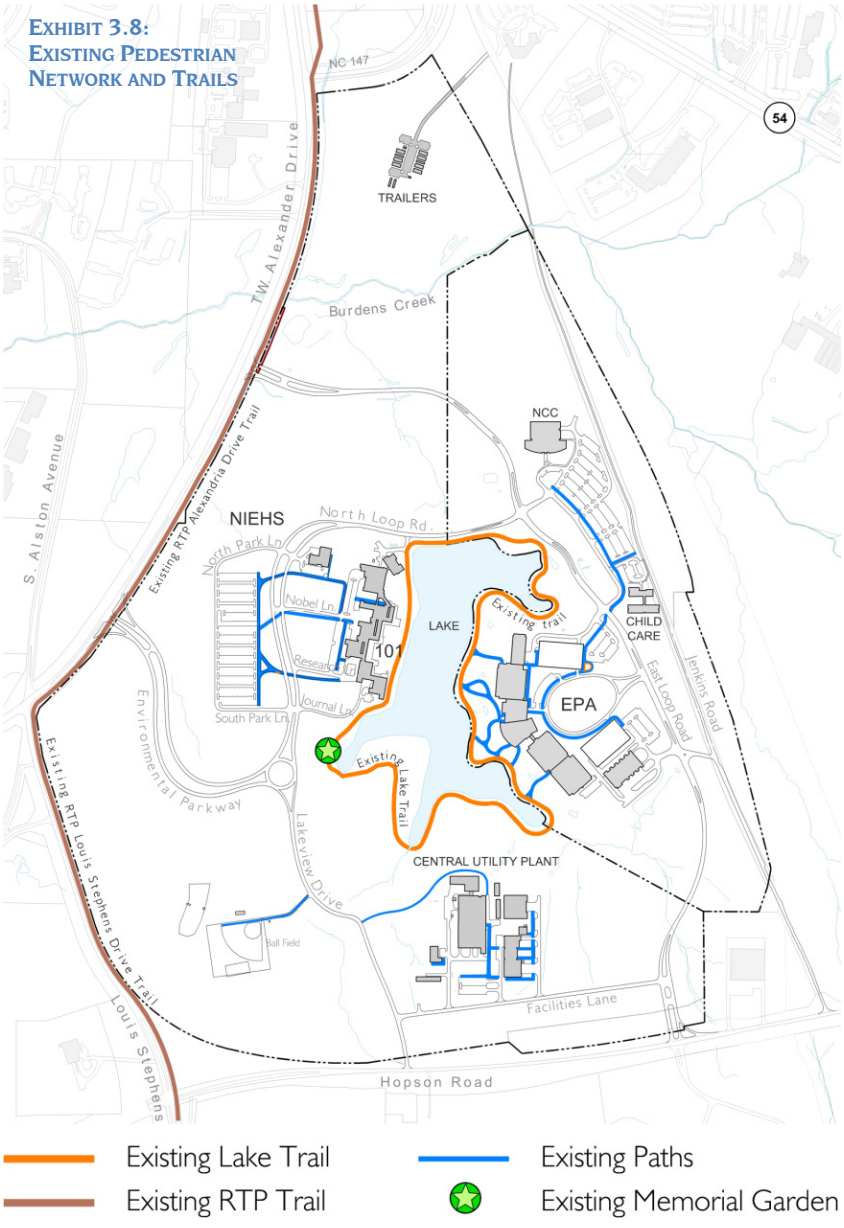
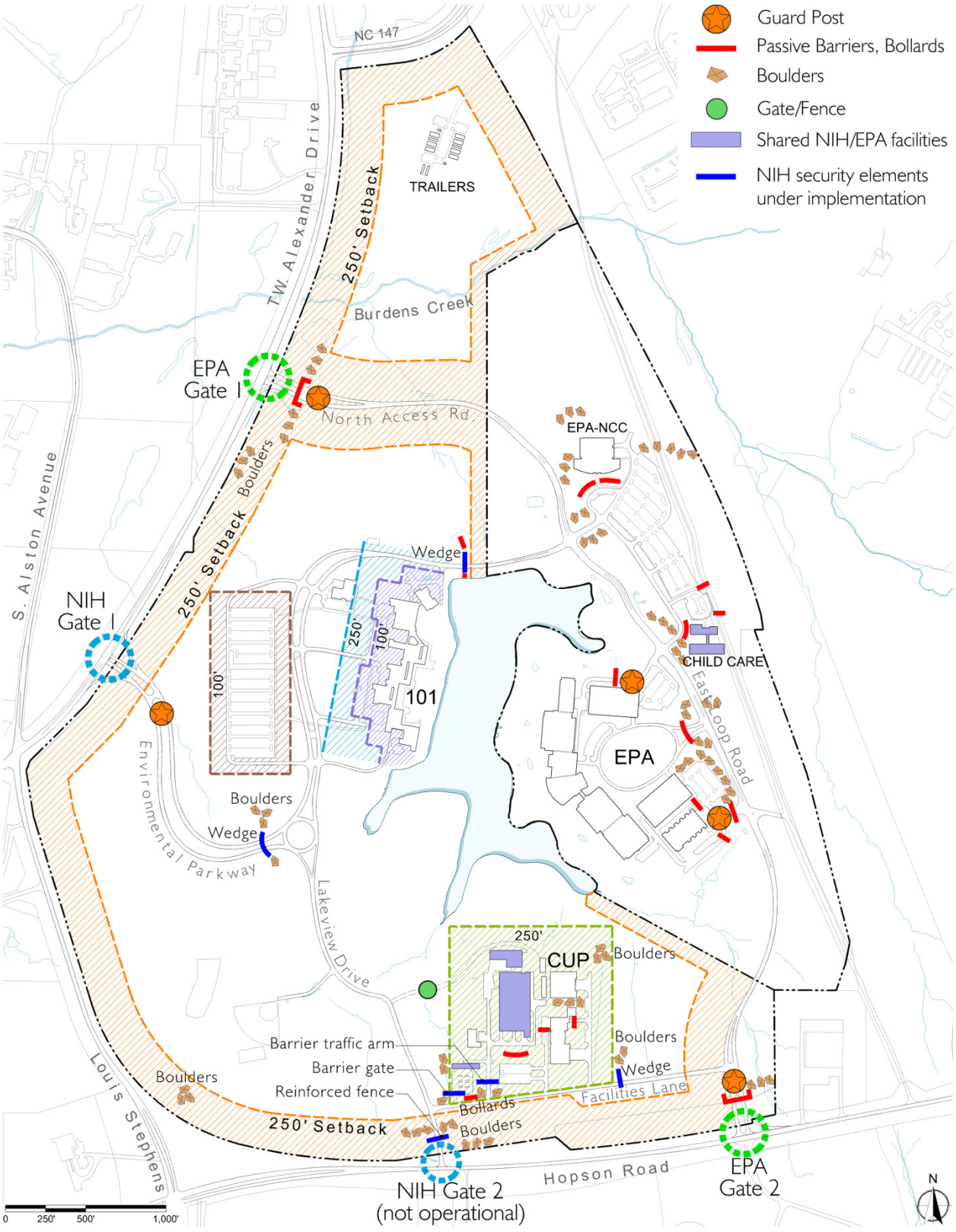


EXHIBIT 3.9: EXISTING SITE SECURITY



3.6 Security

The NIH and EPA have a shared campus at RTP with an integrated pedestrian and vehicular circulation system providing access to each other's facilities. Although both the Institutions have defined campus boundaries and function autonomously, the employees of either organization are free to enter the campus from any of the three gates controlled separately by NIH and EPA.

The NIH/EPA campus is currently accessible through three separate entrances: the NIH main entrance at T.W. Alexander Drive, the EPA main entrance also at T.W. Alexander Drive, and a second EPA entrance at Hopson Road. Another NIH gate exists at Hopson Road but it is not operational because of its adjacency to critical utility easements and because NIH wants to limit the controlled campus entrances.

In addition to the common entrances, the two agencies also share a few facilities within the campus. These are the Day Care Center, and four buildings within the Central Utility Plant (CUP)--the Power Plant (Bldg 105), the Incinerator Facility (Bldg 106), the Electrical Substation (Bldg 107) and the Waste Handling Facility (Bldg 108).

While both NIH and EPA are subject to similar federal security requirements, the two agencies previously approached security with different philosophies. The NIH considered the site perimeter to be the boundary, much like the Bethesda, Maryland campus, while EPA interprets each building perimeter as the boundary. In August 2009 the NIH adopted a security strategy for perimeter access similar to that used by EPA, thus more closely aligning the security approaches by both agencies.

In 2003 NIH performed a security survey of the RTP site and recommended several security upgrades to the campus. The security plan was reviewed in 2004 by Black and Veatch, security consultants to the US Army Corps of Engineers, for compliance with 'ISC Security Design Criteria for New Federal Office Buildings and Major Modernization Projects' and with 'Physical Security Design Guidelines for NIH-Owned Facilities'. As a result a Security Upgrade Design Intent Document was prepared for this site which is now under phased implementation.

The security upgrade document lists a comprehensive set of security recommendations that: a) specify perimeter entry procedures for credentialed and non-credentialed persons at entrances; b) specify procedures for screening commercial vehicles; c) recommend installation of a Visitors Center and Guardhouse at an NIH entrance; d) suggest securing non-gated secondary perimeter access through use of natural passive barrier systems such as trees and boulders; e) recommend protection of critical assets such as Building 101 and CUP by using on-site vehicular controls; and f) recommend the use of CCTV's in most locations.

The recently adopted and aligned security approach would allow the agencies to maintain an open campus environment, a unified security strategy for site access and protection that is common to both the agencies. The site plan shows the campus operational gates, the NIH guidelines for security setbacks, and the NIH and EPA active and passive barriers, including bollards, wedges, fences and boulders.

3.7 Existing Site Utilities

The principal components of the site utility infrastructure are the Central Utility Plant (CUP) on the southern portion of the campus, and the below-grade utilities distribution corridor aligning with portions of the loop road. This section includes a brief overview of the site utility infrastructure relevant to the master planning effort. A detailed description of existing utilities, requirements and future recommendations is included in Section 8 of this Draft Master Plan. The narrative is based on a separate Master Utilities Plan (MUP) study simultaneously undertaken with this planning effort by SUD consultants.

- **Central Utility Plant (CUP):** The CUP contains administrative offices, warehouse/storage, chemical storage, an incinerator, electrical switchgear, and the power plant. The chillers and boilers in the power plant serve both NIH and EPA.
- **Chilled Water (CHW) Systems**: The CHW system operates year round, 24 hours per day, to provide chilled water for HVAC and process cooling loads. Two separate plants, each consisting of three chillers each, serve the NIH and EPA. The chilled water system currently operates as two independent systems, one to serve NIH and the other to serve EPA. NIH and EPA are examining the feasibility of operating the CHW system as a single plant to achieve economy, reliability and redundancy.
- **High Temperature Hot Water (HTHW) Systems**: The HTHW system generates 400°F HTHW at 315 psig for distribution to the NIH and EPA campuses. NIH and EPA each have two 40-MBTUH generators. One of NIH's generators was recently installed and is yet to be commissioned. All generators are natural gas fired, with fuel oil as a secondary (backup) fuel. The agencies are considering the installation of crossover piping to allow the generators to operate as a single plant.
- **Chilled Water (CHW) and High Temperature Hot Water (HTHW) and Distribution:** The NIH CHW and HTHW distribution system was originally planned to form a complete loop around the site, following the loop road, providing system redundancy in case of a pipe failure in one section. However, the system as constructed consists of two branches starting from Building 105 in the CUP, with one branch serving NIH and one serving EPA. The CHW and HTHW distribution systems consist of supply and return piping running from the CUP to Building 101 along the east side of the loop road, trenched and buried, and connecting to a series of valve pits along the route. The piping enters Building 101 in two locations, at the west side basement level in Module B, and the north side basement level in Module F.
- **Electrical System and Distribution:** Electrical power is supplied to the campus by two redundant 100kV overhead transmission lines that enter the site south of the CUP at Hopson Road and serve an on-campus sub-station operated by Duke Energy. Two step-down transformers convert the voltage to 13.8 kV, which feeds the main distribution switch gear in the Switch House Building 107. The electrical distribution is through underground duct banks that are routed along the loop roads.
- **Domestic Water:** Domestic water is supplied to the campus from the City of Durham. The water main enters the site from Alexander Drive, approximately 350 feet south of the EPA entrance gate. The water main then runs southeasterly to the loop road, and splits into two branches, following the loop road on the west side of Building 101 southward to the CUP, and following the loop road to the east to EPA.
- **Sanitary Sewer:** The sanitary sewer serving the campus consists of two branches, one on the west side of the lake serving Building 101 and the CUP, and one on the east serving the EPA labs, Child Care Center, and EPA National Computer Center. The two branches join at the northwest corner of the lake and follow the lake outfall stream north to the county sanitary sewer easement north of Burdens Creek.
- **Fire Protection:** A water line and hydrant system connected to the Durham water main provides fire protection for Building 101.
- **Site Lighting:** Site lighting on the campus is provided by a system of light standards along the principal roadways and sidewalks, and in the parking lots. The site lighting standards are not consistent across the NIH-RTP and EPA campuses.
- **Stormwater:** This Master Plan describes the existing system and the suggested framework in Section 6 "Landscape and Storm Water Framework."

EXHIBIT 3.10: EXISTING SITE UTILITIES

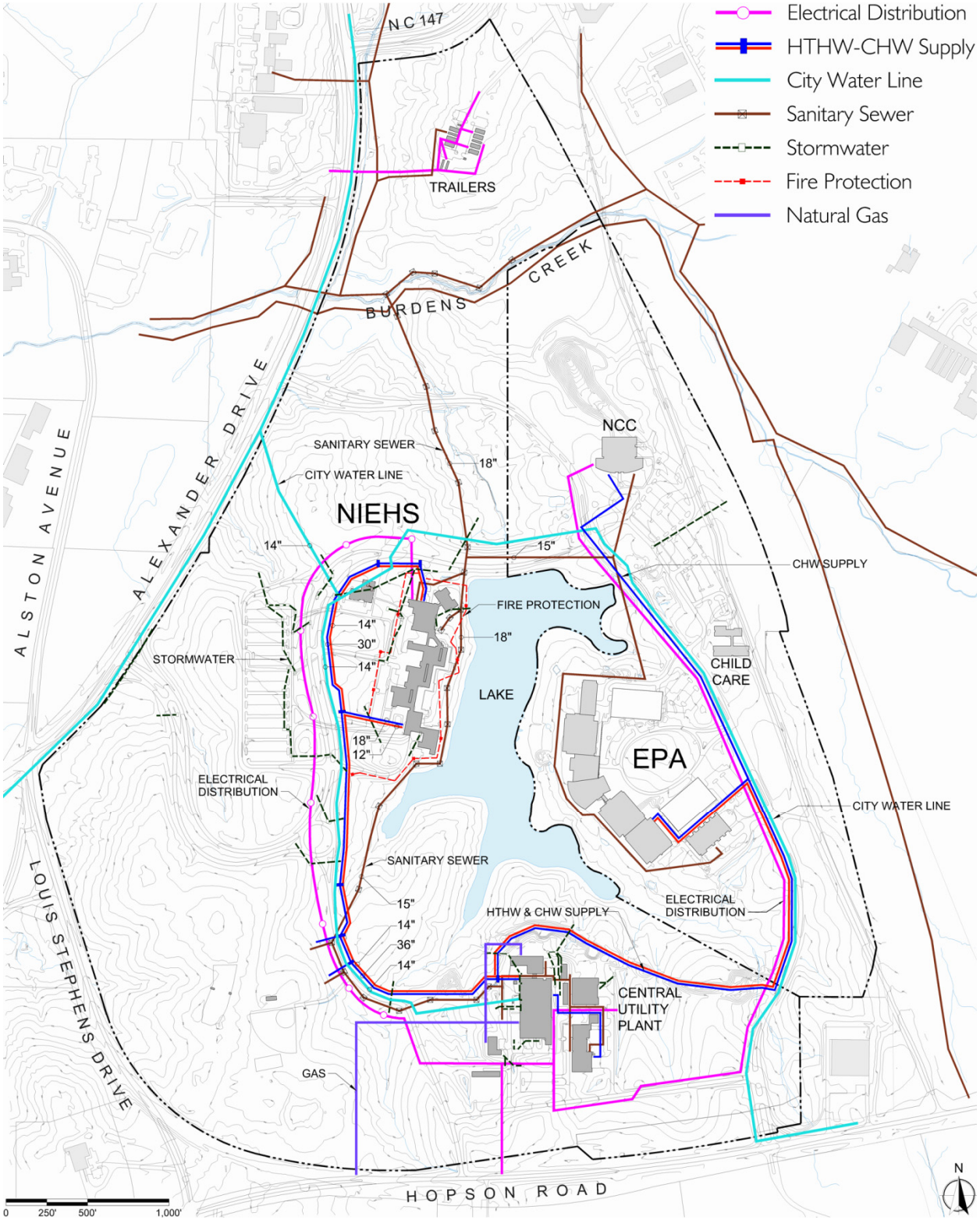
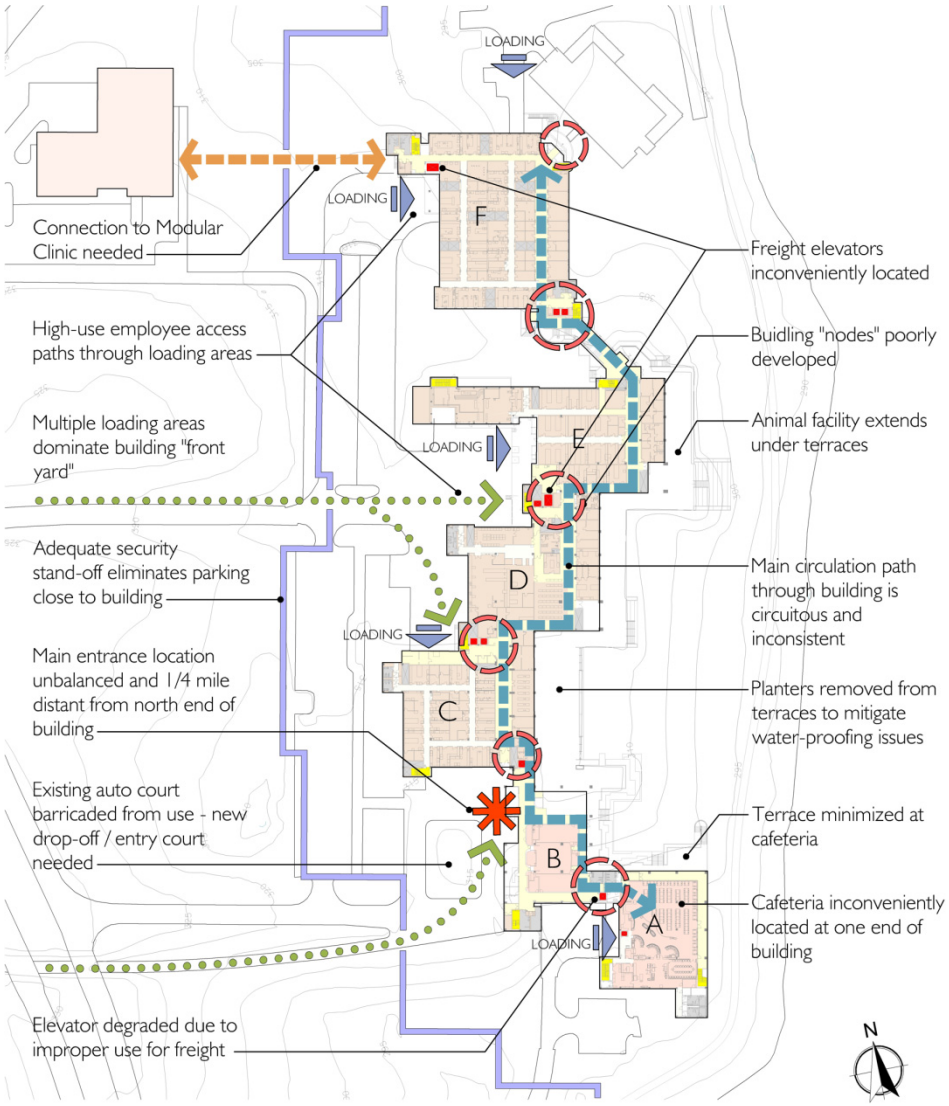


EXHIBIT 3.11: BUILDING 101 - EXISTING DEFICIENCIES



3.8 Existing Building Conditions

NIH houses nearly 1,800 personnel in nine buildings on campus and in two leased buildings off-site. (The two leased building were consolidated into one leased facility in 2009.) Over 80% of the on-campus space is in the Building 101, a four-story + basement structure consisting of seven building modules interconnected to create a linear complex. An evaluation of the campus buildings' physical condition and functional suitability yielded the following key findings:

A. Building 101

- The buildings are uniformly well maintained and in good condition. Selective major maintenance tasks, e.g. replacement of roofs and cleaning and repair of the façade, have been undertaken at appropriate intervals. However, many of the engineering infrastructure systems are almost 30 years old, exceeding their life expectancy and falling short of current laboratory practice standards.
- The building layout is generally functional and flexible for the laboratories, because utility services are distributed in interstitial space and there is a column-free structure. However, the 10 x 20 research laboratory module is smaller than the current standard, and the lab door and window configurations introduce some restrictions. Although flexible internally, Building 101 is not easily expandable because of the floor configurations and interconnections.
- Laboratory infrastructure is aging, and some systems and equipment require upgrading or replacement, for example, fume hoods and exhaust fans, most of which are 30 years old. Original fume hoods are currently being replaced with new hoods with upgraded controls and air handling – at the rate of about four hoods per year.
- Emergency power in Building 101 is in need of augmentation. Existing emergency power generators were sized to provide 20 amp emergency power circuits for each lab, in addition to life safety and HVAC emergency power loads. This is not sufficient for equipment that requires continuous power such as freezers. Currently in the building, there are about 700 freezers (for biological samples). Many of them, specifically the -80° freezers, require emergency power, and the current emergency power capacity is not adequate.
- The Animal (Vivarium) Facility is located in the basement level of Modules C, D and E. The infrastructure that serves it limits the type of caging and rodent capacity and affects operations due to temperature, humidity, and airflow problems. The ability to maintain water temperature and steam pressure for cage wash and autoclave operations is a recurrent problem. The automated feed and bedding delivery systems have had ongoing operational problems as have water leaks in the animal areas.
- Energy conservation could be significantly improved. The original HVAC system is constant volume dual duct system with constant volume mixing boxes and pneumatic controls. An upgrade and retrofit is in progress, but the systems will still operate in constant volume mode. The original lighting fixtures in the offices, which used T12 lamps, magnetic ballasts and limited controls, are now being replaced with T8 lamps and high efficiency electronic ballasts.
- Most campus buildings have some issues in their fire and life safety systems, and many facilities are in minor violation of the Uniform Federal Accessibility Standards (UFAS) requirements.
- Lab needs have grown over time, making the lab floors overcrowded and filling most of the original support spaces and many offices with lab functions. Operationally, there are few convenient break areas, group meeting spaces and other support spaces. Equipment and furniture in the hallways inhibit accessibility and creates a safety hazard.
- Building 101 has little visual presence as an Institute headquarters, and seemingly, no front door. The entrance is located at one end, and the door is not visible from the entry drive or sidewalk. The back of the building, where there are loading docks, faces the parking lot and pedestrian entrances.
- Circulation through the building is similarly unremarkable, with circuitous corridors and no circulation hierarchy. Elevators in the junctions of Module A-B and B-C are single elevators, and appear to be

undersized, resulting in above-average waiting time by current standards. Service elevators have functional problems – in terms of limitations in locations, size, and shared use.

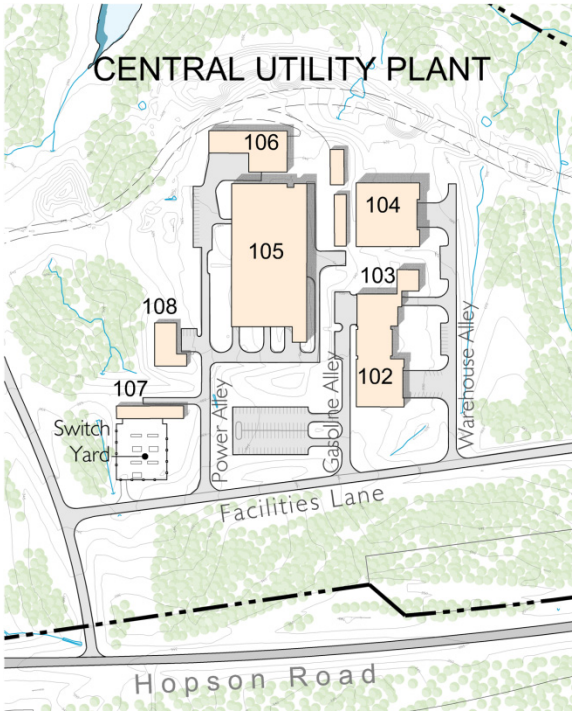
- The cafeteria takes advantage of the lake view with expansive windows and a small outdoor patio, but the remaining public spaces do not. There is an opportunity on the first floor to visually/physically connect with the lakefront, especially where support spaces are located along the "lake" wall.
- The current animal facility, containing about 40,000 nasf, is located in the basement of Building 101 and is landlocked. Its Animal Bedding and Feed (ABF) building is located on the main level adjacent to 101 E loading dock. Some of its administrative and support spaces are outside the main animal facility while its warehouse storage area, the incinerator and the waste disposal facility are located in the Central Utilities Plant.

B. Central Utility Plant Complex (CUP)

- The CUP Buildings relate comfortably to the site and to each other, creating a series of landscaped open spaces between the structures. Buildings 102 through 107 were constructed with the initial site development while Building 108 was constructed in 1997-98 and expanded in 2001. The buildings have a uniform appearance and the area is well-maintained and the site is functional from an access and service standpoint
- The CUP has sufficient capacity to provide heating and cooling to NIH and EPA. These buildings were expanded in capacity when the EPA facilities were built. However, there have been ongoing operating concerns including controls and the ability to operate efficiently. While some improvements have been made, no substantial or totally effective revisions have been implemented. Accordingly, an in-depth evaluation of the systems has been recommended.
- Most portions of these buildings are in fair to good condition, and except for buildings 102, 104, and 106, all others have a Facility Condition Index (FCI) of over 90. Some of the buildings require replacements of aging systems and infrastructure.
- The safety of Building 107 is at risk, as the building is not equipped with any fire suppression system.
- In general, the CUP buildings all have similar accessibility issues such as non-compliant bathroom fixtures and emergency exit signage.

The existing campus buildings are an integral part of the new Master Plan, and are to be renovated as needed to correct the deficiencies noted above. All will remain in use, except the modular outpatient clinical center, which has a planned phase-out.

Exhibit 3.12: CUP Buildings



102 Administrative Offices and Shops
103 Chemical Storage
104 Warehouse Storage & Server Room
105 Central Utility Plant (CHW/HTHW)
106 Incinerator
107 Electrical Switch Room
108 Waste Handling

3.9 Current Space and its Utilization

The review of existing space and its utilization provides a snapshot of the institution as it works today. The planning team used database information provided by NIH augmented by observation and discussions to analyze use patterns to assist in the planning effort. The statistics and findings here are based on the situation as of December 2006, although we realize that space assignments are dynamic and some minor variations may have occurred since that time. Key findings relevant to the Master Plan are the following:

- This campus is primarily a lab-based research facility, with approximately 50% of the space devoted to biology research labs and related functions. The administrative office space houses both personnel supporting the scientific research functions and personnel administering other NIEHS programs. Space is leased off-campus to house approximately half of the administrative office functions.
- The amount of existing space per person (utilization) is below the 2006 NIH guidelines for common space/amenities (fitness, break rooms etc.) and somewhat below the guidelines for both lab space and office space. Space utilization is shown for 2006 in net assignable square feet (nasf) per person. Office space utilization on campus is 145 nasf/person (guideline is 160 nasf/person). Office space utilization off-campus is 192 nasf/person (guideline is 190 nasf/person). Lab space utilization is 177 nasf/person (guideline is 200 nasf/person). Informal meeting rooms and break rooms that were originally designed into the building have been converted to lab space over time. There is less than 1 square foot of lab ancillary space per researcher.
- Leased space in Nottingham Hall and Building 4401 is used primarily for administrative office space. Each office building is located within a 10 minute drive from the main campus, although not in the same direction. Some office support functions, such as copying and conference facilities are duplicated because of the separation. (These two buildings, occupied in the first phase of this study, have been consolidated into a new lease at the Keystone Building, located at 530 Davis Drive.)
- Lab spaces are successfully used in a variety of configurations, and are relatively easy to change. Different lab groups organize their work space to suit them, some sharing support space, some not, some separating research offices, others not. Lab core space is approximately 30% of the total lab space, with the animal facilities, NMR, glass washing and media prep comprising most of it.
- Lab modules are the basic building block of lab assignment. Lab modules in all buildings are nominally 10 feet wide and 20 feet long, although their use is somewhat compromised by the architectural design. The windows open "in" making the adjacent space unusable for equipment or stationary research. Likewise, corridor doors open "in" and their swing limits the placement of equipment and the flow within the lab. Therefore, the effective usable space within the lab is less than 200 nasf.
- The animal facilities were designed to serve the labs in modules C, D and E. When Module F was built, no additional animal facilities were included, although the research space increased by 43 %. The animal facilities need to be expanded to support the current use, plus the change in NIEHS emphasis to more clinical-based research is expected to increase the need for animal space.
- Lab floors are visibly crowded, and support equipment and freezers are located in any available area, including corridor nooks and former meeting or break rooms. Freezers are the most typical lab equipment to crowd shared support rooms, corridors and former break areas. At this time, there are approximately 700 freezers in Building 101. Scientists have the option of sending their freezers to an off-campus facility.
- The current space in animal facilities is over subscribed. The animal cage utilization is consistently at a very high rate of 85% to 90%. As a result the NIEHS outsources antibody production, most rodent rederivation, most cryopreservation and some rodent breeding. This is to retain a minimum amount of rodent housing space for emergency use. Almost at full capacity, the facility is deficient in spaces for existing operations such as clean cage/storage, rodent housing, quarantine for incoming animals, rodent behavior testing, administrative space, break and locker rooms etc.

Exhibit 3.13: Building 101 Organizational Distribution of NIEHS Components

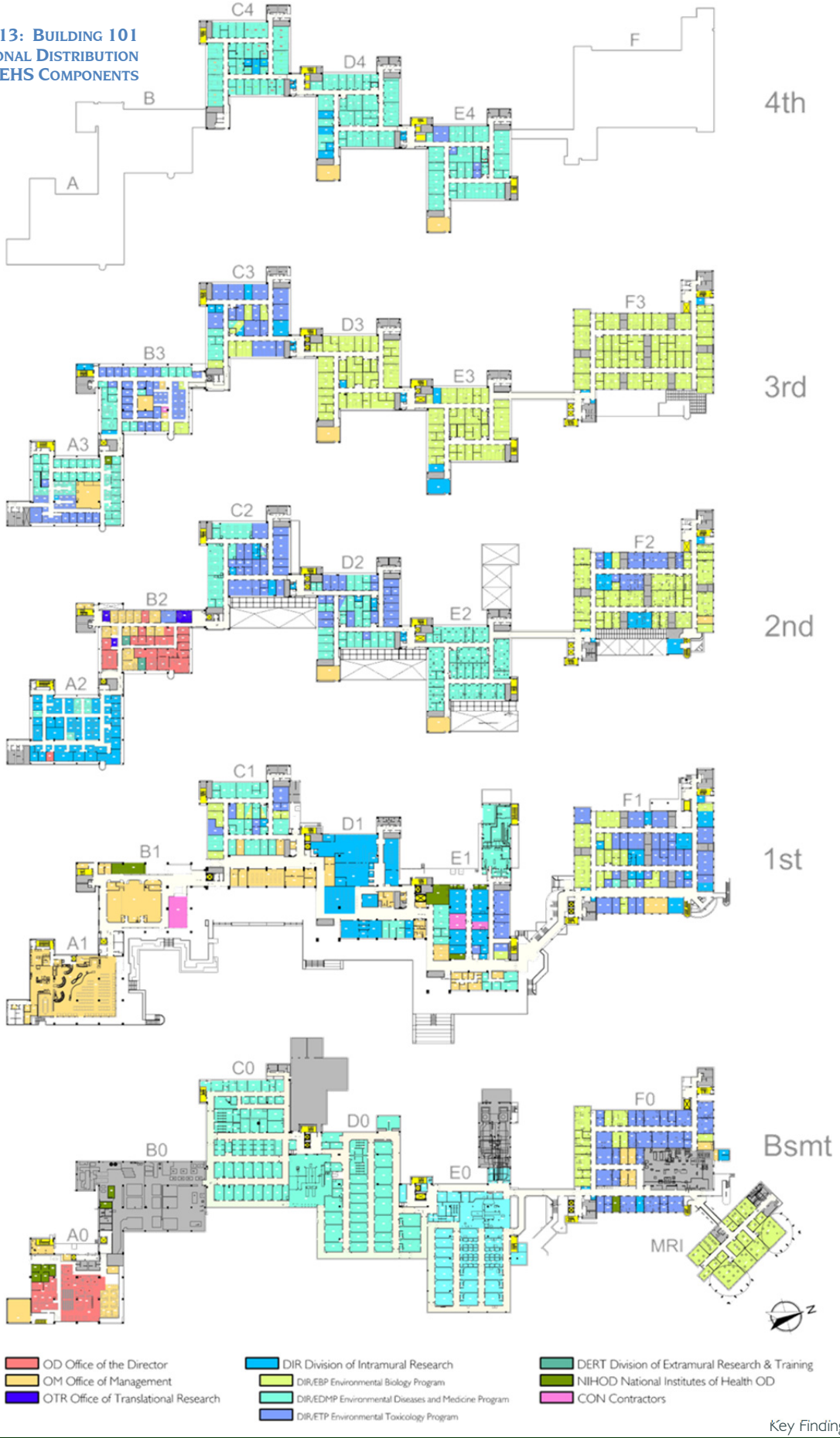
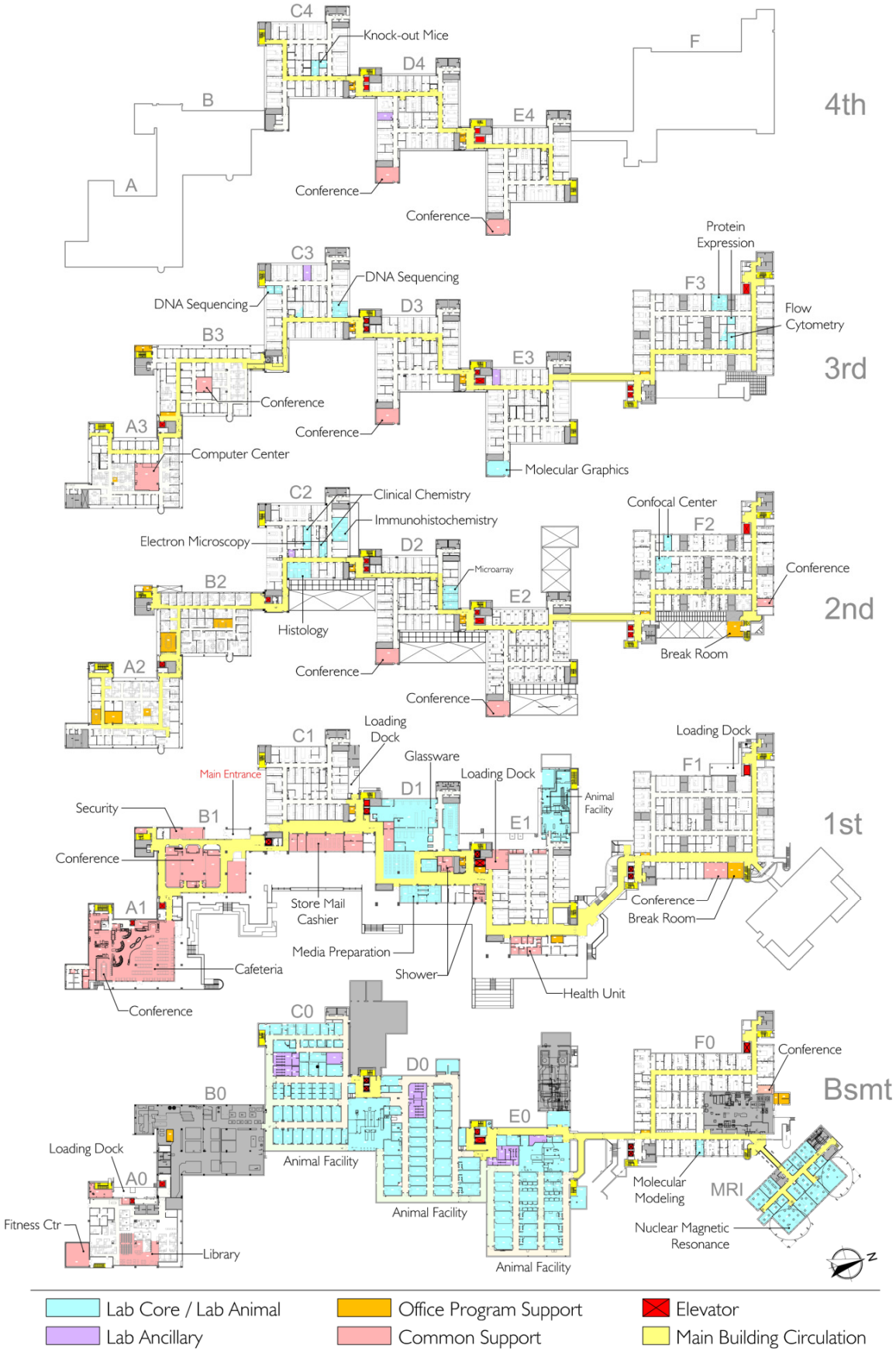


EXHIBIT 3.14: EXISTING NIH SPACE INVENTORY AT RTP

Building	Net Assignable Square Feet	Gross Square Feet	Primary Usage
Building 101 - Module A	31,494	54,180	Offices / Support
Building 101 - Module B	20,595	50,013	Offices / Support
Building 101 - Module C	43,511	164,281	Research
Building 101 - Module D	49,913	174,026	Research
Building 101 - Module E	49,550	186,432	Research
Building 101 - Module F	54,459	226,190	Research
NMR (MRI) Building	5,728	8,795	Research
Building 101and MRI subtotal	*255,250*	863,917	
Subtotal w/o interstitial space and penthouses		459,772	
Modular Clinic	12,352	14,145	
Building 102	20,280	30,033	Offices / Support
Building 103	2,283	2,412	Chemical Storage
Building 104	22,285	24,842	Warehouse / IT
Building 105	2,403	79,395	Utility Plant
Building 106	205	17,293	Incinerator
Building 107	0	10,890	Switch Room
Building 108	4,414	8,333	Waste Handling
South Campus Total	*51,870*	173,198	
Campus Total	319,472	1,051,260	
4401 Building*	33,588	46,626	Offices - Leased
Nottingham Hall*	19,446	26,922	Offices - Leased
Warehouse	23,471	24,150	Storage - Leased
Leased subtotal	76,505	97,698	
Grand Total	**395,977**	**1,148,958**	

* Leases consolidated in January 2009.

EXHIBIT 3.15: BUILDING 101 CIRCULATION AND SUPPORT SPACE DISTRIBUTION



3.10 SPACE PROGRAM FOR THE MASTER PLAN

The space program is a planning tool that identifies the square footage and types of space needed under the Master Plan. It defines new buildings, expansions and other space changes that are needed to address NIEHS's research requirements. The NIH-RTP Master Plan program was projected from 2007 to 2027, a twenty year period. Obviously the short-term space projections are the most accurate; nevertheless the Master Plan looks ahead in order to create a physical framework that will accommodate gradual growth over time. The NIH-RTP space program accounts for several categories of space:

- Shortfall, or current needs – space needed today to support current functions and current personnel. Shortfall space represents immediate needs to accommodate existing functions – in the program it includes the office space, lab space and the lab ancillary space needed to reach the NIH utilization guidelines.
- Program needs – space needed to support new or changing functions (sometimes this could be considered Shortfall space). NIEHS identified priority facilities required to support their mission-related program and research, and these include the permanent clinical research center, conference center, and vivarium expansion. Employee amenities are included in this category, although they could be considered shortfall – fitness center, meeting area, coffee bar, employee store etc.
- Growth – projected space based on anticipated growth of personnel over time. Staff growth has been projected over the next 20 years, based on the employee trends form past census data – at a conservative 2% staff increase per year starting in 2012. Space was assigned to accommodate the anticipated employees, using the NIH guidelines.
- Existing space, determined from the survey and utilization study.

The overall 20-year growth in personnel is projected at approximately 40%, based on historic patterns. The net assignable square footage (nasf) need was projected to grow by close to 60% over the existing usable square footage on campus. This is attributable to the categories described above, and includes several new components: a new permanent clinical research center, a conference center, and other missing employee amenities. Major expansion of the vivarium is also anticipated to support the current focus of biomedical research on animal models.

EXHIBIT 3.16: PROGRAM PROJECTIONS[1] (EXCLUDING PARKING STRUCTURE AND CIRCULATION LINK)

	People	Net Square Feet	Gross Square
Existing	1,740	396,000	1,149,000
Projected to 2027[2]	2,450	621,000	1,658,000
Difference	710	225,000	509,000

[1] All areas are rounded

[2] Projected People based on 2% /year growth starting in 2012 (with earlier vivarium staffing)

Projected space need does not equal the space to be constructed, because some existing facilities will be replaced, additional space will be needed to integrate new buildings into design, and because of the construction of structured parking.

3.11 Governing Regulations and Constraints

The NIH-RTP campus is within the jurisdictional boundaries of Durham County and is therefore subject to the use and development restrictions of the Durham County Unified Development Ordinance (UDO). The zoning designation for the campus is "Science Research Park," a district which allows business, scientific research and development, training, production of prototype products, plans or designs as well as associated office and support facilities in a low-density, open, campus-like setting. The development restrictions that are particularly relevant for the NIH-RTP campus are: up to 250 foot setbacks from public streets; up to 150 foot setbacks from adjoining lots; a maximum of 15% lot coverage[1]; and, a maximum building height of 120 feet which can be extended to 145 feet with approval from the Durham County Board of Adjustment[2]. The southwestern-most portion of the site falls within a designated Watershed Protection Overlay (Falls/Jordan District), which generally limits the amount of impervious surface to 24 percent for low density option and 70 percent for high density option[3]. Other applicable development restrictions include: tree coverage standards requiring 10-15% of preserved and replaced trees; floodplain and flood damage protection standards; steep slope protection standards that require adaptive designs with minimum disturbance and impact on the slopes requiring minimal grading[4]; and wetland protection standards.

Exhibit 3.17: Governing Regulations and Constraints

A compilation of the various environmental and regulatory constraints on the site, and other areas that are not suitable for development such as excessive slope, flood plain, zoning setbacks, and security buffers, determine the suitable areas for development. This analysis is shown above.

[1] Lot coverage limits apply to building footprints only.
[2] Durham City/County Unified Zoning Ordinance, as of December, 2008
[3] Details of these options and provisions for exceeding the stipulated limits under certain conditions are available in the Durham City/County Unified Zoning Ordinance
[4] The UDO defines steep slope areas as land areas that have a grade of 25 percent or more, have an area of 5,000 square feet or greater, and are located within 200 feet of any foldaway fringe or perennial stream or within 100 feet of an intermittent stream. Stipulations include minimizing disturbance to the natural land form; using terrain-adaptive design and construction techniques; limiting grading to 15 percent of the steep slope area; and, minimizing the impact of street construction on steep slope areas.

3.12 Other Development Constraints and External Site Influences

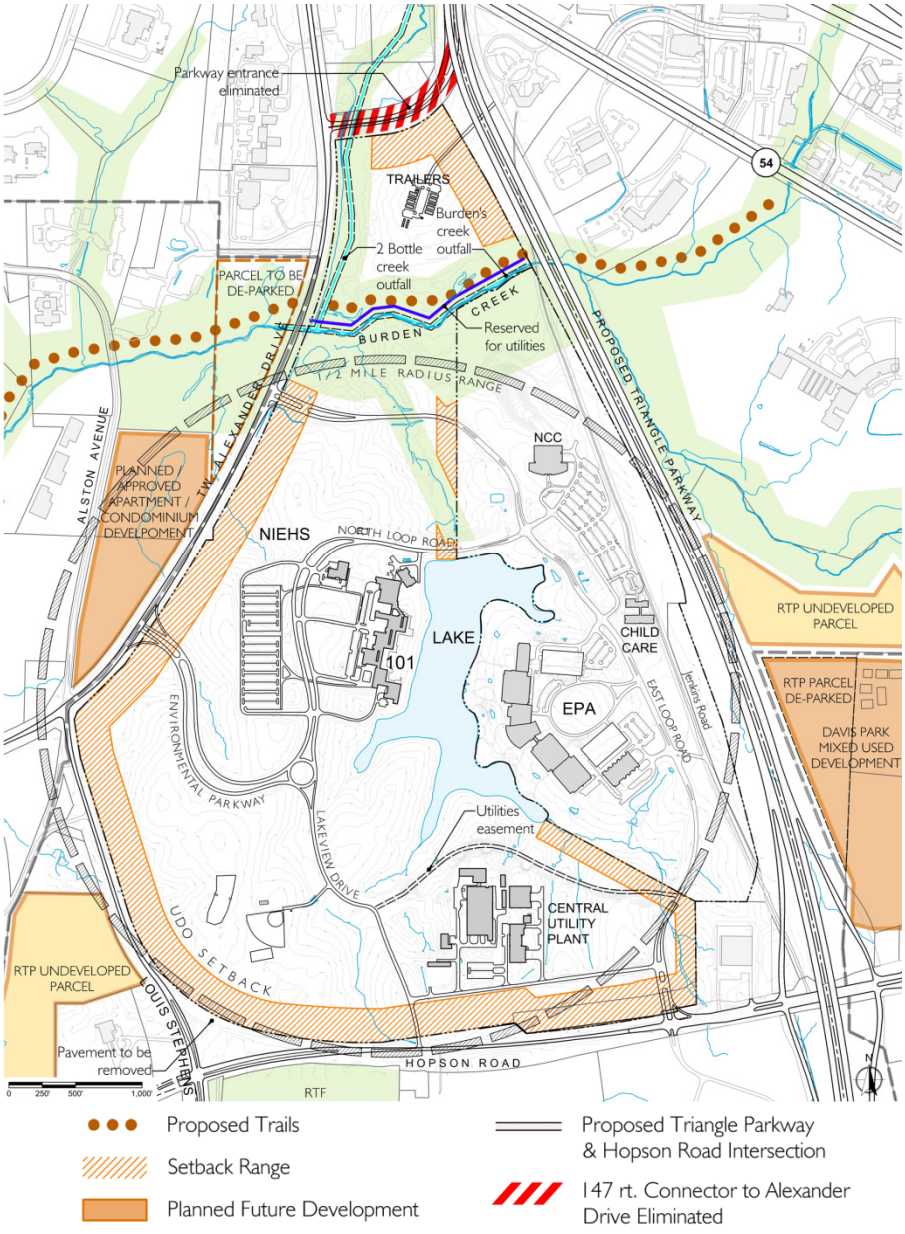
The NIH site is subject to influences by a number of external developments in its immediate vicinity. These include development projects adjacent to the site, new road construction including the Triangle Parkway, plans for the local and regional open space and trail network, and the regulatory requirements of the Durham County Unified Development Ordinance.

Triangle Parkway: The master planning effort commenced while the Triangle Parkway was still "proposed." It runs along the east side of the NIH-RTP and EPA campuses, and was expected to significantly affect the site environment. As a six-lane, limited access divided toll road, the Triangle Parkway would generate significant noise along the east site boundary, remove a significant number of trees, and change the travel patterns for NIH and EPA employees due to elimination of the Durham Freeway connector to TW Alexander Drive (NC 147 spur).

Adjacent Developments: To the west of the NIH-RTP campus, between T.W. Alexander Drive and Alston Avenue, a development for offices and retail has been approved. This development is planned to include a portion of RTP (purchased from the Research Triangle Foundation) site to its northeast that will count toward the development's open space requirement.

Another development project that is under construction is Davis Park, located east of the EPA campus and abutting the Triangle Parkway right-of-way. Davis Park will occupy a large parcel of land stretching east all the way to the railroad tracks, bounded on the south by Hopson Road, and on the north by RTP (on the west side of Davis Drive). Davis Park will include 1800 dwelling units, retail, and commercial space.

Exhibit 3.18: Other Constraints and External Site Influences



3.13 Master Plan Alternative Concepts

Three alternative concepts were developed, exploring different approaches to accommodate the future space program and the Master Plan goals. The alternatives were reviewed with NIH and NIEHS with an evaluation of the advantages and disadvantages of each. Concept C, with some elements of Concept B was the preferred alternative to be studied and explored in Phase II of the Master Plan. This hybrid concept would establish the Campus Center and allow for future growth adjacent to Building 101, and also locate an iconic building for public functions on the nearby lake peninsula. The following is a brief overview of the alternatives:

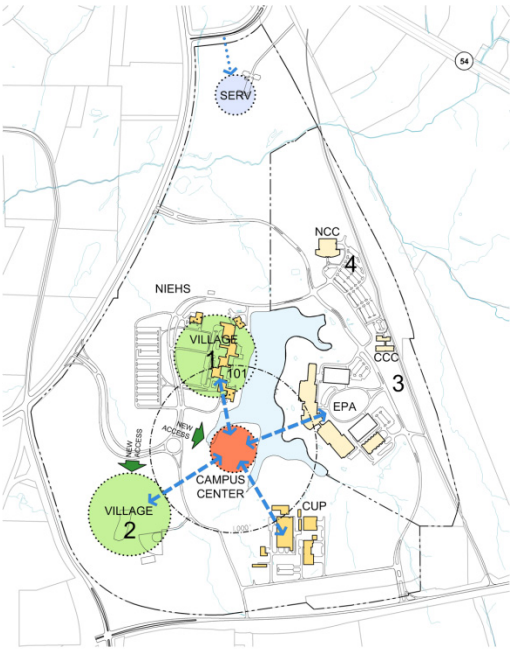
A. Concept A: Academic Villages

This concept proposes two science centers sharing a Campus Center of shared common services. One center is Building 101, and the second center is a new cluster of buildings on the hill to the south. The Campus Center is to be located on the peninsula. Outdoor pathways and visual corridors connect the centers.

Key Advantages: Each center has its own character and relationships to the site, recognizing the natural features and beauty; and, construction and growth can be easy and non-disruptive.

Key Disadvantages: Disperses activity across the site, making casual interaction and some shared research more difficult; disturbs the natural features on 2 new areas of the site; and, the peninsula pavilion (Campus Center) and new center need to be built at the same time to unite the campus.

Exhibit 3.19: Concept A Illustration



A - ACADEMIC VILLAGES

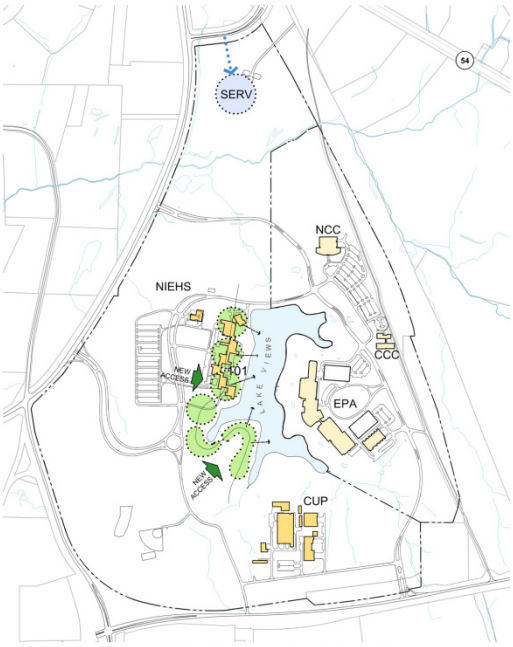
B. Concept B: Lakeside Promenade

This concept proposes a linear array of buildings along the lakefront, and takes advantage of the view and incorporating a promenade along the lake. A new building cluster is built on the peninsula connected to 101 Module A by a bridge. Lab functions are accommodated in 101 with some renovation and expansion.

Key Advantages: Concept takes advantage of the lakefront setting and acknowledges that it is the defacto front of Building 101; and, buildings designed for non-lab functions can be a lighter, more welcoming structure.

Key Disadvantages: Special care will need to be taken with lakeside construction to avoid erosion and environmental damage; and, expansion and renovation of Building 101 will be disruptive.

Exhibit 3.20: Concept B Illustration



B - LAKESIDE PROMENADE

C. Concept C: Town Center

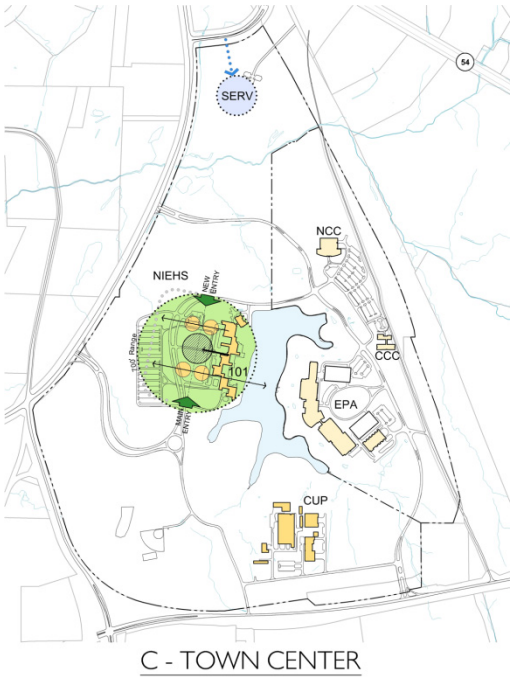
(now called Campus Center)

This concept proposes a campus formed around Building 101. The new development creates a "downtown" campus center pavilion that welcomes visitors, consolidates common services and links new facilities to the existing Building 101.

Key Advantages: Creates a new image for Building 101 and a lively campus hub that can encourage casual interaction; consolidation provides easy access to all facilities and therefore flexibility in assignment and location; and, most tolerant option for incremental growth / funding.

Key Disadvantages: Phased construction around Building 101 would be more complex and disruptive; and, creates more density, concentration of activity, cars etc. requiring a parking structure.

Exhibit 3.21: Concept C Illustration



3.14 Selected Concept

The process for selecting a preferred alternative included presentation of the concepts to the staff and directors at NIEHS and NIH for input and discussion. The concepts were evaluated by the design team for: campus image; function and program fit; sustainability and environment (including tree removal, site disturbance, impervious surfaces added, floodplain and wet land incursion etc); security and circulation; and overall support of the campus vision. The design team found that "Concept C" had the least environmental impact due to its concentrated development, and at the same time was the best fit with the master plan vision for creating a lively campus. This recommendation was ratified by NIEHS employees and leadership.

Exhibit 3.22: Illustrative Plan of Selected Concept

4.

PROGRAM FOR GROWTH AND CHANGE

4. PROGRAM FOR GROWTH AND CHANGE

The National Institute of Environmental Health Sciences (NIEHS) is the primary tenant of the National Institute of Health (NIH) campus at Research Triangle Park (RTP), sharing it with the NIH Office of the Director staff. The facility has approximately 319,500 net assignable square feet (nasf) of space in their fourteen campus buildings, plus approximately 76,500 nasf in leased space nearby. The majority of the on-campus space is located in the seven interconnected building modules of the Rall Building, also called Building 101. Also on-campus are seven smaller buildings housing support and utility spaces, plus an MRI Building attached to the Rall complex. Approximately 60% of this on-campus space is lab, vivarium and lab-related space. Leased space in a nearby commercial building is used for offices, and another building is leased for warehouse use.

In 2007, NIH-RTP site population, based on the annual census, was 1,740. NIH Office of the Director (NIHOD) personnel accounted for 241 of the staff, including employees and contractors, with another two persons from the World Health Organization. Of the 1,740 total, 1,472 were located on campus and 268 in leased facilities.

The space needs of current and future NIH employees are constantly shifting, modulating with the rise and fall of research projects, changes in staff assignments, and shifts in NIH priorities and budget realities. For the Master Plan, space requirements were projected based on historic patterns, current usage and the NIEHS/NIH goals developed for the Plan – realizing that the program components and square footages are a framework for the Master Plan and will be reviewed with each construction project.

The space program for NIH-RTP was developed with NIH/NIEHS participation, and analysis of the current space use and NIH data base information. The planning team interviewed representatives of each group at RTP to

understand their requirements and estimate the space necessary to accomplish their functional goals. The program was based on the following:

- Review of NIH guidelines for labs, office space and amenities
- Analysis of the existing RTP space, its use and assignment
- Projections of staff growth based on the patterns of historic personnel data
- Interviews with each group at RTP about their program needs, future direction and goals
- Consideration of the overall NIH goals for the campus and the Institute's specific goals

Space was projected for a twenty year period – 2007 to 2027 – to provide the framework for the Master Plan. The anticipated usable square footage (net assignable) required is anticipated to increase by approximately 60% in 20 years. This is based on a projected 20-year growth in personnel of approximately 40%, and space needs generated by research/functional needs and employee amenities. The NIH-RTP Master Plan program is derived from space needs in several categories: 1) Shortfall, or current needs – space lacking today to support current functions and current personnel; 2) Program Needs – space needed to support new or changing functions; 3) Growth –projected space based on anticipated growth of personnel over time; and 4) Existing Space, determined from the survey and utilization study.

4.1 Five-Ten Year Needs, Including Shortfall

Priority needs are those shown in the first phase of Master Plan growth, and include space required to meet the critical shortfalls and the needs projected for the first 5 to 10-years. The program centers around new functional needs of the NIEHS related to scientific research and space lacking for amenities and allocations that do not meet NIH guidelines. New square footage is included for the following:

- E*ntrance pavilion and plaza*. A welcoming entry and a recognizable "front door" are established in the first phase, bringing together spaces to help unite the Institute and encourage collaboration.
- E*mployee Amenities*. NIH-RTP has very limited employee amenity space, and one of the core Master Plan goals is creating a vibrant interactive campus and adding amenity space to encourage this. Based on comparison with NIH's Guidelines for Services and Amenities within NIH Facilities, space was projected for a cyber café/coffee bar, fitness center and lockers/shower, employee store, and others. Although these needs are immediate, some may not be addressed in the first construction phase because of unacceptable disruption.
- *Conference Center*. Encouraging scientific collaboration is the goal driving the need for a conference center, both for internal seminars/training and outside conferences. The existing facilities are too limited in size and number for either. A shared conference center with neighboring EPA has been discussed, which if considered would require more square footage than indicated here.
- *Replacement Office Space*. One of the Master Plan goals is the consolidation of NIH operations, bringing off-campus staff back from leased office space locations. A locational shift in square footage is shown, rather than an increase. This would be timed to coincide with the ending of the current lease in 2018.
- *Lab Ancillary Space*. Like the general employee amenities, staff support space related to the labs is lacking. Over the years, the increasing science needs of the laboratories have subsumed any amenity space within the lab modules (less than one sf per scientist remains). The 5-year program includes space for lab break rooms based on the NIH Design Policy and Guidelines.
- *Vivarium/Animal Core Expansion*. The existing vivarium is in good condition, with an excellent health status rating and high utilization/assignment rate. Additional specific animal groups are housed off-site under commercial contracts. NIEHS has submitted a Buildings and Space Plan request for the design and construction of enhanced animal facilities, with added cages, an inhalation toxicology section and an upgraded quarantine/isolation section. For the Master Plan, the requested square footage of 40,000 nasf (80,000 gsf) was utilized. Based on NIH discussion, the requirement would be implemented in two separate Master Plan phases. The first phase includes 40,000 gsf of vivarium expansion

- *Warehouse*. A joint on-site NIH-EPA warehouse is in the planning stages. It would replace both agencies" existing leased warehouse spaces..
- *Parking*. The new office building would house the returning off-campus staff, creating a requirement for additional parking.
- Visitor *Center*. A visitor reception and screening center near the main entrance is in the advanced planning stages by NIH, and is expected to be completed before Master Plan Phase 1.

4.2 TEN-FIFTEEN AND FIFTEEN-TWENTY -YEAR NEEDS

The later Master Plan space program is divided into two additional phases, Phase 2 in ten to fifteen years, and Phase 3 in the following five years. Many of these future space needs are based on staff growth and related functions. Although the Master Plan separates the program into these two growth phases, the sequence of construction may vary. New square footage is included for the following:

- *Personnel Growth*. Personnel is projected to grow approximately 40% over the next 20 years, and the corresponding additional facility space is planned. Included are offices, labs, support and amenity space – all corresponding to NIH guidelines. Within the lab allocation, expansion of Magnetic Resonance Imaging and other technologies is anticipated.
- *Research Buildings 1and 2*. Space provision for laboratories, inclusive of the shortfall, has been shown in Phases 2 and 3. This phasing responds to the immediate NIEHS priorities for vivarium expansion and consolidation of off-site office in Phase 1. However, the Master Plan has the flexibility to build laboratories in Phase 1 if there is a shift in NIEHS priorities.
- *Office and Lab Shortfall*. Space for both labs and offices are based on per-person allocation guidelines from NIH's Design Policy and Guideline. The existing laboratory shortfall, although needed now, has been shown in the second phase because of expected funding priorities. These needs could be folded into the project for the first Research Building.
- *Clinical Research Center*. To support the current focusing of the NIEHS mission to include patient-related research, a permanent Clinical Research Center is planned that would replace the recently constructed modular outpatient clinic. The permanent clinic was included in the original approval for the modular clinic.
- *Vivarium/Animal Core Expansion*. The second portion of the vivarium expansion is planned for Phase 3.
- *Parking*. The latter phases of the Master Plan require more parking. Additional structured parking is planned, to meet both the environmental goals and proximity demands.

In addition to the projected space needs in the Master Plan program, a Master Utility Plan (MUP) is underway under another contract. The MUP may uncover needs for the campus Central Utility Plant, shared by NIH and EPA. Additionally, the information on projects identified in this architectural Master Plan would be provided to Sud Associates, who should take that into consideration when developing the MUP.

4.3 SPACE PROGRAM

Square footages are shown in terms of both net and gross square feet. Net assignable square footage is the area that is usable and assigned to specific personnel groups, such as offices and labs. For administrative space, net includes the office areas and the secondary circulation within the suites. Gross square footage covers the entire building, including the bathrooms, corridors, mechanical spaces, etc. The ratio of net-to-gross varies for different kinds of space; for example, the lab spaces at RTP have a very high net-to-gross ratio because the interstitial space is part of the "gross". (Interstitial space is a separate floor over each lab floor that contains the mechanical equipment for the labs). For the Master Plan, gross square footage is the building block, because it represents the entire building or addition that must be included in the plan. Cost estimates would be based on gross square feet. Exhibits 4.1 and 4.2 provide projections for program space.

The space program must be considered as projections based on assumptions and existing priorities of the Institute. These projections are not definite requirements but provide the planners a basis to develop a framework for the Master Plan. They do not represent pre-approval of individual facilities projects. The financing and approval of any project must be addressed within the annual HHS building process and the HHS Capital Investment Review Board mechanisms.

EXHIBIT 4.1: SPACE SUMMARY – CONSTRUCTION AND DEMOLITION BY PHASE

	Existing GSF	5-10 Year GSF	10-15 Year GSF	20 Year GSF	Total GSF	Notes
		Phase 1 Added Space	Phase 2 Added Space	Phase 3 Added Space	End of Phase 3	
On-campus						
Office – in 101	78,600	-	see Research below	see Research below	78,600	Office growth built in concert with Research Bldgs
Office – in 102-108	17,300	-	-	2,100	19,400	
Office – New	-	95,400	-	-	95,400	Office + related support
Related Amenity		4,200			4,200	Extramural Council Rm.
Lab & Cores	616,200	-	-	-	616,200	
New Research Bldgs.					313,700	
Lab & Cores			122,200	134,000		
Office Growth	see above	-	19,100	24,200		
General Support	-		1,400	4,600		
Common Amenities			1,700	6,500		
Vivarium	115,300	40,000	-	40,000	195,300	
Support - General	21,600	9,900	see above	see above	31,500	Phase 2/3 included with Research Buildings
Common Amenities	32,300	40,600	see above	see above	72,900	
Infr. Support-102-	155,900	-	-	-	155,900	
Clinical Res. - Modular	14,100	-	-14,100	-	0	Perm replaces temp
Clinical Res. – Perm.	-	-	50,000	-	50,000	
Warehouse – new[1]	-	25,000	-	-	25,000	
Office, Research and Support - Subtotal	1,051,300	215,100	180,300	211,400	1,658,100*	
Other MP Space[2]						see note 2
Design Integration	-	15,000	10,000	10,000	35,000	
Pedestrian Link 101	-	-	20,000	-	20,000	
Parking Structure -new	-	150,500	122,500	217,000	490,000	
On-Campus – Total	**1,051,300**	**380,600**	**332,800**	**438,400**	**2,203,100**	
Off-campus						
Office + common sup.	73,500	-73,500	-	-	-	New replaces leased
Warehouse	24,200	-24,200	-	-	-	New replaces leased
subtotal	97,700	-97,700	0	0	0	
Master Plan Program - Total	**1,149,000**	**282,900**	**332,800**	**438,400**	**2,203,100**	
Total Released/ Demolished	-	97,700	14,100	0	111,800	
Total Construction	-	380,600	346,900	438,400	1,165,900	

**For further breakdown, refer Exhibit 4.2*

Notes:

[1] A shared warehouse with EPA is in the design stage, to be on-campus at total size of 68,000 gsf for both agencies.

[2] Additional square footage is needed to accomplish the Master Plan concept and to integrate the new space into the existing campus. This space includes new circulation, expanded building service, and renovated/reconfigured space in Building 101.

GSF Rounded to nearest 100.

For cumulative increase by phase, refer to Exhibit 1.6.

EXHIBIT 4.2: PROJECTIONS FOR PERSONNEL, NET ASSIGNABLE AND GROSS AREAS

	EXISTING			ADDED SPACE -- PROJECTIONS											TOTAL PROGRAM			NOTES
				SHORTFALL		5-10 YEAR			10-15 YEAR			20 YEAR						
	People	NASF	GSF est.	NASF	GSF est.	People	NASF	GSF est.	People	NASF	GSF est.	People	NASF	GSF est.	People	NASF	GSF est.	
On Campus Facilities																		
101 -- Office	294	39,276	78,600	7,800	11,700				31	4,960	7,400	101	16,160	24,200	426	68,200	121,900	
101 -- Lab& Cores	841	148,785	616,200	19,420	64,100 [7]				88	17,600	58,100	203	40,600	134,000	1,132	226,400	872,400	@200 NASF /Gross assumes full interstitial space
101 -- Vivarium	68	40,230	115,300			24	20,000	40,000				24	20,000	40,000	116	80,230	195,300	Gross assumes no interstitial
101 -- Support-General [1]	80	10,908	21,600						8	900	1,400	28	3,070	4,600	116	14,880	27,600	4% of net general support (amenities not included)
Emergency Generator Exp.							6,000	6,600								6,000	6,600	
Freezer Storage							3,000	3,300								3,000	3,300	
101 -- Common Amenities																		Implementation of shortfall needs may be phased.
Conference		3,520	7,040				10,000	14,000								13,520	21,000	300 person ctr / extg SF for general conf.shortfall
Extramural Council Room							3,000	4,200	Extramural in leased space now							3,000	4,200	Include with new Office Building or Conferenc Ctr
Cafeteria / Kitchen		8,532	17,060	400	500					420	500	tbd	2,500	3,100		11,850	21,200	seating ; assumes off campus offices return
Fitness Center		884	1,770			2	4,450	6,200							2	5,330	8,000	Fitness center w/ aerobic room & wellness
Health Center		592	1,180	200	300							1	400	600	1	1,190	2,100	
Library		1,718	3,640				400	600								2,120	4,200	study carrels + 2 small media rms
Security Office		804	1,610	200	300					+	+		+	+		1,000	1,900	Additional security space tbd - MP concept
Lab breakrooms etc.				7,570	10,600					790	1,100		1,830	2,600		10,190	14,300	Ancillary space @ 9 nasf / researcher
Recycling areas -- Labs				900	1,300					60	100		120	200		1,080	1,600	60 nasf per lab floor (corridor clearing)
Employee Store							1,000	1,400								1,000	1,400	
Coffee Bar/Cyber Café							1,270	1,800								1,270	1,800	
Secure Bike Storage							2,000	2,200								2,000	2,200	Amount for all phases (per LEED)
Other Amenities [2]							500	700								500	700	
ADA fix allowance				500	700											500	700	Implemented with Building 101 improvements
Subtotal 101	**1,283**	**255,249**	**864,000**	**36,990**	**89,500**	**26**	**51,620**	**81,000**	**127**	**24,730**	**68,600**	**357**	**84,680**	**209,300**	**1,793**	**453,260**	**1,312,400**	
102-108. – Office	56	11,533	17,300	-2,600 [6]					6	0	0	19	1,400	2,100	81	12,960	19,400	
102-108.-- Infr. Support [3]	133	40,338	155,900						14	0	0	46	+	+	193	40,330	155,900	Additional CUP etc.to be determined w/ Utility MP
Subtotal 102-108	**189**	**51,871**	**173,200**	**-2,600**	**0**	**0**	**0**	**0**	**20**	**0**	**0**	**65**	**1,400**	**2,100**	**274**	**53,290**	**175,300**	
New Facilities																		
Clinical Res. - Modular		12,352	14,100						removed	-12,352	-14,100					0	0	modular clinic to be replaced
Clinical Res. - Permanent									new	28,700	50,000					28,700	50,000	
Warehouse						replaces leased	22,000	25,000								22,000	25,000	New on-campus; shared w/ EPA; replaces lease
Office Building [5]					replaces leased	282	61,120	91,700	30	see Note below		70	see Note below		382	61,120	91,700	Staff from leased offices (+ growth) return to campus
Support in Office Bldg.							2,440	3,700				1	0	0	1	2,440	3,700	See Note below
Total on Campus	**1,472**	**319,472**	**1,051,300**	**34,390**	**89,500**	**308**	**137,180**	**201,400**	**177**	**41,078**	**104,500**	**493**	**86,080**	**211,400**	**2,450**	**620,810**	**1,658,100**	
Off Campus Faculties																		
Office -Leased	264	50,653	69,000	-8,400 [6]	--	move to new	-50,653	-69,000							0	0	0	Lease given up
Office Support [4]	4	3,287	4,500				-3,287	-4,500							0	0	0	Lease given up
Warehouse - Leased		22,566	24,200			move to new	-22,566	-24,200							0	0	0	Lease given up
Total off Campus	**268**	**76,506**	**97,700**	**-8,400**	**0**	**0**	**-76,506**	**-97,700**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	
Base Program Totals	**1,740**	**395,978**	**1,149,000**	**25,990**	**89,500**	**308**	**60,674**	**103,700**	**177**	**41,078**	**104,500**	**493**	**86,080**	**211,400**	**2,450**	**620,810**	**1,658,100**	
				PHASE 1 [8]					**PHASE 2**			**PHASE 3**						

NOTES

1. 101 -- Support - General. Mail copy, cashier, shipping, building services, storage, computer, lobby, etc.
2. Other Amenities include: Lactation rooms, ATMs, vending.
3. 102-108 -- Infrastructure Support: storage, shops, garage, waste holding.
4. Off-Campus Support: break rooms, conference, copy, storage, lactation.
5. New Office Building: Phase 1 Build-out is planned for the projected staff in these now off-campus groups (382 persons). In Phases 1 and 2, the Building will accommodate current office shortfall and interim growth of on-campus groups.
6. Shortfall includes 2 negative numbers, indicating that there is more space than NIH space standards would recommend
7. Laboratory shortfall is in cluded in Phase 2 Research Building.
8. Shortfall in common amenities is included in Phase 1.

GENERAL No staff growth is projected from 2007 to 2012, except Vivarium and fitness. From 2012 to 2027, growth is projected at 2% per year.
Total Program does not include design integration space that will be needed to link the buildings.

5.

MASTER PLAN:

CONCEPT AND ARCHITECTURAL FRAMEWORK

5. MASTER PLAN: CONCEPT AND ARCHITECTURAL FRAMEWORK

The NIH-RTP Master Plan is a flexible framework for growth and incremental change over the next 20 years. The plan fulfills the Master Plan goals that promote a lively campus with appropriate facilities for scientific needs. It augments employee amenities, and emphasizes both efficient operation and sustainable practices. The plan recognizes that research priorities, availability of funding and approvals by HHS will determine the implementation of the Plan.

The plan makes optimal use of Building 101 by strategically renovating the building, improving ground level circulation, and providing a new entrance and courtyard. It pragmatically saves, enhances, and re-uses as much of the existing infrastructure and buildings on campus as possible.

The implementation of the Master Plan will require the construction of new buildings and roads, landscaping, utilities upgrades, and maintenance and operations undertakings. The Master Plan would provide direction and control for all these projects through frameworks for each of its components in the order listed below:

- Campus Development, Sustainability and Land Use
- Landscape and Stormwater Management
- Circulation
- Utilities
- Building 101 Improvements

These Master Plan frameworks are intended to be used with the Design Guidelines and the Implementation Plan described later in the report. The first component - Campus Development, Sustainability, and Land Use - is described in this chapter.

NIH and NIEHS have worked closely in developing the Master Plan and its components. The campus development is conceptualized at two levels: the entire NIH-RTP campus, and the more focused development of the Campus Center around Building 101.

The development framework for the entire campus is first described here, followed by that of the Campus Center.

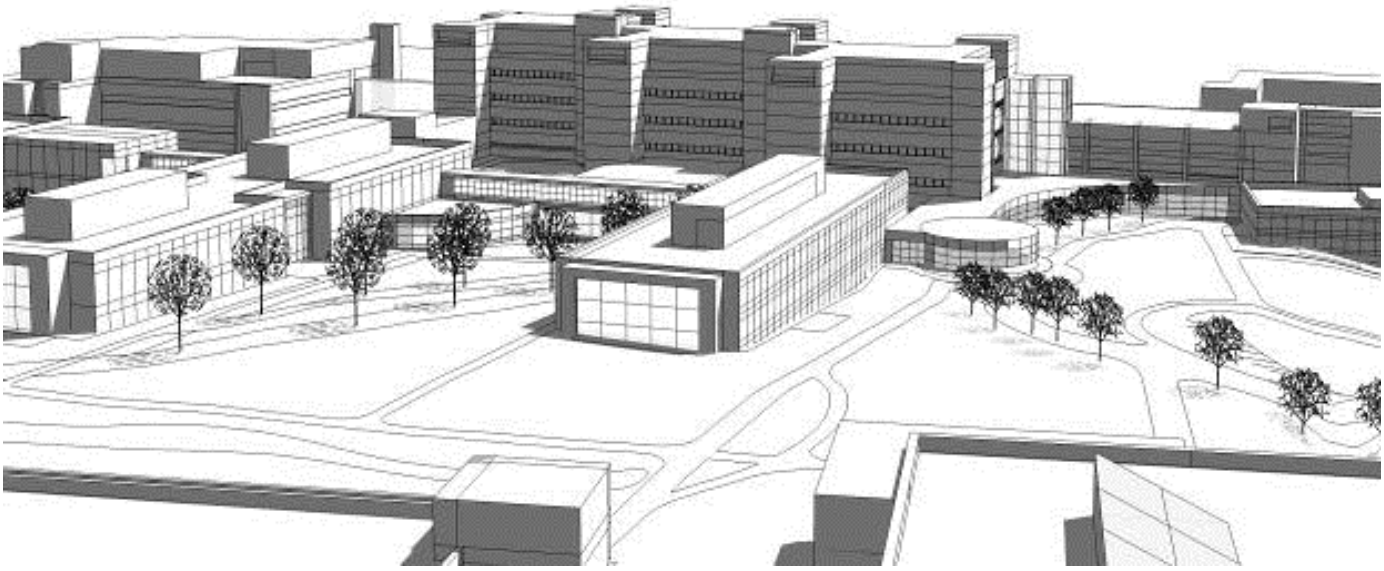
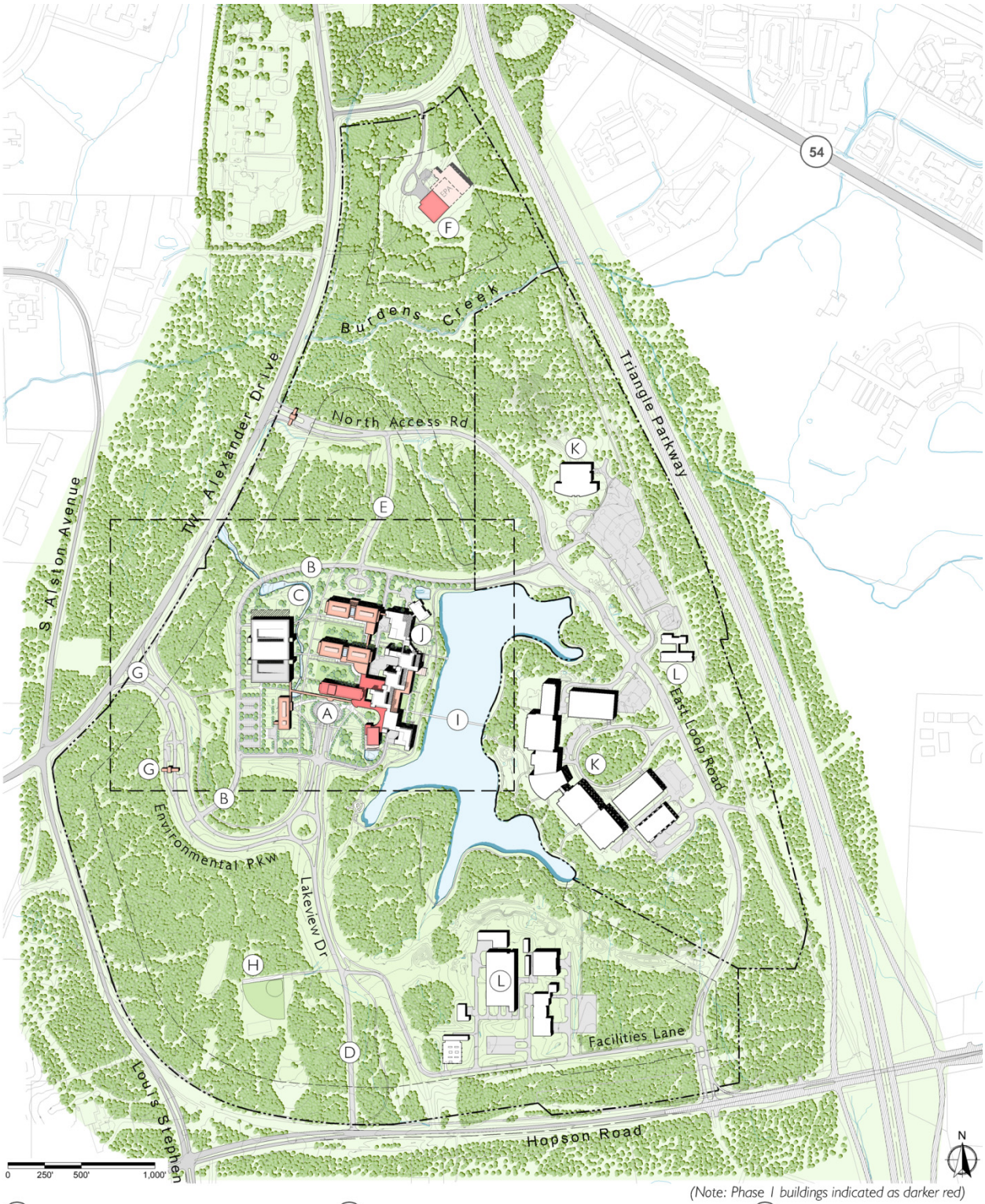


EXHIBIT 5.1: ILLUSTRATIVE MASTER PLAN



(Note: Phase 1 buildings indicated as darker red)

- (A) Campus Center
- (B) New circulation connector
- (C) New stormwater detention feature
- (D) New employee entrance
- (E) New north entrance
- (F) Warehouse - shared with EPA
- (G) Main entrance and visitor center
- (H) Open space, recreation & future development
- (I) Bridge to EPA
- (J) Building 101
- (K) EPA facilities
- (L) NIH/EPA shared facilities

5.1 DEVELOPMENT FRAMEWORK FOR THE ENTIRE SITE

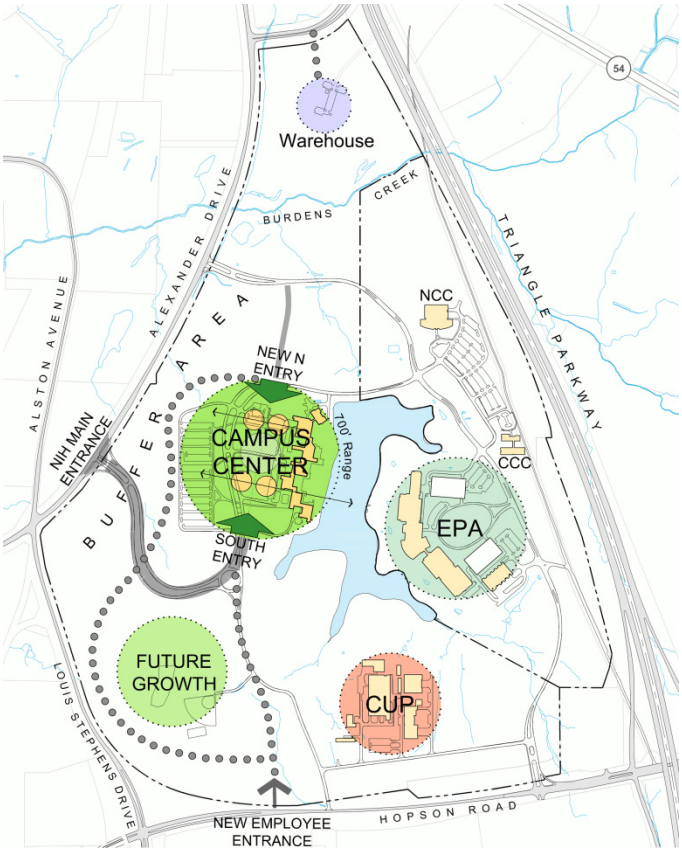
The NIH-RTP Master Plan builds upon the original 1971 Master Plan, following the concept of creating distinct development centers surrounding the lake, and on portions of the site considered to be most environmentally suitable for development.

While the NIH-RTP Master Plan does not attempt to determine the future of EPA, it endeavors to build a functional and conceptual relationship between the two sites of mutual benefit, and recognizes the shared interests in collaboration, environmental stewardship, security, and campus utilities.

In addition to creating appropriate facilities for the work of NIH, the plan strives to create a vibrant campus environment with appropriate employee amenities, including recreation, food service, and quiet courtyards. The campus environment is intended to enhance the working environment at NIH, encourage employee interaction, and provide a sense of place and pride in the institution.

New development is concentrated adjacent to Building 101, improving function and security, and creating a stronger sense of place within the campus. Supporting this plan, the North Loop Road/Lakeview Drive is modified, removing a portion of the road between Building 101 and the existing north and south surface parking lots.

EXHIBIT 5.2: DEVELOPMENT FRAMEWORK



A. Existing and Future Development

The Master Plan recommends growth on campus of 621,000 gsf in office, research, clinic and warehouse facilities, and 545,000 gsf in circulation and parking structures over a twenty year period. The additions represent a 59% increase in programmatic space over the existing on-campus space not including parking structures and circulation links. The Master Plan accomplishes the growth by developing an additional 6.5 acres of site or 1.72% of the total acreage. The developed site area increases from 33 acres to 39.4 acres upon implementation of the Master Plan.

EXHIBIT 5.3: EXISTING AND FUTURE MASTER PLAN DEVELOPMENT

Area	Existing sf	Removed sf	Added sf	Master Plan sf	% change	Phase 3 developed acres
Building (footprint)[1]	310,400	14,100	219,500	515,800	66%	11.8
Parking structure (footprint)			108,200	108,200		2.5
Paved Roads / Gravel Roads	670,600	154,700	174,700	690,600	3%	15.9
Surface parking [2]	353,200	242,600	60,500	171,100	-52%	3.9
Trails / Paths	72,300	38,700	84,700	118,300	64%	2.7
Terraces/Paving	23,900	23,900	68,200	68,200	185%	1.6
Total						39.4

Notes: [1] *Existing trailer square footage is not included*
[2] *New surface parking includes permeable paving*

B. Site-Wide Urban Design Structure

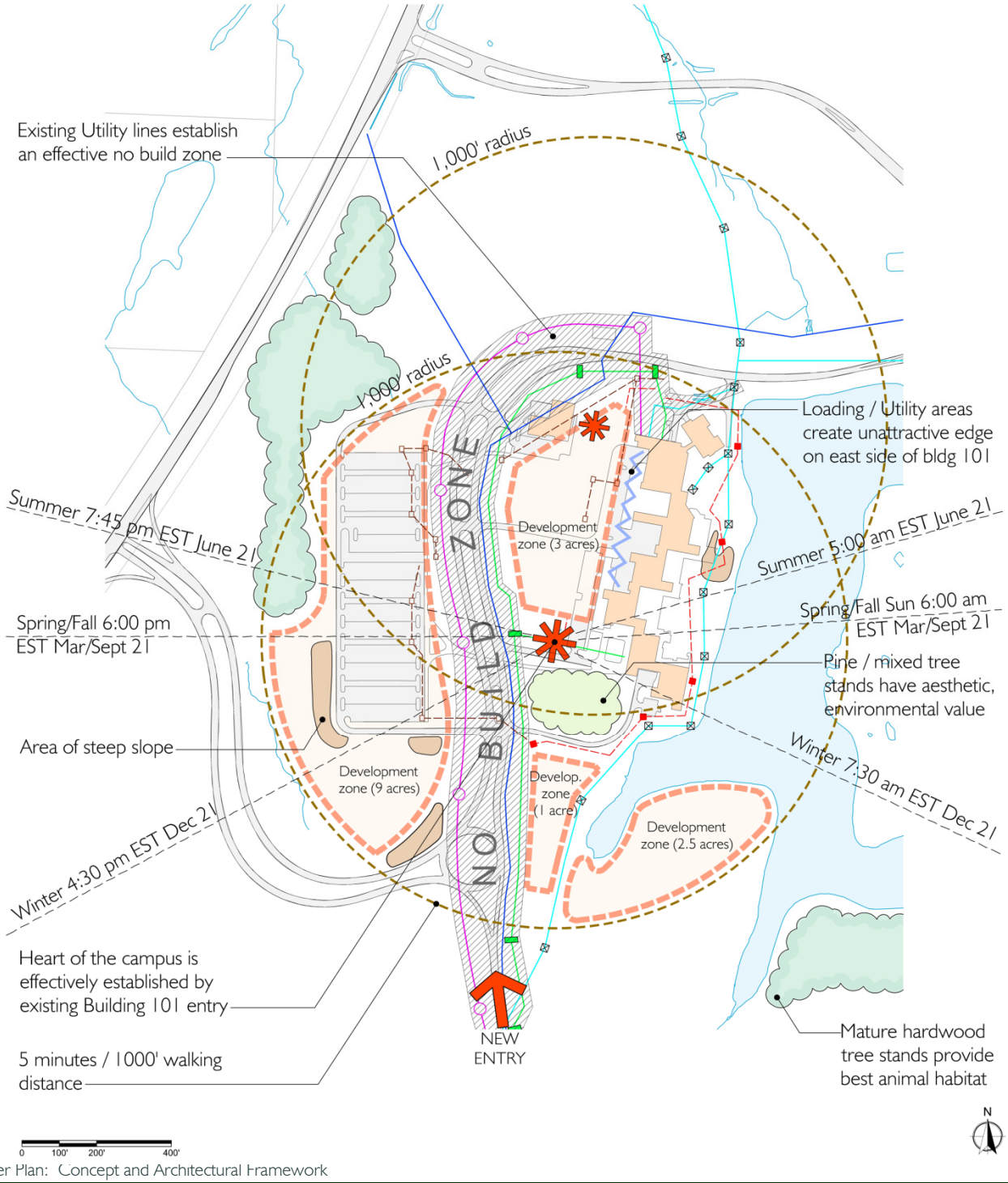
The campus concept emphasizes clustered development centers surrounded by preserved open space and buffers, with a new campus circulation system linking the various clusters. Key elements of the Master Plan are:

- **Clustered development** - the plan follows the original 1971 Master Plan by creating compact development clusters, meeting both functional and environmental objectives.
- **Open space preservation** and buffers on campus edges - the plan emphasizes protection of stream channels, sloped areas, significant tree stands, and visual buffers on the site edges. The 377-acre NIH-RTP campus is an important part of Research Triangle Park, with the forested edges of the campus contributing greatly to the RTP setting. The wooded spaces are already an important buffer on the east side of the campus where the Triangle Parkway passes close by, and they will becoming increasingly more important on the west edge as well, as future development happens along T.W. Alexander Drive. The Master Plan envisions the Campus Center as a research enclave in a wooded setting, approached by attractive entrance drives through naturally landscaped open areas. The concentration of development in the Campus Center preserves a substantial amount of undeveloped space on the NIH-RTP campus, including wooded buffers on the edges of the site, preserved floodplain areas, and future development sites.
- **Campus heart** - an identifiable open space for visitors, main building entrances, and a destination for employee amenities. The Plan transforms the Campus Center into a pedestrian realm, from automobile-dominated areas to people-friendly places, with the rerouting of roads.
- **Circulation reorganization** – The Master Plan delineates a new circulation system with a greater focus on the core of the NIH-RTP campus. The Master Plan envisions transformation of the original loop road concept in the 1971 Master Plan to a system of primary, formal entry roads, and secondary functional service roads. The terminus of the formal circulation at the campus front door would create a more significant sense of arrival to NIH, and the removal of the loop road from the heart of the Campus Center would allow building expansion and create a more significant pedestrian realm. The perimeter circulation system is planned for employee parking and service vehicle access, which can be extended in the future to circumnavigate the outside edge of the future development site. The Master Plan aims to promote and strengthen the aesthetic and functional relationship between the NIH-RTP campus and the rest of the area within the RTP through improved access for vehicles, pedestrians, and bicycles at T.W. Alexander Drive, and by providing a new entrance at Hopson Road. A future new entrance on the north of the Campus Center from the EPA Access Road is also envisioned.
- **NIH-EPA bridge** - NIH policy initiatives and the Master Plan promote increased interaction between NIH and EPA by proposing a pedestrian bridge across the lake. Currently, the two agencies share the CUP, campus open spaces, circulation, and pedestrian trails. A shared warehouse is in the planning stages and would be located at the north end of the NIH-RTP campus. This would allow both agencies to release their off-site leased warehouse space.
- **Naturalized landscapes** - The landscape plan emphasizes an enhanced lake as a central organizing landscape feature. It completes the campus trail system, preserves and enhances existing forests, and minimizes areas of high-maintenance landscapes in favor of natural landscapes. Another significant component of the Master Plan is the inclusion of structured parking, which would replace most surface parking and greatly contribute to open space preservation.
- **Future development** - future development potential through the preservation of major building sites.
- **Security enhancements** – In view of the changing security requirements, this Master Plan emphasizes better management of vehicles on campus. A visitors' center, to be located at the entrance to the campus on Environmental Parkway, would process and screen non-employee vehicles. An independent circulation zone would be established in the vicinity of the CUP, eliminating day-to-day through-traffic at the CUP.
- **Central Utility Plant (CUP)** - A separate Master Utilities Plan (MUP) is being developed for the CUP, and the campus utilities distribution system. Very little building growth is foreseen at the CUP during the 20-year course of the Master Plan, though enhancements in security and landscape are planned.

5.2 DEVELOPMENT FRAMEWORK FOR THE CAMPUS CENTER

The Campus Center framework was shaped by confining future development to a zone within a five minute walking distance of the current most concentrated area of the campus (near the Building 101 entry), establishing a no-build zone in areas where major infrastructure is currently located, considering site opportunities and constraints, and giving appropriate consideration to future building orientation.

EXHIBIT 5.4: CAMPUS CENTER FRAMEWORK PARAMETERS



One of the fundamental Master Plan concepts is a concentrated Campus Center adjacent to Building 101, which would focus most of the activity and development on campus in one area. The Campus Center development is concentrated on the west side of Building 101, creating a series of outdoor spaces framed by the new and existing buildings. The concept strengthens the pedestrian realm of the campus, and integrates the buildings and natural features of the site. The Campus Center plan has been conceived such that it can be constructed in a series of incremental steps over the 20-year horizon.

The planned facilities and common spaces in the center will foster a greater sense of community, and create lively gathering places and closely-linked program elements, while establishing a new entrance and image for the campus. A new, multi-level lobby near the B Module would be the campus hub, linking new buildings to the old, and concentrating the shared common spaces. The conference center, office building, cyber café, and library would all be accessible from the shared lobby.

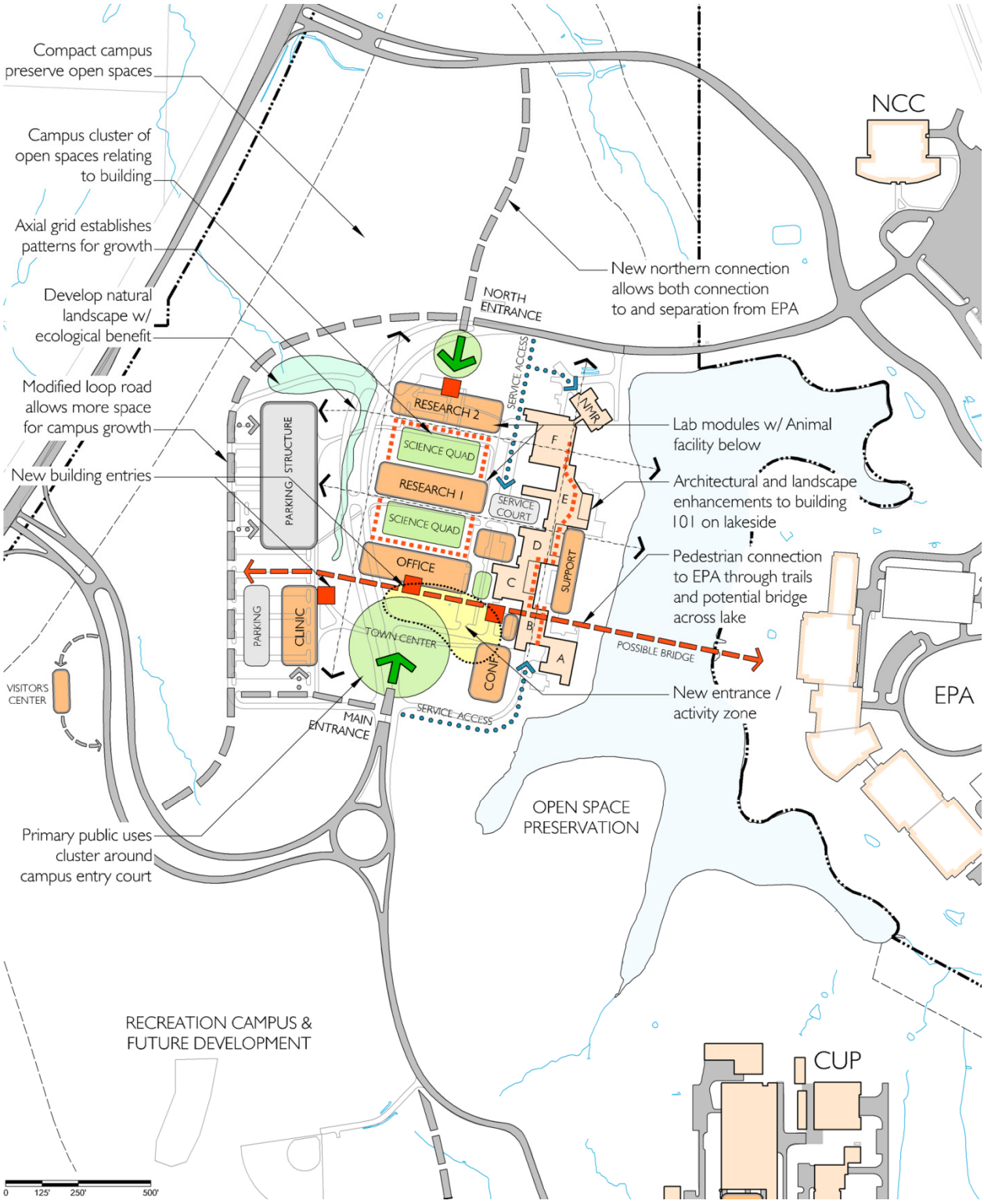
As buildings are added, they would be clustered around new open spaces to give each building its own identity and outdoor space. A new circulation spine would be located perpendicular to the existing linear circulation spine of Building 101, connecting the Campus Center with the parking structure and lots. Building 101 would be renovated, especially on the ground floor, to bring in more natural light and locate shared employee amenities facing the lake.

A. Campus Center Urban Design Structure

The design structure of the Campus Center is shown on the diagram opposite. It includes these key features:

- The campus is organized around open quadrangles that integrate the site's natural landscape with designed spaces.
- A new campus entrance is established in an open space framed by new buildings on three sides, partially open to views of the lake, and facing south to the sun. The entrance includes an automobile drop-off to the main building entries and handicapped and short-term visitor parking.
- Lakeview Drive is removed from the Campus Center creating a consolidated pedestrian environment.
- The plan creates a new pedestrian zone in the heart of the campus with the removal of Lakeview Drive/Loop Road. Removal of this road allows for easier pedestrian circulation in the Campus Center and reduces the security concern of vehicles within the center of campus. The utility corridor would remain in place even though Lakeview Drive is removed.
- The large-scale, institutional massing of Building 101 is buffered by smaller-scaled new buildings.
- Three blocks of new buildings are planned on the west side of Building 101. These buildings would be lower in height than Building 101 and, because of their height and orientation, would break up the large-scale, institutional character of Building 101.
- The main building complex has entrances/lobbies at both the north and south ends.
- In order to balance employee access from parking and provide better development opportunities in the later phases, a new building entrance is recommended on the north end of the Campus Center.
- The majority of surface parking is replaced with structures, controling the amount of surface area devoted to parking. This would minimize impervious area, and concentrate employees closer to the buildings in which they work.
- Building locations are organized for optimal solar orientation and efficient service and circulation, promoting the ability to utilize natural lighting on the interiors.

EXHIBIT 5.5: CAMPUS CENTER FRAMEWORK

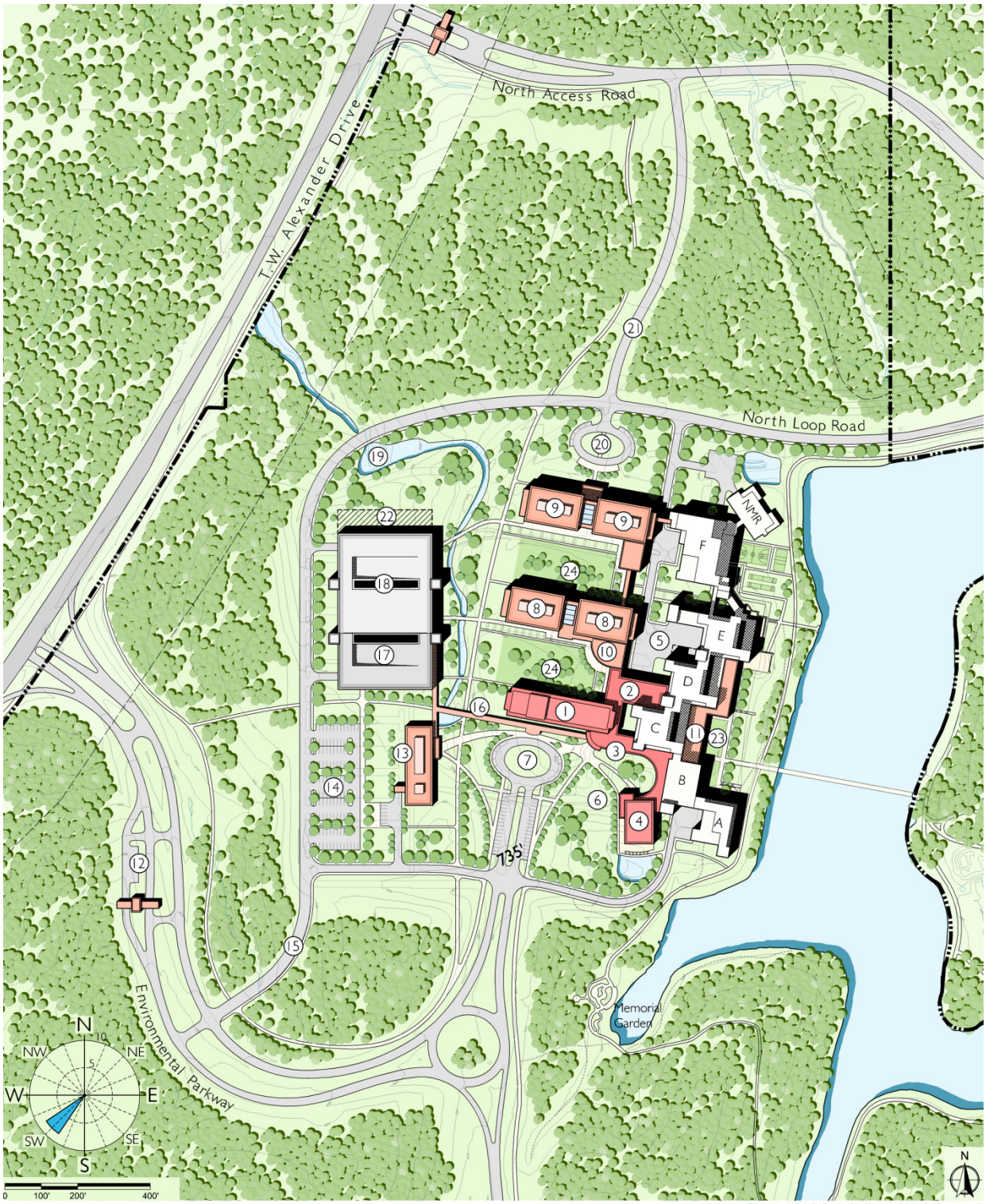


B. Key Elements of the Campus Center

The Campus Center Plan has taken into account numerous issues, including: adjacencies, utilities, phasing, topography, service access, program, massing relationships, and other design characteristics. The new buildings would provide enhanced facilities for scientific research, and would define the campus open space structure and are recommended to include the following:

- **Office Building.** The new office building, connected to Building 101, is envisioned to form a new three-story backdrop for the campus entrance and front door. The NIH priority is that this building replace the leased office space at the end of the current lease in 2018.
- **Conference Center.** The conference center should be located adjacent to Modules A and B, creating a new public image at the front of Building 101. It would have functional connectivity with the main building lobby, cafeteria, and existing conference spaces. A fitness center is envisioned in the lower level of the conference center.
- **Animal Facility Expansion.** Animal facility is being expanded in space contiguous to the existing animal facility, and also includes a first floor loading area and dedicated animal elevator.
- **New Research Buildings (Phases 2 and 3).** New research buildings are envisioned in the plan as two- or three-story wings extending west from Building 101, connected to the existing facility and to its circulation.
- **Clinical Research Center.** A new clinical research center is to replace the existing modular clinic, situated so as to have its own identity and public entrance. It would frame the west side of the entrance courtyard and complete the enclosure of the Town Center. A covered walkway to the research cluster would be developed, for convenience and the protected transfer of samples.
- **Visitors' Center.** The visitors' center would provide check-in and screening for NIH-RTP visitors. The visitors' center includes a small parking area and building to allow campus guests to park and check-in prior to proceeding onto campus.
- **Parking Structure.** Surface parking is planned to be gradually phased out and replaced with structured parking.

EXHIBIT 5.6: ILLUSTRATIVE CAMPUS CENTER PLAN



A, B, C, D, E, F, NMR: Existing Building 101 complex

(Note: Phase 1 buildings indicated as darker red)

1. Office building
2. Animal facility expansion
3. New main entry, lobby and elevator
4. Conf. facilities w/ fitness center below
5. Loading court
6. New entrance plaza/campus outdoor
7. New drop-off / visitor parking
8. Research Building 1 (Labs)
9. Research Building 2 (Labs)
10. Employee amenity space/ food serv.
11. Bldg.101 ground FL. improvements
12. Visitor's center / Entry
13. Research Clinic
14. Ex. surface parking modified
15. New road link
16. Covered walkway
17. Phase 1 parking structure
18. Phase 2&3 parking structure
19. Storm water collection / rain garden
20. New north auto drop-off phase 3
21. New north access road
22. Parking expansion if higher growth
23. Lakefront landscape enhancements
24. Science quad

5.3 Circulation and Parking

The circulation system of the Master Plan is a significant component in the campus urban design. While most of the existing roadways are maintained in the plan, several important modifications in the circulation system would be made, including:

- Creation of two types of campus roads, including a more formal entry parkway and visitor parking and drop-off, and less formal service roads accessing the parking and loading areas.
- Removal of Lakeview Drive/North Loop Road from the heart of the campus, and consolidation of most of the loading functions in a centralized location,
- Increase in parking accommodated in structures rather than surface expansion.
- Enabling easier pedestrian movement. The campus trail and bicycle paths would be fully integrated with the landscape and development plans. Locations for bus/other transit are shown at the entrances.

5.4 Landscape and Open Space

The Master Plan landscape and open space concept envisions a range of campus spaces - some that reinforce the existing lakefront and open spaces established by Building 101, and others that create a sequence of new plazas, quadrangles, walkways, trails, and recreation spaces that complement the built environment and increase the amount of softscape on the campus. The principal landscape components in the Plan are:

- A new main entry plaza on the south end of campus introduces visitors to NIH, provides short-term parking, and is the principal open space through which NIH employees pass on a daily basis. The entry plaza is organized to keep building entrances and outdoor gathering areas south facing and in the sun. An important landscape component in the entry plaza would be the existing trees located in a sloped area west of Module A, which would frame the south and east side of the entry space.
- Two new science quadrangles between the new office and lab buildings on the west side of Building 101 would integrate the natural landscape with the new structures. These quadrangles would retain existing trees and integrate the natural landscape with the more structured campus landscape.
- A new "Eco-commons," in the area currently occupied by Lakeview Drive between Building 101 and the surface parking lot, would help in stormwater management and reduce the amount of mowed lawns. The Eco-commons would replace the loop road with a more naturalized landscape, while retaining accessibility to the utilities currently located in this area.
- Lakefront landscape enhancements would provide a better transition between the mass and scale of Building 101 and the more natural lake edge. Two zones would be created - a terraced lawn and planted area next to the building, and a more natural area with riparian and water's edge plantings. Space for recreation would be created east of the E and F Modules, with a terraced area for basketball, volleyball, and other lawn sports.
- The final significant new landscape feature in the landscape plan is a new entrance area on the north end of campus, with a passenger drop-off, handicapped and short-term visitor parking, and public building entry, related to the new road connection north to the EPA Access Road. This is planned for the last phase of the 20 year plan.
- The landscape plan integrates areas for improved stormwater management, with a new bioretention basin on the northwest corner of the Campus Center, capturing water that currently drains off-site. Two smaller bioretention areas would be located at the southeast and northeast corners of Building 101, improving water quality and flow into the lake.

5.5 Building 101 Improvements

While the NIH campus comprises a large site with many natural attributes, Building 101 is a large-scaled, singular structure that relates poorly to the lake and on-site views, and lacks a campus atmosphere. Designed as a continuous series of aggregated "modules" connected at their corners along an irregular circulation route, it lacks identity and does not engage the site, particularly the lakeside. The building does not have a clearly-defined main entrance. Pedestrian access from the main parking lot to the building is also problematic. Multiple service docks are located around the perimeter of the building, and these are visually exposed to the public approach to the building, because all service and access to the facility is from the west side of the building opposite the lake.

Besides its awkward relationship to the site, circulation within Building 101 is one of the most problematic functional aspects of the facility. Both the vertical and horizontal circulation systems are inefficient, and lack a sense of hierarchy and place-making, which could better orient employees and visitors in the building.

The Master Plan, recognizing the site relationship issues, established a set of principles that provided direction for integrating Building 101 with outside space and future growth. In addition, it identified functional improvements to circulation, provision of amenities, exposure to the lake views and improved access to the lake. Some of the improvements recommended are listed below. A more detailed description of Building 101 is in Section 9 of this report.

- New entry, lobby and elevator core
- Improvement of the vertical circulation system in the building, with a new primary public elevator core, interior circulating stairs, and improved service elevators
- A series of interior renovations and small additions to improve ground-floor circulation and amenities in Building 101, and take advantage of the views to the lake
- Conference facilities with a new fitness center below
- A consolidated loading court providing loading access to all of the major facilities in the campus center other than food service.
- Improvement of Laboratories by reverting use to ancillary spaces.

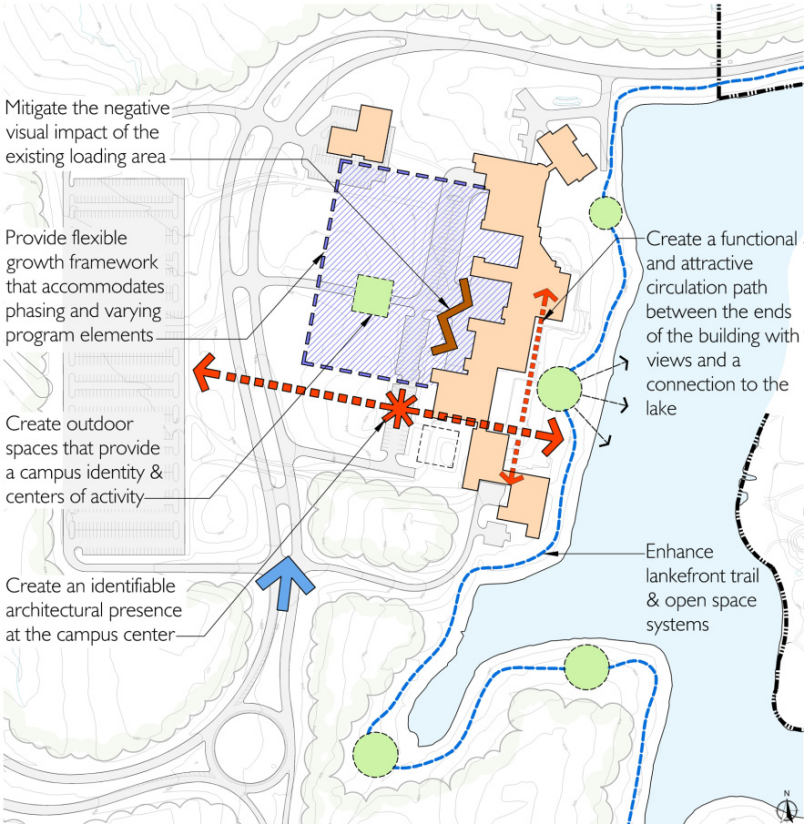


Exhibit 5.7: Building 101 Improvement Principles

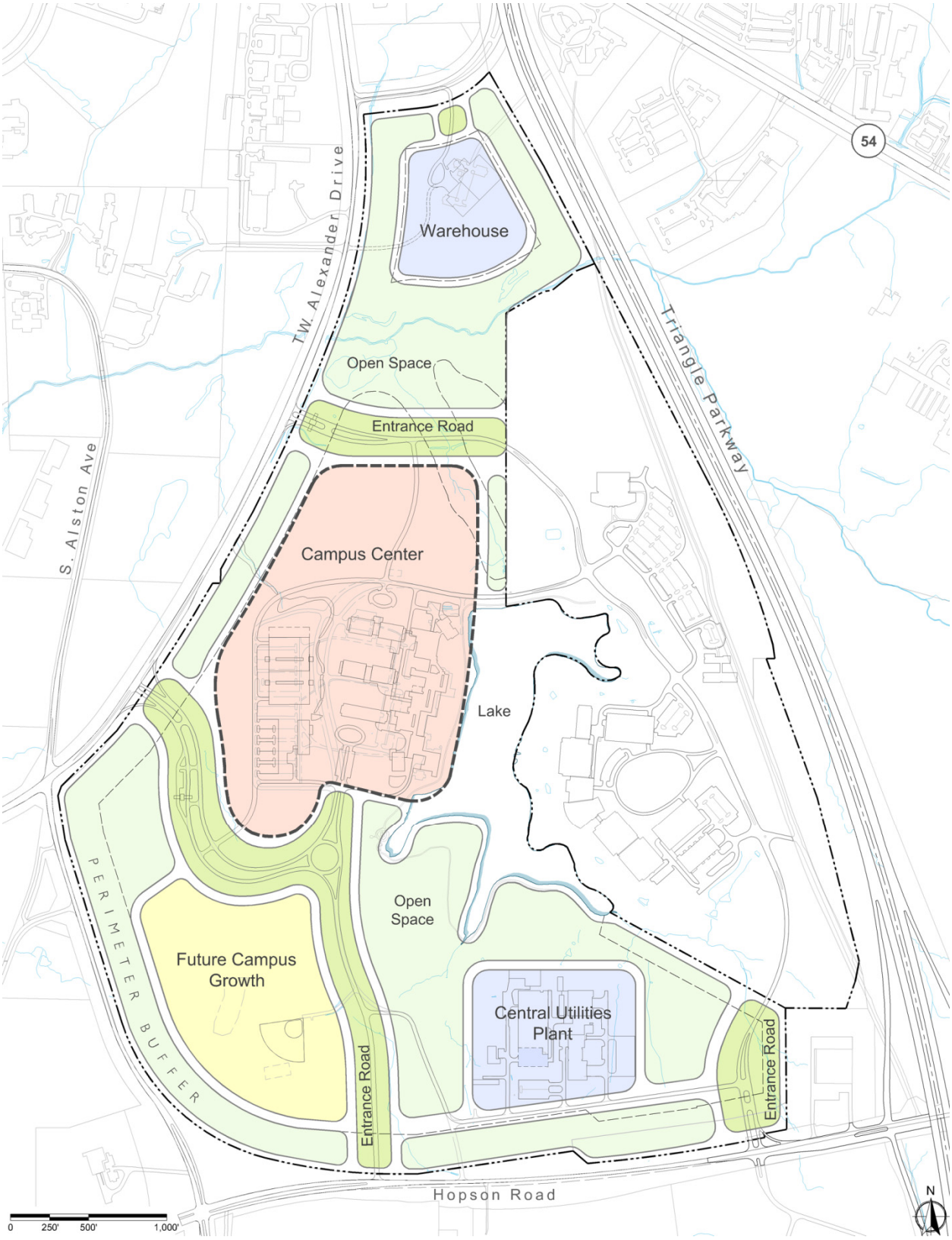
EXHIBIT 5.8: PLANNED SUSTAINABILITY FEATURES

5.6 SUSTAINABILITY PLAN

The Master Plan promotes sustainable development, and a number of different design strategies are, therefore, incorporated into the plan to ensure this. These strategies are summarized here, and illustrated in the Sustainable Features plan. Sustainable building practices are incorporated into all of the components in this Master Plan, and arise from the following planning principles:

- Organize buildings to be able to utilize natural daylight for interiors to the maximum degree. Utilize strategies to reduce solar heat gain on the building envelope through building orientation, design and screening with vegetation.
- Organize the site to reduce on-site vehicle trips and encourage pedestrian movement and bicycle use.
- Facilitate mass transit (e.g. TTA buses) and multi-occupant vehicle use (e.g. van pools and car pools) through improved access to bus stops and priority parking for high occupancy vehicles. Facilitate and encourage bicycle usage for commuting to campus.
- Maintain the maximum amount of tree cover possible to moderate temperatures, minimize heat island effects, shade the buildings, enhance stormwater management, and absorb pollutants.
- Facilitate and augment the already established on-site recycling program.
- Provide on-campus food service, recreational, and other amenities that would reduce daytime off-campus employee trips.
- Minimize mowed/maintained landscapes in order to reduce fertilizer and pesticide use, and pollution from mowers, blowers, etc. – return to a naturalized landscape wherever possible.
- Minimize water-dependent landscapes and water-intensive plantings that require irrigation (lawns, gardens, and specimen trees) –irrigate with collected rainwater where needed.
- Collect rainwater from building roofs and store in cisterns to be used for on-site irrigation.
- Utilize strategies to ensure stormwater quantity and quality control, including: reducing impervious surfaces and utilizing plantings where possible to increase ground water recharge rather than runoff.
- Consider planted roofs on low rise buildings/wings, for both stormwater management and visual interest.
- To the extent possible, locate new development on those parts of the site that have already been developed or disturbed, rather than pioneering new development on previously undisturbed areas of the site.
- Utilize existing buildings and other infrastructure through renovation and adaptive reuse. rather than demolition and construction of all-new facilities. Renovate and rehabilitate Building 101, extending its useful life, and obviating the need for an equivalent amount of new construction.
- Keep new development a minimum distance of 100 feet from water bodies.
- Provide solar access to building roofs and south-facing facades to allow Photo Voltaic Cells installation and utilization of solar thermal systems – design spacing between buildings and determine heights of adjacent buildings accordingly.
- Reduce the extent of surface parking. Use permeable pavers to minimize polluted storm water run-off by filtering it through the paver system.

EXHIBIT 5.9: LAND USE PLAN



5.7 Land Use Plan

The land use plan establishes functional zones within the campus to accommodate the development program, organizing land uses according to adjacencies with other uses, fit with the landscape, and contribution to the urban design framework. The land use plan complements the other component plans in the NIH-RTP Master Plan, especially the development, circulation, landscape, and the forest preservation plans. The guiding principles supporting the land use plan are:

- Consolidate NIH functions in a single campus
- Locate uses that have a high degree of interaction contiguous to each other, especially lab functions
- Provide a compact campus that minimizes circulation time between functions
- Improve way-finding and operational efficiency through appropriate location of entrances
- Provide for on-site recreational activities close to employee work spaces
- Enhance the physical relationship between the NIH-RTP and EPA campuses

The land use plan included here has been formulated at two different scales, one covering the campus as a whole, and the second providing more detailed guidance for the Campus Center.

A. Campus-Wide Land Use

The principal land use zones guiding development across the whole of the NIH-RTP campus are illustrated in the Land Use Plan, shown opposite. Campus-wide land uses include the following:

Perimeter Buffer

The landscape buffer on the perimeter of the site is required by RTP zoning, and consists of a 250-foot setback on property edges along T.W. Alexander Drive and Hopson Road. In addition, a perimeter buffer of 100 feet along the lakefront is part of the plan, with no building construction recommended in this area. The perimeter buffers designated on the site would preserve the natural setting of the campus, and screen the views of campus buildings from outside the site.

Open Space

The areas designated in the land use plan for open space preservation are usually environmentally sensitive areas including floodplains and steep slopes. The open space area around Burdens Creek corresponds with Durham County's land use plans and floodplain designations. Designated open space is unsuitable for development other than limited roads crossing through (which must be carefully planned and designed).

Primary Entrance Zones

An area has been designated in the land use plan around each of the campus entrances, identifying a land use zone for the roadway and associated natural landscape. Other than the Visitor center, no buildings are to be built in these zones.

Campus Zone

The campus development zone comprises a large, contiguous area at the heart of the campus. This zone is identified as a broad area in the Master Plan because it not only accommodates the buildings of the 20-year growth plan, but allows for future facilities to be linked to the existing ones. The campus zone can contain: labs, offices, clinic, conference facilities, and parking. In general, these are all uses that are pedestrian-friendly, and can be housed in buildings that would form attractive edges for the campus open spaces.

Support Facilities

Two areas indicating support facilities are included in the plan: the existing CUP, and a site north of Burdens Creek. The CUP comprises a land use zone that is designated for campus utilities and support functions. The characteristics of this zone are a requirement for security, and the need for carefully planned growth to ensure that future utilities expansions can be economically implemented. The CUP zone would require special landscape treatment for screening of views. The site north of Burden's Creek is currently the location for several unoccupied trailers, which would be replaced by a planned warehouse for joint use by EPA and NIH. This would have its own entrance and security plan.

B. Campus Center Zone Land Use

The land use concept for the Campus Center differentiates the functional land uses within the core of the NIH-RTP campus. The functional grouping of uses is organized to create a front door to the campus that is more publicly-oriented, and a series of "science quads" that are quieter spaces more oriented to use by NIH researchers and employees. The Campus Center Land Use Plan is illustrated opposite, and includes the following:

Research

Research uses include clinic, laboratories and lab support spaces, and accompanying animal space and employee amenities. New laboratory space is located functionally adjacent to the existing labs in Building 101, allowing a direct connection to existing animal facilities and lab core functions. The land use plan identifies a primary site for a new clinical research building, with its own identity. The clinical research center would be located at the campus entrance court, forming an edge on the west side of the entry quadrangle.

Office

The new office building faces the entry court, linking into the new entry pavilion and common shared facilities. This location encourages interaction between scientists in Extramural Research and Training and scientists in Intramural Research and other lab personnel.

Parking

Functional land use for parking is designated in the same area as existing parking, with the environmental goal that no new land area for parking expansion be used. This parking area is accessed from a perimeter service road, keeping the majority of automobile traffic outside the heart of the campus.

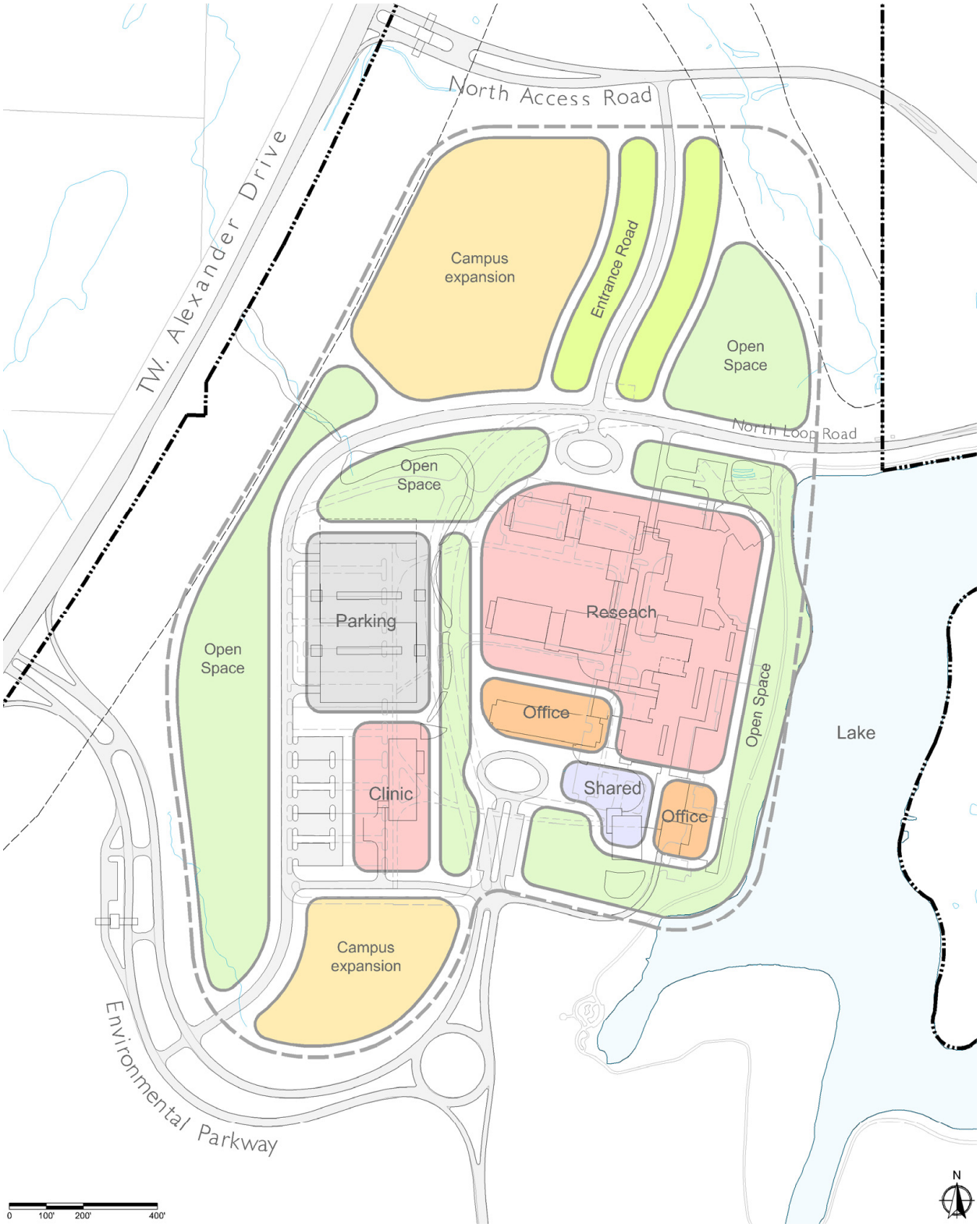
Functional Open Space

The functional open spaces in the Campus Center contain active and passive uses and are located close in to new construction and existing buildings.

Landscape Buffers/Naturalized Landscapes

Landscape buffers and naturalized landscapes in the Campus Center preserve existing natural features and provide transitions from the natural open spaces on the campus periphery to the functional open spaces and buildings.

EXHIBIT 5.10: CAMPUS CENTER LAND USE PLAN



6.

MASTER PLAN:

LANDSCAPE AND STORMWATER FRAMEWORK

Exhibit 6.1: Illustrative Landscape Plan

6. MASTER PLAN: LANDSCAPE AND STORMWATER FRAMEWORK

6.1 Landscape Framework

The NIH Master Plan increases the developed area of the campus, but within a compact, sustainable footprint. The campus is fortunate to have beautiful undulating natural terrain beneath a dense woodland canopy of native evergreen and deciduous vegetation. The terrain is punctuated by both perennial and intermittent streams, while the existing campus frames the lake. The natural resources of the campus both define and insulate it from the surrounding community. As the Master Plan evolved, several principles for the landscape emerged:

- Preserve natural resources to the greatest extent possible.
- Integrate natural areas into the heart of the expanding campus.
- Develop new landscapes that are sustainable and minimize intensive maintenance.
- Create newly designed, people-friendly landscapes at key locations.
- Maximize the scenic attraction of the existing lake.
- Emphasize walkability and improve connections to destinations.

The compact development pattern of the new structures in the expanded campus creates civic open spaces and frames protected natural resources. The Master Plan aims to enrich the existing campus by creating new places for working, congregating, socializing and recreation. This chapter describes the Landscape Plan.

A. Natural Areas

The compact expansion of NIH would protect the extensive natural areas of the campus. Within the new courtyards framed by the expanded laboratories, large swaths of woodland would be preserved as "tree save" areas. These areas would be augmented along their edges with native, ecotone vegetation (flowering trees, shrubs, ground covers, and grasses), providing a transition from natural to designed landscapes.

Tree coverage on the NIH-RTP campus encompasses approximately 219.81 acres. The new design would remove approximately 9.48 acres or 413,024 sf of existing tree coverage. New access and perimeter roads hug new buildings in order to minimize grading and removal of woodland. New roads and trails avoid sensitive natural areas (stream valleys, wetlands, deciduous forests) and skirt existing woodlands. The expansive woodland areas would continue to function as both a buffer to adjacent development and as a green envelope for the expanded campus.

Stormwater runoff from the new campus would be collected and channeled over land to the natural stream valley northwest of the planned garage as well as southeast to the existing lake through cleansing bio-swales.

B. Gateways

In addition to the main entrance at T.W. Alexander Road, the NIH campus is planned to have two new gateways – one at the southern edge of the expanded campus, and the other at the northern edge of the campus at the end of a new access road. The landscape of existing primary roadways which leads to the new southern entrance plaza would be modified from a mowed lawn into an ecotone. An ecotone is the transition area between the forested edges and cleared or developed land; it serves as a blending area of plant communities such as shrubs, grasses, lawn, and forested edges. On the NIH campus, the ecotone, following forest edges, native grasses and shrubs would be encouraged to replace the existing lawns. An ecotone landscape at the end of the forest fosters improved wildlife habitats and more diverse woodland species. Woody vegetation would be removed yearly from the no-mow native grassland areas. A similar landscape treatment would be implemented adjacent to the new northern entrance road and the forest edge.

At both the northern and southern entrance areas, new temporary parking areas for the disabled and short-term visitors would be marked by the following:

- Permeable paving in the parking and drop-off areas which allows stormwater runoff to infiltrate into the ground water.
- Broad swaths of ornamental perennial plantings that require low maintenance and are sustainable.
- Covered walkways that link the main entrances to both the drop-off areas and the new garage.
- Gathering areas marked by comfortable, moveable chairs, tables, and colorful umbrellas.
- Lighting for staff safety..
- Orientation maps and interpretive and wayfinding graphics.

C. Sustainable Landscapes

An infrastructure of new sustainable landscapes has been threaded through the expanded NIH campus. The new landscape infrastructure originates on green roofs of several new structures and terminates in stream valleys and the lake outside the newly developed areas. A description of the new features follows:

- ***Green roofs*** are suggested for the new low rise structures adjacent to the existing and future laboratories. The green roofs both reduce the initial rush of stormwater runoff and provide an aesthetic visual amenity from the laboratories.
- ***Cisterns*** would be placed at strategic locations at the base of buildings to collect stormwater runoff from both green and non-planted roofs. The water from the cisterns can be used to irrigate the courtyard gardens and ornamental plantings at both the northern and southern entrances.
- ***Bio-swales*** would collect and channel stormwater runoff at the two entrance areas and the two courtyards to the Eco-commons area between the new garage and laboratories. The bio-swales are typically planted in native grasses and small woody plants. Stormwater usually infiltrates into the groundwater; however, in periods of heavy precipitation, runoff is channeled to the meandering water course in the Eco-commons.
- The ***Eco-commons*** is a new landscape zone between the new garage and the new laboratories. This area is designed to channel stormwater runoff from the garage and other structures into a new stormwater management pond north of the garage. The landscape of the Eco-commons would be similar to a savanna: native grasses and low-growing shrubs are marked by clusters of deciduous and evergreen trees. The intent is to create a sustainable landscape that fosters wildlife habitat and minimizes intensive landscape maintenance.
- ***Native and local recycled materials*** are recommended throughout the campus. Native plant materials are recommended in all new and rehabilitated landscape areas. Local hardscape materials (paving, site furnishings, and lighting) are encouraged. A wide variety of recycled materials is available for paving and site furnishings.

D. Garden Connections

Several new east/west pathways would be developed to link the new garage with the new courtyards and north and south entrances. The pathways terminate at key entrances to existing structures on the east side of the campus. A series of gardens would be planted along the new pathways. These gardens, framed in geometric beds along the pathways, would be planted with native vegetation of ornamental value. Fixed and moveable chairs and tables would enhance the gardens, particularly in the two new courtyards. Low level cut-off lighting would mark the pathways and the indirect lighting would illuminate the gardens.

E. Recreation Places

A new recreation compound, including volleyball, basketball and bocce courts, is suggested for the area adjacent to the lakeside trail on the northern end of the existing laboratory complex. These areas would complement the new lakeside landscape described next.

F. The Lakeside

The existing lake is both a prominent visual feature and a primary stormwater management facility for both NIH and EPA. The riparian areas adjacent to the lake would be enhanced with environmentally appropriate vegetation: water-loving perennials and woody plant material along and adjacent to the shoreline and upland plantings of native trees and shrubs between the lakeside trail and the shoreline. New terraces with native plantings would step down from the main concourse level to the trails along the shoreline. Benches, moveable chairs, tables, and umbrellas, as well as low-level lighting would create an important civic gathering area with dramatic vistas of the lake and EPA beyond. A new floating bridge, crossing the lake and linking the NIH and EPA campuses, is planned.

G. Pedestrian-Focused Landscape

The landscape of NIH is designed to be pedestrian-focused and emphasize walkability. New primary pathways would link the new garage to the new and existing campus buildings. A new multi-use north/south pathway would traverse the Eco-commons and connect to existing and future trails. New trails would connect at strategic locations with the existing trails along the perimeter of the NIH site. The pathways and trail would be able to accommodate pedestrians and bike riders, as well as service and emergency vehicles.

6.2. Landscape Developments by Phase

The landscape planning approach strives to preserve the natural features of the campus and integrate sustainable landscape features into the Campus Center. The Plan is realized gradually, linked with the phased building development.

A. Phase 1

The first phase of landscaping is modest, with the goal of enhancing the new entrance and drop-off. The entrance zone landscaping is welcoming, taking advantage of the southern exposure, and providing sitting and waiting areas in addition to walkways and a new entrance drive. Ornamental plantings add to the public character of the entrance zone. In this phase, landscaping and permeable paving is provided for the new visitor center. The hardscape, planting and site furnishing guidelines further the environmental design goals.

The stormwater management plan is initiated in Phase 1, with the construction of the first bioretention area south of Module A. The basin function would be supplemented by rooftop run-off management, cisterns to collect water for irrigation and the removal of existing asphalt paving.

B. Phase 2

The second phase of the landscape plan improves the campus in several areas, as building and circulation development occurs. With Research Building 1, a landscaped courtyard would be created to give a "campus feel." The courtyards function as both outdoor rooms for quiet activities, and as gardens to be viewed from inside. Lakeside landscaping would improve the environmental management and create a transition from the lake to Building 101 and its Phase 2 pedestrian/amenity link. This would be an ideal event area for NIH gatherings and leisure use. Aquatic and riparian plantings along the lake edge would help filter stormwater runoff. The modular clinic removal is included in Phase 2, to be replaced by a parking lot with permeable pavers.

The stormwater management plan would be advanced with the construction of a second bioretention area at the north end of campus and the initiation of the Eco-commons and rain garden.

Exhibit 6.2: Landscape Developments in Phase 1

Exhibit 6.3: Landscape Developments in Phase 2

C. Phase 3

The third phase of the landscape plan would complete the realization of the landscape concept, with natural and sustainable plantings, completion of the Eco-commons, new entranceways and employee-use areas. A second landscaped courtyard would be created between Research Buildings 1 and 2, with sitting areas and plantings. Important existing trees would be preserved. An active recreation area is planned in the area between Module F and the lake, which could include courts for sports and games. In this phase, the roadways are re-aligned and a new north vehicle drop-off is planned. These entrances would be distinguished with more formal plantings, signage, permeable paving and appropriate lighting. Low maintenance landscaping would be introduced along all campus drives.

Exhibit 6.4: Landscape Developments in Phase 3

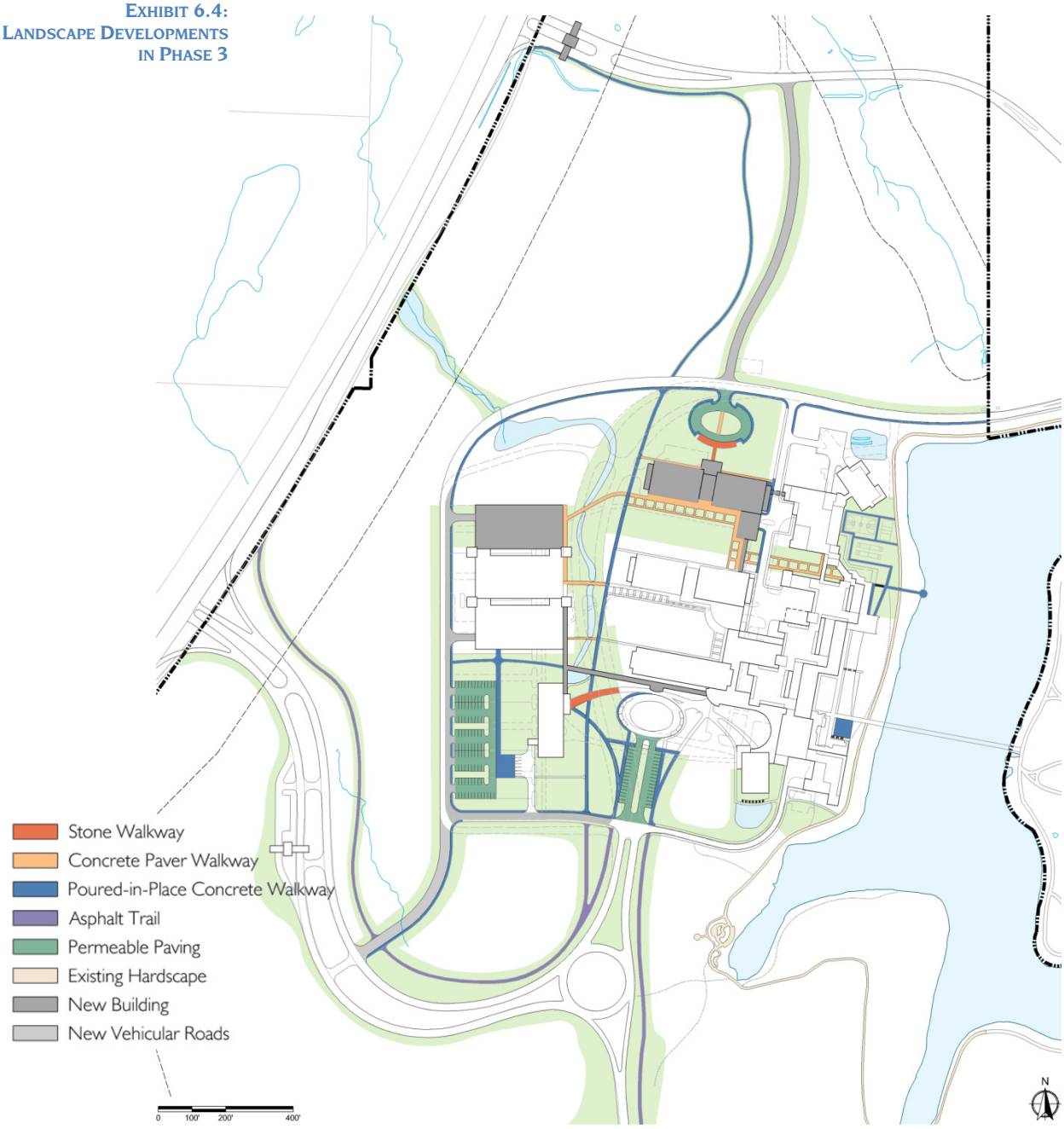
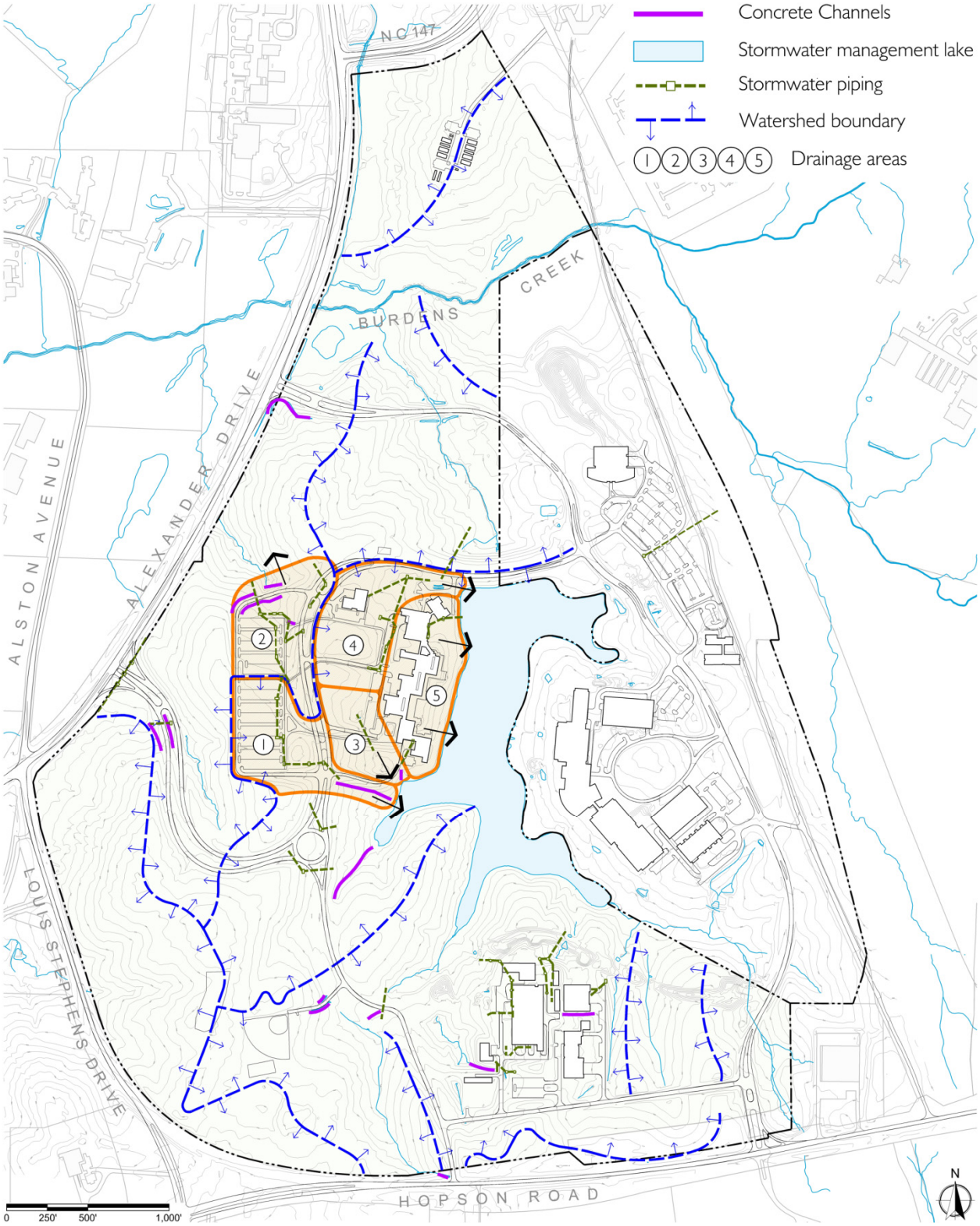


EXHIBIT 6.5: EXISTING STORMWATER MANAGEMENT



6.3 Stormwater Management Plan

Techniques for managing storm water have changed substantially since construction of the NIH-RTP campus in the early 1980s. Most of the developed areas on campus currently drain into the lake, including the developed area surrounding Building 101. While the lake provides both stormwater quantity and quality control, its function could be improved with a better site stormwater management plan. The lake ultimately discharges into the Burdens Creek sub-basin through Jordan Lake of the Cape Fear drainage basin. Currently, there is a draft strategy for the drainage area upstream of Jordan Lake (see Exhibit 3.1). The potential impact of the Jordan Lake supply nutrient strategy on the NIH site and master plan, based on current language, would require a minimum 50-foot wide riparian buffer directly adjacent to the on-campus lake and possibly the establishment of nitrogen and phosphorus load limits. As there is no development within the 50-foot wide buffer, the load limits should be evaluated at the time of construction in Phase 1.

A. Existing Site Stormwater

The developed area of the site, excluding access and entrance drives, is divided into five general drainage areas:

1. The southwest parking lot surface drains into collection structures , through an underground storm piping network collecting boulevard drainage, and then discharges into a concrete channel and ultimately into the lake.
2. The northwest parking lot surface drains into collection structures through an underground storm piping network joining an underground storm piping from the boulevard, and then discharges into a channel that drains northeast, off-site under Alexander Drive and ultimately into Burdens Creek.
3. The area north of the service road, east of the boulevard, west of the campus buildings and south of the ridge, at the future Phase 2 development site, drains to a culvert under the south parking lot access drive and ultimately into the lake.
4. The area that includes the parking lots west of the campus buildings and east of the boulevard, north of the ridge (approximately at the Phase 3 development site), drains northerly through an underground storm piping network and ultimately discharges into the lake.
5. Finally, the roof drainage from the campus buildings ultimately discharges into the lake.

B. Stormwater Management Concepts

The master stormwater management plan incorporates several site Best Management Practices (BMPs) including vegetated swales, raingarden, bioretention basins and rooftop runoff management. The North Carolina Division of Water Quality Stormwater Best Management Practices Manual dated July 2007 was used for design criteria. All future development should provide additional detention capacity or infiltration methods on a case-by-case basis. Examples of BMPs include percolation trenches, porous pavement, green roofs, and rainwater cisterns. These stormwater management strategies can be used in conjunction with each other or on an individual basis.

1. **Vegetated Swales**: The main drainage feature for the improvements would be a vegetated swale. The vegetated swale is a shallow open-channel water quality drainageway stabilized with grass or other vegetation designed to filter pollutants. The vegetated swale would be sufficient to convey runoff from all of the building expansions, building additions, parking structure and surface parking drainage to the new bioretention areas. The vegetated swale would provide stormwater runoff quality control, including suspended solids, nitrogen and phosphorus removal, with low construction and maintenance costs as per the North Carolina Department of Water Quality (NCDWQ) Stormwater BMP Manual.
2. **Bioretention Basins**: The vegetated swale would channel stormwater to a forebay prior to discharging into the bioretention area at the northwest corner of the site. The forebay is a storage strategy to capture sediments and prevent their accumulation in the bioretention area. The design of the bioretention facilities would be refined when Master Plan buildings and site improvements are implemented, following Best Management Practices and recommendations of EPA and NCDWQ.

3. **Rooftop Runoff**: Several new buildings would incorporate rooftop runoff management systems, which can include vegetated roof cover, roof ponding and roof gardens (also known as green roofs) to detain and promote vegetative uptake and evapo-transpiration of roof runoff. The rooftop runoff from these buildings would be collected and stored in underground cisterns for irrigation. The cisterns would be designed to capture one-half inch of runoff volume and be connected underground to maximize storage and minimize pumps. Irrigation would be manually controlled based on seasonal variations to maximize storage capacity, with the pumps accommodating the necessary pressure and flow for the irrigation area.

C. Stormwater Management Implementation

The techniques for stormwater management would be implemented gradually, as construction projects are built and areas of the site modified. Each construction project should implement Best Management Practices (BMPs), such as rainwater cisterns, porous pavements, green roofs etc. The campus-wide techniques are associated with the Master Plan phases, and coordinated with the planned site and building development.

Phase 1

For the central campus, Phase 1 primary stormwater management includes a bioretention basin located southwest of Module A. The basin would be created by constructing an outlet structure on the existing culvert under the service road and act as a sedimentation basin throughout Phase 1 construction. At the end of construction, it would be cleaned and converted to a bioretention area. The bioretention basin would be supplemented by rooftop runoff management at the animal facility expansion, the new main entry and the conference/ fitness center. In addition, cisterns combined with underground storage would be provided for irrigation of the new entrance plaza and campus outdoor space. Phase 1 improvements include the removal of approximately 60,000 square feet of asphalt pavement.

On other areas of the site, Phase 1 improvements be implemented at the visitor center and associated parking. Construction BMPs may include silt fence and rock check dams, and post-construction BMPs for these areas may include stormwater treatment with grass filter strips and vegetated swales.

Phase 2

Implementation of Phase 2 improvements would involve the relocation of the north access drive and construction of the northwest stormwater bioretention basin and forebay. This would be constructed at the beginning of Phase 2 for use as a sedimentation basin until the completion of Phase 3 construction. Initially, the basin would receive drainage from only the parking garage in Phase 2 and the existing drainage from the north parking lot.

Phase 2 implementation would also relocate the loading access drive and construct another bioretention basin and forebay in the northeast. Similar to the northwest basin, this would be constructed at the beginning of Phase 2 for use as a sedimentation basin until completion of Phase 3 construction.

Phase 3

Phase 3 stormwater management techniques would continue and extend those of the Phase 2 BMPs. The North Loop Road would be moved from the heart of the campus, and Phase 3 would complete the Eco-commons, replacing the underground storm drains with stepped pools and vegetated swales and adding the northwest bioretention area. The northwest and northeast bioretention may be converted to sedimentation basins during the construction phases for the parking structure, office, associated parking, laboratory support, and vivarium construction. At the end of Phase 3, the basins would be cleaned and converted back to bioretention.

EXHIBIT 6.6: STORMWATER MANAGEMENT IMPLEMENTATION BY PHASE

Phase I

Phase II

Phase III

Existing Stormwater piping
Demo Stormwater piping
Drainage area and direction
Bioretention / Rain garden

1. Office Building
2. Animal facility expansion
3. New main entry, lobby and elevator
4. Conf. facilities w/ fitness center below
8. Research Building 1 (Lab+Office)
9. Research Building 2 (Lab+Office)
10. Employee amenity space / food serv.
11. Bldg.101 ground floor improvements
13. Research Clinic
16. Covered walkway
17. Phase 1 parking structure
18. Phase 2 & 3 parking structure

(Building numbers related to Campus Center elements in exhibit 5.6)

7.

MASTER PLAN:

CIRCULATION FRAMEWORK

7. MASTER PLAN: CIRCULATION FRAMEWORK

This section describes the existing transportation infrastructure that serves the NIH-RTP site and identifies the planned changes that impact the Master Plan. In particular, aspects of the campus circulation and relevant issues to the Master Plan include: site access and associated entry facilities, the on-campus roadway system, access for service vehicles and emergency vehicles, public transit, pedestrian and bicycle access, transportation demand management, and campus parking.

The existing campus road system accommodates a number of circulation needs, most notably the circulation needs of approximately 3,700 NIH and EPA employees each day. It also includes visitor access to the buildings, employee access to the parking areas, circulation between the NIH-RTP and EPA campuses (including EPA access to the incinerator and waste handling at the CUP), service and delivery traffic, TTA bus movements on site, and NIH and EPA employee access to the Child Care Center.

The circulation plan takes a multi-modal approach to accommodate the transportation needs of the NIH site as it grows in the future. It assumes that vehicular traffic would continue to be the primary means of accessing the site in the future. However, throughout the development of the Master Plan, an emphasis has been placed on promoting carpooling, vanpooling, transit ridership, and pedestrian and bicycle non-motorized access. Although the site is situated in a relatively low-density suburban office park area, increasing vehicular operating costs and awareness of alternative transportation methods are expected to result in an increase in usage of transportation modes other than the single occupant vehicle.

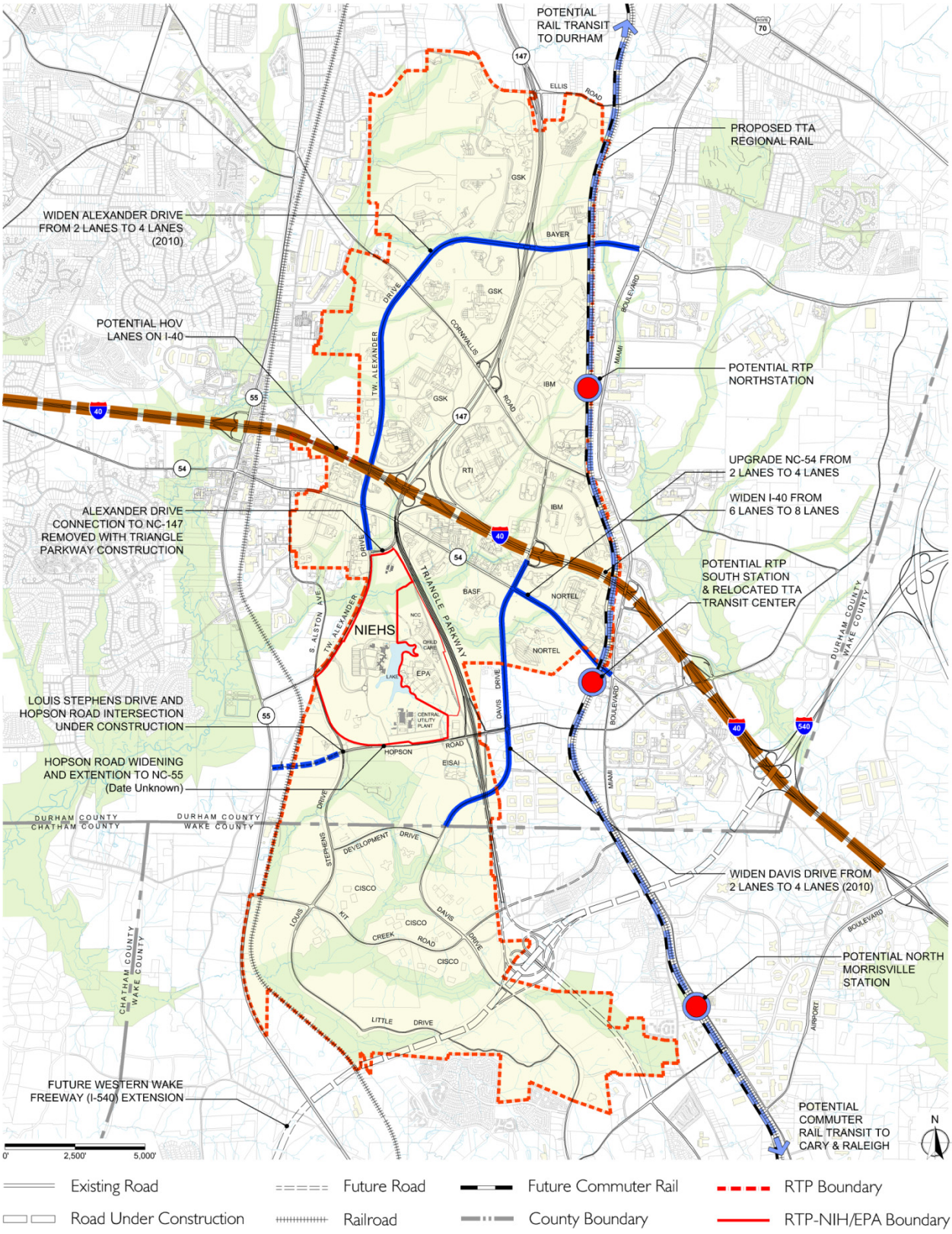
7.1 VICINITY ROADWAYS

The local roadway system in the vicinity of the campus, which provides linkages to the regional highway system, is an important component in the efficient functioning of the RTP campus.

The internal road network of Research Triangle Park is primarily organized around two north-south routes: T.W. Alexander Drive generally aligned along the west side of RTP, and Davis Drive, along the east boundary. These north-south roads are linked by a series of east-west roads that cut across RTP: Cornwallis Road, NC 54, Hopson Road, Development Drive, and Kit Creek Road. T.W. Alexander Drive forms the west edge of the NIH campus, and is the location of both the NIH and EPA main entry gates. This road connects to and terminates at NC 55 on its south end, just to the west of the NIH campus. North of the NIH campus, T.W. Alexander Drive provides a connection to the Durham Freeway and Interstate 40. In addition to providing the main entrances to NIH and EPA, T.W. Alexander Drive also provides access to the main entrance to the Glaxo Smith Kline campuses, and an important entrance to the IBM facilities at the northeastern corner of the Research Triangle Park.

Davis Drive runs north-south along the east side of RTP beginning on the north with an intersection at Cornwallis Road, and opposite the Loop Drive entrance to the IBM facilities. Heading south, Davis Drive has an intersection with I-40 and NC 54, and then exits RTP at an intersection with Hopson Road outside of the park. South of Hopson Road, Davis Drive reenters RTP, passes into Wake County, and connects with Kit Creek Road which runs east-west through the Cisco Systems campus.

EXHIBIT 7.1: SITE VICINITY ROADWAYS AND PLANNED IMPROVEMENTS



7.2 Planned Vicinity Roadway Improvements

A number of improvements in the local transportation infrastructure are in process, newly completed or planned to occur over the next ten to twenty years. The improvements in the immediate vicinity of the campus were related to projected loads and access changes needed to support the construction of the Triangle Parkway.

In December 2011, the long-awaited Triangle Parkway, a North Carolina Turnpike Authority (NCTA) toll road, opened for business. It extends for approximately four miles from an intersection with the Durham Freeway (NC 147) and Interstate 40 on the north, to an interchange with Interstate 540 on the south. It is a six-lane divided toll facility with full access control. In the immediate vicinity of the NIH-RTP campus, there is a new diamond interchange at Hopson Road. The NC147 spur, which gave access to T. W. Alexander Drive is now closed.

The construction of the Triangle Parkway was expected to significantly alter the employee traffic access patterns to and from campus. Approximately half of the traffic accessing the campus would likely use the Hopson Road entrances, versus approximately ten to fifteen percent under pre-construction conditions. Based on meetings and discussions with NCDOT, significant improvements would be required at the existing EPA gate on Hopson Road to accommodate the increased traffic volumes. Although signalization of the intersection is not planned initially by NCDOT, the Master Plan recommends that it be planned. DOT and the Turnpike Authority have agreed to reevaluate the need for signalization when requested by NIH/EPA. In addition, the construction of a second southbound left turn lane could be required to accommodate future traffic volumes exiting the site and accessing the Triangle Parkway.

The connection at NC 147 spur to T.W. Alexander Drive was removed upon the opening of the Triangle Parkway. It was anticipated that NCDOT would abandon the spur once State maintenance requirements cease and a portion of the right-of-way would revert back to NIH giving it access to its parcel on the North.

Additional local street and highway improvements are currently under construction and are shown in Exhibit 7.1 They include:

- Davis Drive, from NC 54, to the Wake County line, is to be widened from two-lane to four-lane by 2009[1]
- Hopson Road will be extended from Louis Stephens Drive to NC 55 by 2010[1].
- NC 54 (Page Road) from Davis Drive to Miami Boulevard will be upgraded from two-lanes to four lanes by 2009[1].

Hopson Road is currently programmed for improvements in the vicinity of the parkway interchange. However, along the southern frontage of the campus, Hopson Road is not programmed to be improved and will remain a two-lane roadway. It is also important to note that there are no programmed improvements for T.W. Alexander Drive along the frontage of the campus.

7.3 Existing and Future NIH-RTP/EPA Traffic

Existing traffic counts were completed by Traffic Engineers and Transportation Planners at OR George & Associates, Inc. in 2007. Existing counts were conducted from 7:00 AM to 9:00 AM and from 4:00 PM to 6:00 PM during a typical weekday. From these counts, the total entering and exiting traffic volumes for the NIH-RTP site and the EPA site were determined for the single busiest hour during the morning peak period (the "AM peak hour") and for the single busiest hour during the afternoon peak period (the "PM peak hour"). The AM and PM peak hours usually experience the heaviest traffic volumes for an office park land use. As a result, the planning and analysis for this Master Plan considers the AM and PM peak hours since these reflect the worst case traffic volumes throughout a typical weekday.

[1] Durham-Chapel Hill-Carboro Metropolitan Planning Organization 2030 Long Range Plan, as amended May 9, 2007.

Projections for future campus generated traffic were based on the twenty year growth and the consolidation of NIH off-site leases within the campus. For NIH an employee increase of 983 was considered while for EPA a straight line projection of 2% per annum employee increase was factored. A simplified table comparing existing and future peak hour traffic for each campus gate was generated.

EXHIBIT 7.2: EXISTING AND PROJECTED TRAFFIC VOLUMES AT ACCESS POINTS

GATE	AM Peak Hour Entering	AM Peak Hour Exiting	AM Peak Hour Total	PM Peak Hour Entering	PM Peak Hour Exiting	PM Peak Hour Total
Existing Traffic						
NIH Gate at T.W. Alexander Dr.	172	18	190	22	205	227
(Future) NIH Gate at Hopson Rd.	-	-	-	-	-	-
EPA Gate at T.W. Alexander Dr.	465	55	520	88	521	609
EPA Gate at Hopson Rd.	138	21	159	18	154	172
TOTAL	775	94	869	128	880	1,008
Twenty Year Build-out Traffic						
NIH Gate at T.W. Alexander Dr.	182	20	202	26	212	238
(Future) NIH Gate at Hopson Rd.	228	26	254	32	266	298
EPA Gate at T.W. Alexander Dr.	403	50	453	69	454	523
EPA Gate at Hopson Rd.	437	56	493	77	490	567
TOTAL	1,250	152	1,402	204	1,422	1,626

7.4 RECOMMENDED CAMPUS CIRCULATION SYSTEM

There are three active gates to the combined NIH-RTP/EPA campus, with two access entries from T.W. Alexander Drive to the west, and one access entry from Hopson Road to the south. Principal considerations related to site access include the geometry and traffic controls of the roadways, the number of vehicles entering and exiting during the peak hours on a daily basis, as well as the security provisions for vehicles entering and circulating through the site.

The main entrance to the NIH-RTP campus is via a gated roadway (Environmental Parkway), which intersects with T.W. Alexander Drive at a point approximately one-half mile south of the NC 147 (Durham Freeway) spur. The inbound roadway into the campus is controlled by a security post approximately 400 feet into the campus. This entrance will continue to be the main NIH and visitor's access. The other two EPA entrances would continue to be used by NIH employees. The first of these is located approximately 2100 feet north of the main NIH-RTP access off of T.W. Alexander Drive, at a signalized intersection. The second entrance is located off of Hopson Road at the southeast corner of the campus. An additional access driveway to NIH exists along Hopson Road, approximately 1,800 feet west of the EPA driveway, however it is currently non-operational.

Exhibit 7.2 compares the existing gate traffic to the estimated future traffic (at the time of the study, while the Triangle Parkway was still "proposed"). It indicates that after the construction of the Triangle Parkway, and on full build-out of the campus, the two existing gates on T.W. Alexander Drive would have traffic comparable to current volumes at peak hours. The projected campus growth and change in employee commuting patterns would however see a substantial gain in employees accessing the gates off Hopson Road. The morning and evening peaks indicate an increase of four to five times by the end of Phase 3.

This Master Plan therefore recommends the reactivation of a permanent access off Hopson Road as in the 1971 Master Plan. The new access point (existing gate is too close to utility easements) should ideally be located at least 1000 feet east of the Hopson Road/Louis Stephens Drive intersection to maintain adequate intersection spacing. Due to the construction of the Triangle Parkway and the closure of the NC 147 spur, the Hopson Road driveway is expected to become the second NIH egress/ingress to the campus. In order for the access along Hopson Road to be operational soon after the Triangle Parkway opening (December 2011), the Master Plan

recommended that the construction of the new Hopson Road access occur concurrently with the Phase 1 improvements. Obtaining a driveway permit from NCDOT is essential and may take up to nine (9) months for issuance thus it is important to begin the process early in the Phase 1 improvement stage.

Access to the joint NIH-EPA warehouse is planned via the former NC 147 spur, part of which is expected to revert to NIH. If the warehouse remains an early-action item, the timing of the Triangle Parkway opening (which occurred in December 2011) was essential to monitor for the required design, permitting and construction of the Warehouse.

A future on-campus road link, connecting the warehouse to the main NIH campus has been considered to allow delivery of secured material without leaving campus. Given that any future road would require crossing Burdens Creek, a feasibility study to investigate environmental impacts would be required. However, NIH and EPA have previously utilized the now abandoned Jenkins Road (SR 1975) for access to the trailers. The temporary bridge over the Burdens Creek was damaged during surveys for Triangle Parkway. The current condition of the roadway is not known and therefore further studies would be required to determine the feasibility of utilizing this roadway as the connector. A planning study for upgrading the Jenkins Road and Construction of Burdens Creek Bridge was conducted by EPA in 2000. It is recommended that NIH/EPA revisit this issue as the possibility of this link would be positive in securing the campus.

Traffic Analysis

Traffic analyses were conducted by Ramey Kemp and Associates, Inc. to determine the Level of Service (LOS) at key intersections on the planned campus circulation plan. A computer software package, Synchro (Version 7), developed by Trafficware Corporation, was used to complete the traffic models which are generated based on methodologies in the 2000 Highway Capacity Manual (HCM). Capacity analysis for both unsignalized and signalized intersections was conducted, as unsignalized analysis from this software does not provide an overall level of service for an intersection.

The HCM defines capacity as "the maximum hourly rate at which persons or vehicles can reasonably be expected to traverse a point or uniform section of a lane or roadway during a given time period under prevailing roadway, traffic, and control conditions." Level of service (LOS) is a term used to represent different driving conditions, and is defined as a "qualitative measure describing operational conditions within a traffic stream, and their perception by motorists and/or passengers."

Exhibit 7.3: Level of Service and Delay - Highway Capacity Manual

Unsignalized Intersection LEVEL OF SERVICE	Unsignalized Intersection AVERAGE CONTROL DELAY PER VEHICLE (SECONDS)	Signalized Intersection LEVEL OF SERVICE	Signalized Intersection AVERAGE CONTROL DELAY PER VEHICLE (SECONDS)
A	0-10	A	0-10
B	10-15	B	10-20
C	15-25	C	20-35
D	25-35	D	35-55
E	35-50	E	55-80
F	>50	F	>80

Level of Service varies from LOS "A" representing free flow, to LOS "F" where breakdown conditions are evident. Refer to Exhibit 7.3 for HCM levels of service and related average control delay per vehicle for both signalized and unsignalized intersections. Control delay as defined by the HCM includes "initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay". An average control delay of 50 seconds at a signalized intersection results in LOS "D" operation at the intersection.

Future year (2027) traffic conditions were developed by obtaining background traffic forecasts from the Triangle Parkway Environmental Assessment (Triangle Parkway EA) document dated February 1, 2008. The traffic forecasts from the Triangle Parkway EA were projected to the year 2030, and serve as an approximation for background traffic conditions to be expected in 2027. The additional site trips expected to be generated by a growth of site traffic were distributed to all study intersections and then added to the background traffic projections obtained from the Triangle Parkway EA document. Levels of Service and Delay were analyzed for the intersections of campus roadways with adjacent public roads, and for internal campus intersections.

For this analysis, the AM peak hour occurs between 7:00 AM and 9:00 AM and the PM peak hour occurs between 4:00 PM and 6:00 PM. The NIH-RTP site was modeled to follow the typical traffic flow patterns seen at other office buildings and research facilities nationwide. The result of this analysis is indicated in Exhibit 7.4 in which projected traffic movements at key intersections are indicated.

The study found that site intersections are expected to operate at acceptable levels of service during both peak periods. An exception is the intersection of Environmental Parkway at T.W. Alexander Drive where vehicles exiting onto T.W. Alexander Drive may experience excessive delays due to high through traffic volumes on this road during the peak periods. It should be noted that it is not expected that the future intersection volumes would satisfy the signal warrant criteria necessary for a signal installation, per NCDOT policy. However, a formal signal warrant analysis is recommended at the intersection once the Hopson Road access is constructed and traffic patterns change, to determine if actual traffic volumes satisfy the required signal warrant criteria. Refer to Exhibit 7.5 for a summary of the AM and PM peak hour levels of service at the study intersections. Given the expected good LOS for future year traffic conditions that include site traffic that would be generated by Phase 3 of development, it was not necessary to include a separate analysis for Phases 1 and 2.

A key intersection along Environmental Parkway is planned east of the gate and visitors' center, which would provide the primary access to the parking deck. Traffic flows through this intersection should be similar with entering traffic making a left-turn movement primarily occurring during the morning peak period and exiting traffic making a right-turn movement onto the roadway occurring during the evening peak period thus, conflicting turning movements would be minimized.

To accommodate the increase in traffic accessing the NIH site via Hopson Road, the Master Plan recommends the addition of a new NIH entrance on Hopson Road. This intersection is expected to warrant signalization under future conditions. Under signalized operation, the exiting driveway should be planned with both right and left turn lanes. This configuration would provide acceptable levels of service and traffic operations at this intersection through the 20-year period considered in this Master Plan. In the event that future left turning traffic volumes exceed those projected in this study, the exiting driveway can be reconfigured to have a shared left-right lane and an exclusive left lane without construction of additional pavement. However, if dual left turn lanes are ultimately needed, the eastbound departure of Hopson Road would require two receiving lanes. The planned NIH access and the existing EPA access on Hopson Road are separated by approximately 2,500 feet. Roadway design standards suggest carrying a departure lane at least 1,000 feet from an intersection before a lane reduction. As a result, it is recommended to coordinate roadway improvement efforts with the NC Department of Transportation and the NC Turnpike Authority if the addition of a second eastbound lane on Hopson Road is constructed. At the time of the study, it was considered possible to obtain cost savings by widening concurrent with Triangle Parkway-related widening of Hopson Road near the ramp interchanges close to the EPA access driveway.

EXHIBIT 7.4: PROJECTED FUTURE (HORIZON YEAR) PEAK HOUR TRAFFIC

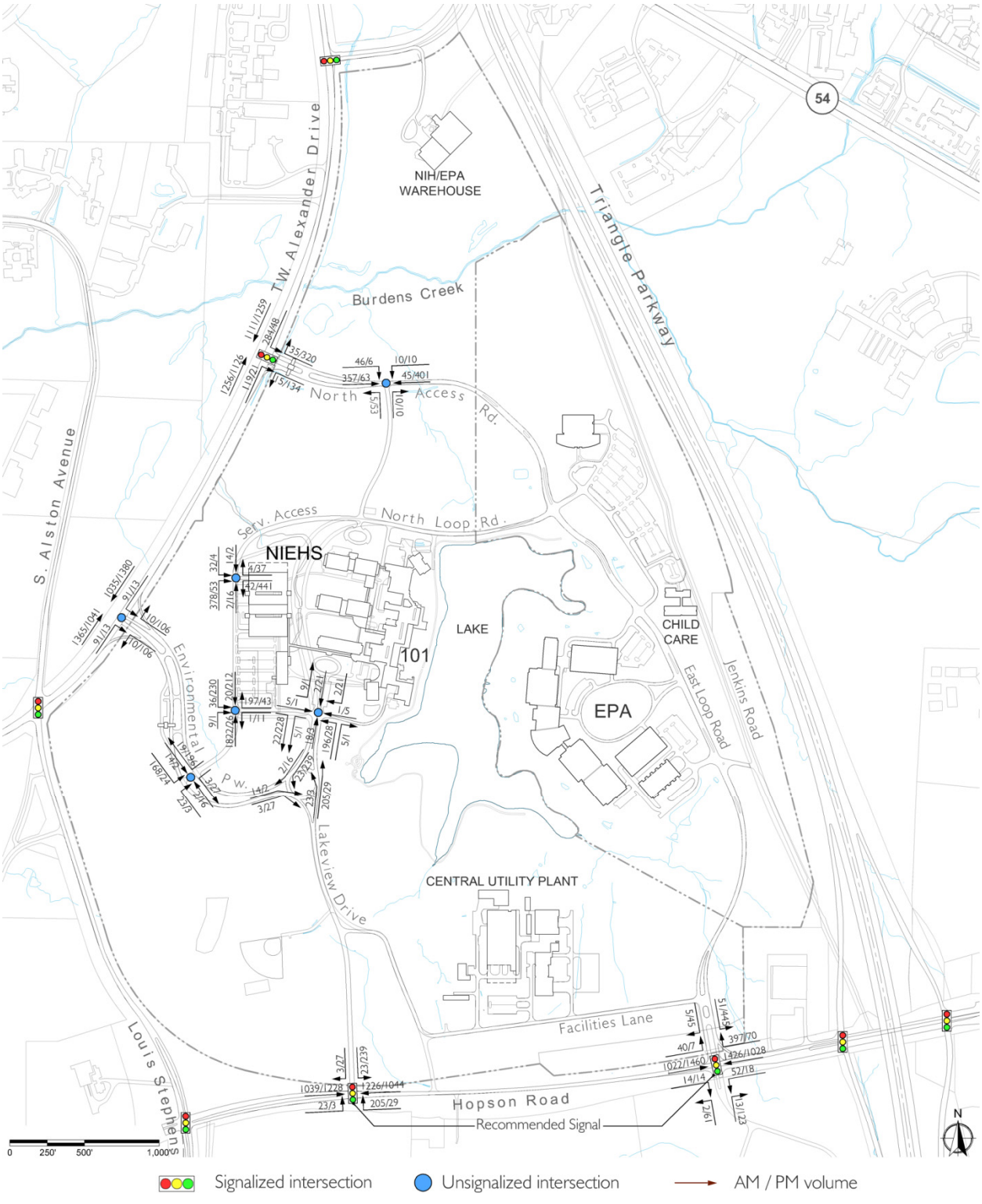


EXHIBIT 7.5: INTERSECTION LEVEL OF SERVICE (LOS) SUMMARY - FUTURE CONDITIONS

INTERSECTION	APPROACH	LANE CONFIGURATIONS	WEEKDAY AM PEAK HOUR LEVEL OF SERVICE Approach	WEEKDAY AM PEAK HOUR LEVEL OF SERVICE Overall	WEEKDAY PM PEAK HOUR LEVEL OF SERVICE Approach	WEEKDAY PM PEAK HOUR LEVEL OF SERVICE Overall
T.W. Alexander Drive and Environmental Parkway	WB NB SB	1 LT, 1 RT 1 TH, 1 RT 1 LT, 1 TH	F[1] -- C[2]	N/A*	F[1] -- B[2]	N/A *
T.W. Alexander Drive and EPA Gate	WB NB SB	1 LT, 1 RT 1 TH, 1 RT 2 LT, 1 TH	C C C	C	D D C	D
Hopson Road and EPA Gate	EB WB NB SB	1 LT, 1 TH, 1 TH-RT 1 LT, 2 TH, 1 RT 1 LT, 1 TH-RT 2 LT, 1 TH-RT	A A A C	A	C B C D	C
Hopson Road and NIH Gate	EB WB SB	1 LT, 1 TH 1 TH, 1 RT 1 LT, 1RT	B C C	C	D B D	C
EPA North Gate Road and NIH N. Access Road	EB WB NB	1 TH-RT 1 LT-TH 1 LT-RT	-- A[2] B[1]	N/A*	-- A[2] B[1]	N/A*
North Loop Road and Parking Deck Access Road	WB NB SB	1 LT, 1 RT 1 TH, 1 RT 1 LT, 1 TH	A[1] -- A[2]	N/A*	B[1] -- A[2]	N/A*
North Loop Road and Main Street**	WB NB SB	1 LT-RT 1 TH-RT 1 LT, 1 TH	B[1] -- A[2]	N/A*	B[1] -- A[2]	N/A*
North Loop Road and Environmental Parkway	EB WB SB	1 LT, 1 TH 1 TH, 1 TH-RT 1 LT, 1 RT	A[2] -- A[1]	N/A*	A[2] -- A[1]	N/A*
Main Street** and Lakeview Drive	EB WB NB SB	1 LT-TH-RT 1 LT-TH-RT 1 LT-TH-RT 1 LT-TH-RT	A[2] A[2] B[1] A[1]	N/A*	A[2] A[2] B[1] A[1]	N/A*
Environmental Parkway and NIH South Gate Road (ROUNDABOUT)	EB NB SB	1 LT-RT 1 LT-TH 1 TH-RT	A A A	A	A A A	A

1. Level of service for minor street approach.
2. Level of service for major-street left-turn movement.

* The Synchro analysis software does not provide an overall LOS for an unsignalized intersection.

** Main Street is the new road that runs east/west north of the circle and intersects North Loop Road and merges with the existing service drive.

7.5 Other On-Campus Circulation Patterns

- NIH access to the Child Care Center: A number of NIH-RTP employees utilize the Child Care Center, with approximately 56 enrolled at the time of this writing. The center has a maximum capacity of 188 children, and a current enrollment of 160. Vehicular movements induced by this utilization consist of added on-campus traffic from employees who drop children at the center in the morning and then travel to one of the NIH buildings. Most of this circulation is assumed to utilize the EPA entry gate at Alexander Drive and then the North Loop Road to the NIH-RTP campus. It is likely that an increased proportion of child drop-off and pick-up trips use the EPA gate on Hopson Road now that the Triangle Parkway is complete.
- Circulation between the CUP and Building 101: Approximately 190 employees and contractors utilize the CUP complex or work out of the facilities there, and require relatively frequent access to the remainder of the campus for meetings and maintenance requirements.
- Circulation between the CUP and EPA: EPA utilizes the incinerator located at the CUP, as well as a small area within the waste holding facility. The frequency of EPA trips to the CUP varies, with no trips on some days, but generally averaging several per day.
- Circulation between Building 101 and the EPA Research and Administration Building: Although there is currently not a high degree of interaction between the two campuses, there are still a number of important shared activities between the two federal facilities, including shared recreation and smart commute days, as well as meetings and routine business between the two agencies related to the operation of the campus.

EXHIBIT 7.6: SERVICE ACCESS

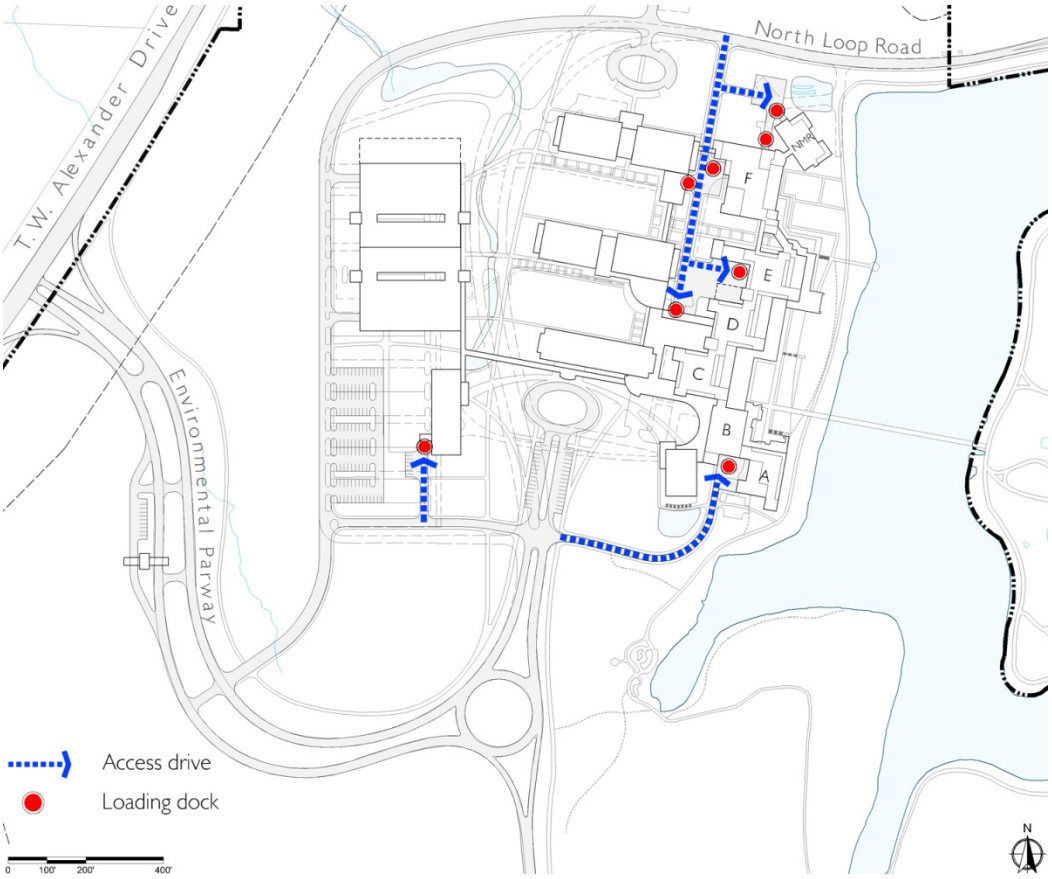
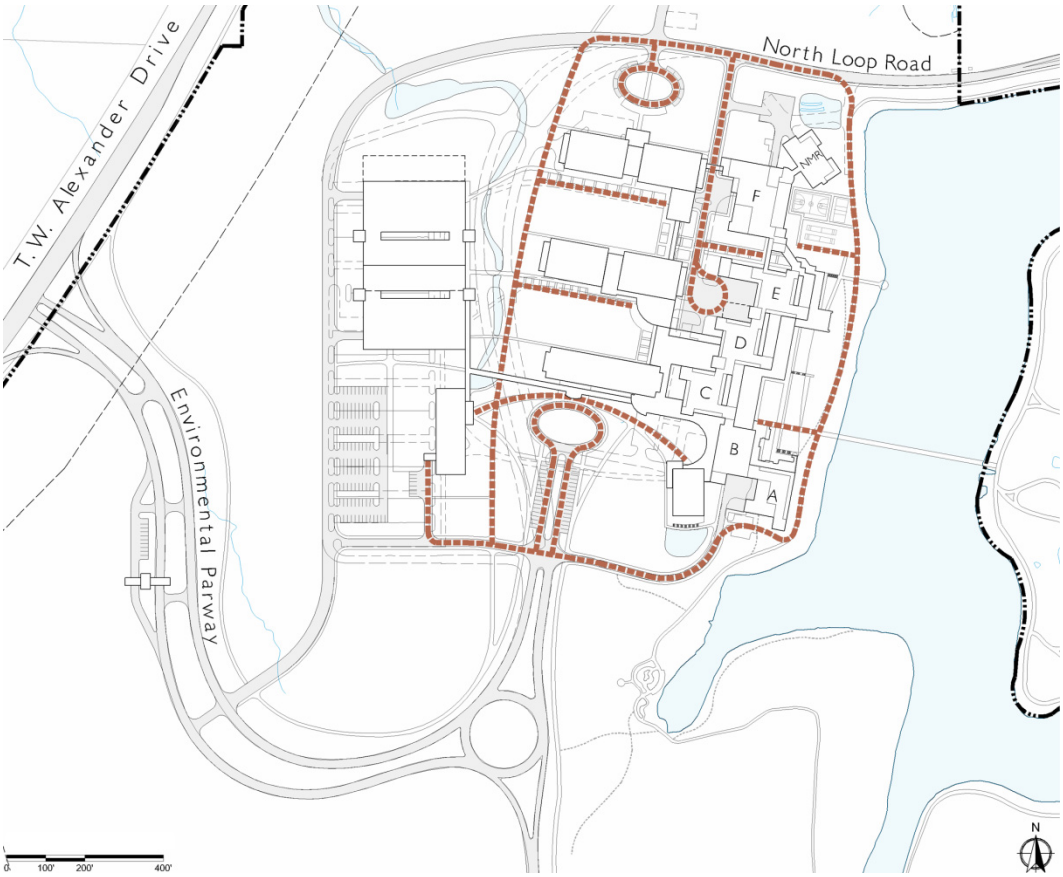


EXHIBIT 7.7: EMERGENCY ACCESS



7.6 Service Access

The service needs for the NIH-RTP campus are relatively uniform from week to week and include a daily municipal solid waste collection, and twice-weekly recycling material collection. Building 101 has several loading docks, and the Central Utility Plant also has its own loading dock facilities. Service vehicles accessing these facilities utilize the main NIH gate from T. W. Alexander Drive and the internal roadways within the campus. These roadways provide adequate widths and turning radii to accommodate delivery vehicles to the campus. Observations were made of dock activities during the surveys. There were no indications of vehicles queuing at the docks. In fact, loading/unloading activity appeared to be generally quite limited.

Future commercial delivery trucks would have limited access to the main campus as most deliveries would be made to the Warehouse. Service trucks would be required to follow security protocols established by NIH and EPA that would direct trucks to the EPA Hopson Road entrance between 6:00 am and 6:00 pm while the gate is guarded. Future driveways and circular turnarounds would be designed to accommodate the turning radii of typical trucks.

7.7 Emergency Access

Existing emergency access to the NIH Building 101 is provided on the west side via the parking lot and circulation roadway fronting the building. Along the east side of Building 101, the multipurpose path facilitates ingress of emergency vehicles.

The Master Plan shows emergency access throughout the NIH-EPA campus under future phases. Important considerations in developing the an emergency access circulation plan included location of buildings and offset distance from adjacent roadways, proximity of existing and future buildings, and availability of adequate roadways to allow ingress and egress of emergency vehicles under situations requiring rapid response.

There are three major routes in the Master Plan emergency access circulation plan. The first route lies to the west of the main building complex and follows the north-south pedestrian walkway through the campus center. The second route consists of the service roads that provide access to the central loading court and southern loading area. These service roads would double as emergency access roads during emergency situations. The third route runs along the pedestrian pathway located to the east of the main building complex adjacent to the lake.

All buildings on the NIH-RTP campus are to have a minimum clearance of 30 feet to other structures to provide for fire separation and emergency vehicle access. The pedestrian pathways (indicated in the diagram) would be designed to accommodate occasional emergency vehicle loads with a clear path of 16 feet minimum width and 14 feet minimum height. The NIH Design Policy and Guidelines published by the Office of Research Facilities also requires the following:

> *Also, all new buildings will have at least two sides readily accessible to fire department apparatus at all times, and access to all fire department connections will be provided. Further, fire lanes shall be provided for buildings that will be set back more than 45 meters from a public road or exceed 9.2 meters in height and are set back more than 15 meters from a public road. Fire lanes will be at least 6.1 meters in width, with the road edge closest to the building at least 3.1 meters from the building. All fire lanes will have painted curbs and appropriate signs. The minimum roadway turning radius shall conform to the standard 14.6 meters semitrailer template. Fire lanes shall be constructed of an all-weather driving surface capable of supporting imposed loads of 27,216 kilograms. Turf-filled paver blocks are not acceptable as an all-weather driving surface. Any dead-end road longer than 90 meters shall be provided with a turnaround at the closed end at least 27 meters in diameter. This requirement principally applies to the road leading into the main loading court and the road leading to the southern loading dock area. Fire lanes and access areas for fire hydrants and automatic sprinkler/standpipe fire department connections shall be clearly identified by painting adjacent curbing yellow. In addition, signage shall be posted and spaced at 30 meter intervals and/or at the beginning and end of the no-parking zones.*

7.8 CAMPUS PARKING PLAN

The site currently consists of office space, research laboratories, amenities, and support infrastructure. The Master Plan considers three phases of development occurring over 5-10, 10-15 and 20 years, hereafter referred to as Phase 1, Phase 2, and Phase 3, respectively.

A. Existing Parking Demand

Section 3.5 of this report documents the existing inventory of parking spaces on NIH campus. A total of 998 parking spaces are located throughout the NIH campus and are distributed in four lots: a) main parking lot-722 spaces; b) parking adjacent to Building 101 – 129 spaces; c) Central Utility Plant parking – 125 spaces; and adjacent to Modular Clinic – 22 spaces.

A parking utilization survey was conducted for the main parking lot by OR George & Associates, Inc. in October of 2007. The total number of vehicles present in the lot was observed in hourly increments. The peak parking demand of 630 vehicles was observed during the 11:00 AM to 12:00 PM interval. For the purpose of the study, it was assumed that the other two lots were filled to their practical capacity. Practical capacity for these lots is 95% of the total space count. As a result it was assumed that the parking lot adjacent to Building 101 contained a peak of 123 vehicles and that the Central Utilities Plant lot contained a peak of 119 vehicles. By adding the peak parking demand in all three (3) lots, a total parking demand of 872 spaces is estimated.

The population census in early 2007 indicated a total population of about 1,472 inclusive of contractors and funded vacancies. Not including the vacancies, a demand rate of 0.67 per employee was established which corresponded to a current peak parking demand of 987 parking spaces.

The practical capacity of the parking lots is assumed as 95% of the total space count due to unutilized spaces resulting from typical parking turnover and vehicular traffic circulating, entering, and exiting the parking facilities. A total space requirement of 1,039 spaces was determined for the existing NIH population by dividing the projected peak demand of 987 parking spaces by the 95% (0.95) practical capacity factor. Refer to the table on the next page for a summary of the parking.

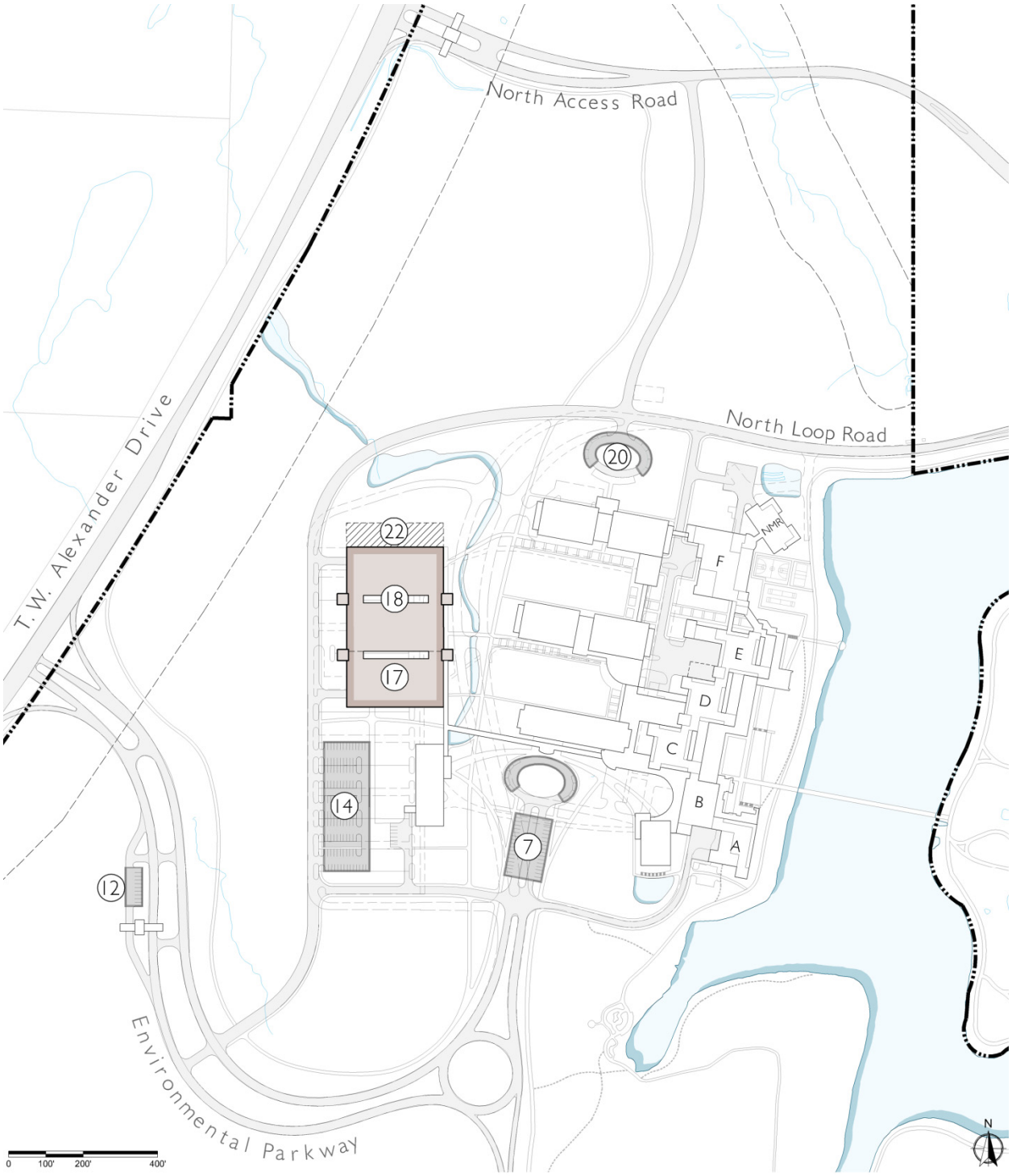
B. Projected Parking Demand

The projections for future space needs and future employment increases were used to calculate future parking demand. Under Phase 1, over the next ten years, 308 employees would be added to the on-site work force. Under Phase 2, over the next fifteen years, 177 additional employees would be added to the on-site work force. Under Phase 3, over the next twenty years, 493 additional employees would be added. All off-site NIH staff would return to campus in Phase 1 of the Master. By the end of Phase 3, it is expected that there would be 2,450 employees on-site.

EXHIBIT 7.8: PARKING DEMAND

	On Site Employee Additions	On Site Employee Count	Peak Parking Demand	Spaces Needed (95% Util)	With Advanced TMP (10% Reduction)	Spaces Needed (Advanced TMP @ 95% Util)
Existing	--	1,472	987	1,039	935	984
Phase 1	308	1,780	1,193	1,255	1,130	1,189
Phase 2	177	1,957	1,311	1,380	1,242	1,307
Phase 3	493	2,450	1,642	1,728	1,555	1,637

EXHIBIT 7.9: PARKING PLAN



(7) Surface - 40 spaces
(12) Surface - 10 spaces
(14) Surface - 105 spaces
(17) Phase 1 Structure 430 spaces
(18) Phase 2&3 Structure 970 spaces
(20) Surface - 10 spaces
(22) Potential parking structure expansion

(Numbers related to Campus Center elements in exhibit 5.6)

To accommodate NIH-RTP growth, additional parking will be required in each phase of development. Refer to Exhibit 7.8 for the total on-site employee projections, the peak parking demand projections, and the required total space count for each phase of the Master Plan. At the completion of Phase 3 the peak parking demand is projected to be about 1,642 vehicles, depending upon the success of the TMP program and the availability of improved transit facilities to the site. The corresponding parking requirement would range between 1,642 and 1,728 spaces.

C. Handicapped Parking

Handicap accessible parking space counts were determined based on Americans with Disabilities Act (ADA) standards that require a minimum of one van accessible space per lot and at least one van accessible space for every eight handicap accessible spaces provided. Although code-required quantity of handicapped spaces have been calculated for each structure and parking lot, the federal government utilizes several programs to employ the handicapped and therefore its facilities require higher allocation of handicapped parking spaces. Exhibit 7.10 shows the calculated and recommended handicapped space allocations. The actual provisions and locations should be coordinated at the design stage to provide the closest access to buildings given the security setback requirements.

EXHIBIT 7.10: HANDICAPPED SPACE ALLOCATION

	Estimated Space Count	Calculation of HC Spaces Standard HC Space	Calculation of HC Spaces Van HC Space	Recommended Allocation of HC Spaces Standard HC Space	Recommended Allocation of HC Spaces Van HC Space
Structured Parking Phase 1 (#17)	430	8	1	16	4
Structured Parking Phase 2 and 3 (#18)	970	16	3	32	6
Surface Spaces Main Lot (Modified) (#14)	105	3	2	8	4
South Auto Drop-off/Visitor Parking – (#7)	40	1	1	8	2
North Auto Drop-off – (#20)	10	0	1	0	1
Visitors Center (#12)	10	0	1	0	1
Warehouse	12	0	1	2	2
CUP	150	4	2	8	2
TOTAL	**1,727**	**33**	**10**	**74**	**22**

Note: The # noted are reflected in Campus Center Illustrative Plan (Exhibit 5.6)

D. Transportation Management Program and Parking Requirements

Presently, NIH has in place a well-developed Transportation Management Program (TMP) also referred to as Travel Demand Management (TDM). This program appears to be rather successful, with a significant proportion of NIH employees reporting the use of carpooling or transit ridership. The Parking Demand table illustrates a potential for reduction in total parking space counts due to advanced and improved TMP techniques. For the purpose of the study, it was assumed that a 10% reduction in parking demand could be obtained by improving upon the existing TMP and implementing additional measures.

E. Durham County Parking Requirements

The Durham County Planning Department has indicated that federal facilities constructed on federally-owned land are not subject to the county planning ordinances governing parking spaces. However, to establish parking space requirements the Master Plan has used the land use category "Light Industrial Office" that most closely resembles the current and future land uses on the site. The ordinance requires one parking space per 1,000 gross square feet of floor space. The Master Plan Space Needs Summary projects the total NIH campus space to be 1,658,000 gross square feet (not including area for linkages) at the completion of Phase 3. This corresponds to a parking requirement of 1,658 spaces.

In addition, the Durham County ordinances allow up to a 20% reduction in the number of required spaces if a TMP plan is implemented and up to 20% of the spaces provided can be sized for compact cars with reduced widths and lengths. However, the reduction in the number of required spaces should be considered after the TMP plan has proven to be successful.

F. Parking Recommendations and Implementation

The Master Plan, after implementation of Phase 3, provides for 1,727 parking spaces. It also identifies areas for additional parking if necessary in future at the Campus Center and at the CUP. Exhibit 7.9 Parking Plan graphically shows the parking provisions within the Campus Center. Parking outside the Campus Center is planned at the CUP (150) and warehouse (12) . Exhibit 7.11 shows the parking implementation by phase. Exhibits 10.2, 10.3, and 10.4 graphically show the location of parking areas and capacities at each phase.

EXHIBIT 7.11: PARKING PROVISIONS DURING PHASED DEVELOPMENT

	EXISTING	PHASE 1	PHASE 2	PHASE 3
Personnel	1,472	1,780	1,957	2,450
Parking Demand	987	1,193	1,311	1,642
Recommended Number of Spaces	**1,039**	**1,255**	**1,380**	**1,728**
Recommended No. of Spaces with Advanced TMP	**984**	**1,189**	**1,307**	**1,637**

AREA	EXISTING	PHASE 1	PHASE 2	PHASE 3
Surface Parking Main Lot (#14)	722	604*	386	105
Surface Parking Building 101	129	60		
Central Utilities Plant	125	125	125	150
Modular Clinic	22	22	85	
Visitor's Parking Phase 1&2		25	25	
Visitor's Center (#12)		10	10	10
Warehouse		12	12	12
Structured Parking Phase 1 (#17)		430	430	430
Structured Parking Phase 2 (#18)			350	350
Structured Parking Phases 2/3 (#18)				620
South Auto Drop-off (#7)				40
North Auto Drop-off (#20)				10
Total Planned Spaces by Phase	**998**	**1,288**	**1,304**	**1,727**

* Does not include temporary parking provided during the construction of the Phase 1 parking structure. (see Exhibit 10.2)

Note: The #'s noted are reflected in Campus Center Illustrative Plan (Exhibit 5.6)

7.9 PUBLIC TRANSIT

NIH-RTP is served primarily by the Triangle Transit Authority (TTA), a regional transit service that provides commuter bus service throughout the Raleigh/Durham/Chapel-Hill area. Bus service via TTA 45 has weekday stops at Building 101 on the existing NIH campus, with service beginning at approximately 6:30 AM and ending at approximately 5:45 PM. Buses generally run at approximately one-half hour intervals during the morning and evening peak periods and at approximately one hour intervals during the remainder of the day. Bus service via TTA 45 begins and ends at the Triangle Transit Center [RTP Bus Center], located off of Interstate 40 (exit #280), near the intersection of NC Hwy 54 and Davis Drive, approximately one (1) mile from the NIH campus. Most shuttle customers of TTA 45 transfer to the center via other TTA buses or the Durham Area Transit Authority (DATA) which also provides bus service to Triangle Transit Center. Transit options are currently limited for the NIH campus thus it is unlikely that significant modifications to existing transit facilities would be necessary in the near-term. Nevertheless, any modifications to the existing campus building should consider the impact to bus stop shelters, benches, etc. A new initiative, referred to as the Regional Transit Vision Plan, has been introduced by the Special Transit Advisory Commission (STAC). The Plan is currently not approved, however it identifies three (3) key categories of investments for a complete transportation system.

- The first category is an enhanced region-wide bus network that would include an expansion of existing bus service to outlying neighborhoods as well as improvements to the existing bus service, including express service busses to key destinations, rush hour only service to outlying communities, enhanced services to key areas to serve the rail and circulator investments, a system of park-and-ride lot to be served by the express and regional services and enhanced transit access for pedestrians and bicyclists. An increased bus network could encourage employees that may reside outside of the typical bus service area to consider transit in lieu of driving their personal vehicles to the campus.
- The second category is circulators which would provide flexible travel options within key activity centers. All circulators are initially expected to be buses with the potential for future service to be provided by street cars or modern trolleys.
- The third category is rail service which would serve the region's most congested corridors and key activity centers. The segments of the proposed rail system in the Raleigh, Durham and Research Triangle Park areas would utilize diesel multiple unit (DMU) rail cars operating within the existing railroad rights-of-way. The segments connecting Durham to Chapel Hill would utilize light rail cars on new alignment.

Full implementation of the vision plan is currently planned by 2035. Upon approval of the plan, the enhancement of the existing bus service and expansion of services could provide a near-term relief to increased vehicular congestion along the primary routes serving the NIH/EPA campus.

A transit loop has been proposed by the Triangle J Council of Governments as part of the Center of the Region Enterprise (CORE) initiative. The loop would connect Raleigh-Durham International Airport (RDU) with the TTA regional rail line and surrounding development within the CORE boundary. The proposed loop is currently purely conceptual, with neither the transit device nor the exact route of the loop defined. However, the development of such a system could provide for enhanced transit service for the NIH/EPA campus in the future.

The expansion of the campus to create a Campus Center atmosphere does not necessitate the need for multiple bus stops since employees utilizing the shuttle should be able to congregate in one or two designated central locations. However, the appropriate location of bus stop(s) would be contingent upon the transit bus routing as determined by site security protocols implemented by NIH and EPA.

7.10 TRANSPORTATION MANAGEMENT PLAN

The primary goal of a Transportation Management Plan (TMP) is to reduce the amount of vehicular trip generation per employee so that vehicular trip growth is managed to limit traffic impacts on the transportation network. The NIH-RTP campus has an extensive TMP currently in place. Although currently relatively informal, the program is coordinated with the employees in an effort to encourage the reduction of vehicular traffic. Several of the TMP strategies currently employed on the campus are listed below:

- Reserved parking spaces for carpool and vanpool participants.
- Flexible work schedules and opportunities for telecommuting.
- Participation within the RTP Smart Commute program, which is an initiative created by the RTP Owners and Tenants Association to address transportation concerns, reduce traffic congestion and improve air quality.
- Annual NIH events to promote smart commuting options.
- Designation of a Campus Transportation Management Coordinator
- Provision of bicycle amenities, including bicycle racks, stands, shower and locker facilities.
- Shuttle service provided between key buildings on the campus.

The NIH-RTP TMP is considered successful, with a large number of NIH respondents to the traffic survey reporting the use of carpooling or transit ridership. Based on the travel surveys completed by NIH staff, the average number of occupants per vehicle is approximately 1.4 people per vehicle. This compares very favorably to the typical vehicle occupancy rate of about 1.1 people per vehicle for peak hour commute-to-work trips.

NIH continues to strengthen and promote its existing TMP. It could consider additional incentives such as 'guaranteed ride home' and 'ride-matching services' in addition to the use of carpooling / vanpooling and alternative modes of travel such as walking, biking and riding transit. In addition the NIH TMP program could be aligned with EPA's TMP since both the agencies are expected to increase the number of employees on campus. Collaboration with city, county, and state planning agencies to encourage the development of a physical environment in the vicinity of the campus conducive to walking, biking, and transit ridership could also be pursued.

7.11 PEDESTRIAN AND BICYCLE CIRCULATION

Planned pedestrian and bicycle provisions are intended to create a safe environment for pedestrians and provide efficient means for bicyclists to access the surrounding bicycle trails. The Master Plan would improve pedestrian and bicycle circulation and mobility on the campus to encourage employees to utilize non-motorized means of transportation.

It is expected that an increase in mixed-use and residential developments in the vicinity of the campus, coupled with TMP initiatives, would spur an increase in pedestrian activity. Currently, pedestrian activity is generally limited to employees and/or visitors walking from the parking areas to the buildings via a network of sidewalks. Additionally, recreational walking is popular during lunch and/or break periods.

One of the goals of the Master Plan is to create a Campus Center atmosphere, which would minimize the need for vehicular travel among buildings. Well-maintained sidewalks throughout the campus are planned, and by relocating the vehicular roadways to the perimeter of the campus center, the potential for vehicular and pedestrian conflicts would be significantly reduced.

On-campus bicycle facilities are an important part of encouraging non-vehicular transportation for employees. Although existing conditions do not indicate a significant amount of bicycle usage for travel to and from the campus, the potential for mixed-use and residential growth in the vicinity of the campus increases the likelihood

of bicycle usage in the future. Bicycle access to the campus for employees should be maintained at all vehicular access points. Bicycle access to the campus for visitors should be limited to the primary access point along T.W. Alexander Drive.

The provision for increased bicycle activity on the campus is important to consider in the development of the Master Plan. It is not recommended that separate on-campus bikeways be established however, in the future, roadway typical sections should consider including bicycle lanes on key roadways. Safe and easy access from the roadways to bicycle storage facilities should be accommodated. The location of bicycle storage racks and lockers would be placed strategically in order to minimize potential conflicts with pedestrian traffic yet provide an efficient means to access the campus facilities.

Master Plan – New Trails

NIH and EPA employees have considered several proposals for new trail segments within the campus. The Master Plan seeks to add more trails in strategic locations to complete campus pedestrian network. These are shown in Exhibit 7.12.

Trail #1 would form a loop with the RTP trail connecting with the two main entrances on T.W. Alexander Drive and would traverse through heart of campus center adjacent to eco-commons.

Trail #2 would link the new entrance plaza south of the Campus Center to the Hopson Road gate, along Lakeview Drive. This trail would provide more convenient access to the softball fields located in the southwest corner of the campus. It is also d to be connected to trail # 3.

Trail #3 would connect the CUP buildings to the existing trail that encircles the lake on the North and is planned to run parallel to Facilities Lane linking to Trail #2 to the south.

Trail #4 would provide a link from the EPA National Computer Center reaching north to Burdens Creek

Adequate signs and markings should be provided along the interior campus roadways for bicyclists. Although some bicycle paths currently exist, it is likely that cyclists would also share the vehicular roadways for circulation around the campus. It is expected that the posted speed limit along the internal roadways would be 25 mph, thus bicyclists should be able to operate in conjunction with vehicle travel with minimal conflicts. The roadways should be well-maintained, clear of debris and have drainage grates that do not impair bicycle travel.

Currently, a well-developed pedestrian, bicycle and trail network exists in the region surrounding the campus and extensions to the network are proposed in the comprehensive transportation plans of the local jurisdictions. Several trails have been developed within the open spaces surrounding many of the bodies of water in the area, with some existing in the Research Triangle Park vicinity as well as some being proposed to run along Burdens Creek on the NIH/EPA campus.

The American Tobacco Trail is an approximately 22 mile rails-to-trails project located in the Triangle Region of North Carolina. The route crosses through the City of Durham; Durham, Chatham, and Wake counties; the towns of Cary and Apex; and the Lake Jordan project land of the U.S. Army Corps of Engineers. The trail runs generally a north-south direction approximately four (4) miles west of RTP.

Adjacent to the campus, a network of bicycle routes exists in the vicinity primarily consisting of marked roadways and facilities with dedicated bicycle lanes. A bicycle trail runs along NC 54 and T.W. Alexander Drive in the vicinity of the campus.

EXHIBIT 7.12: EXISTING AND PLANNED TRAILS

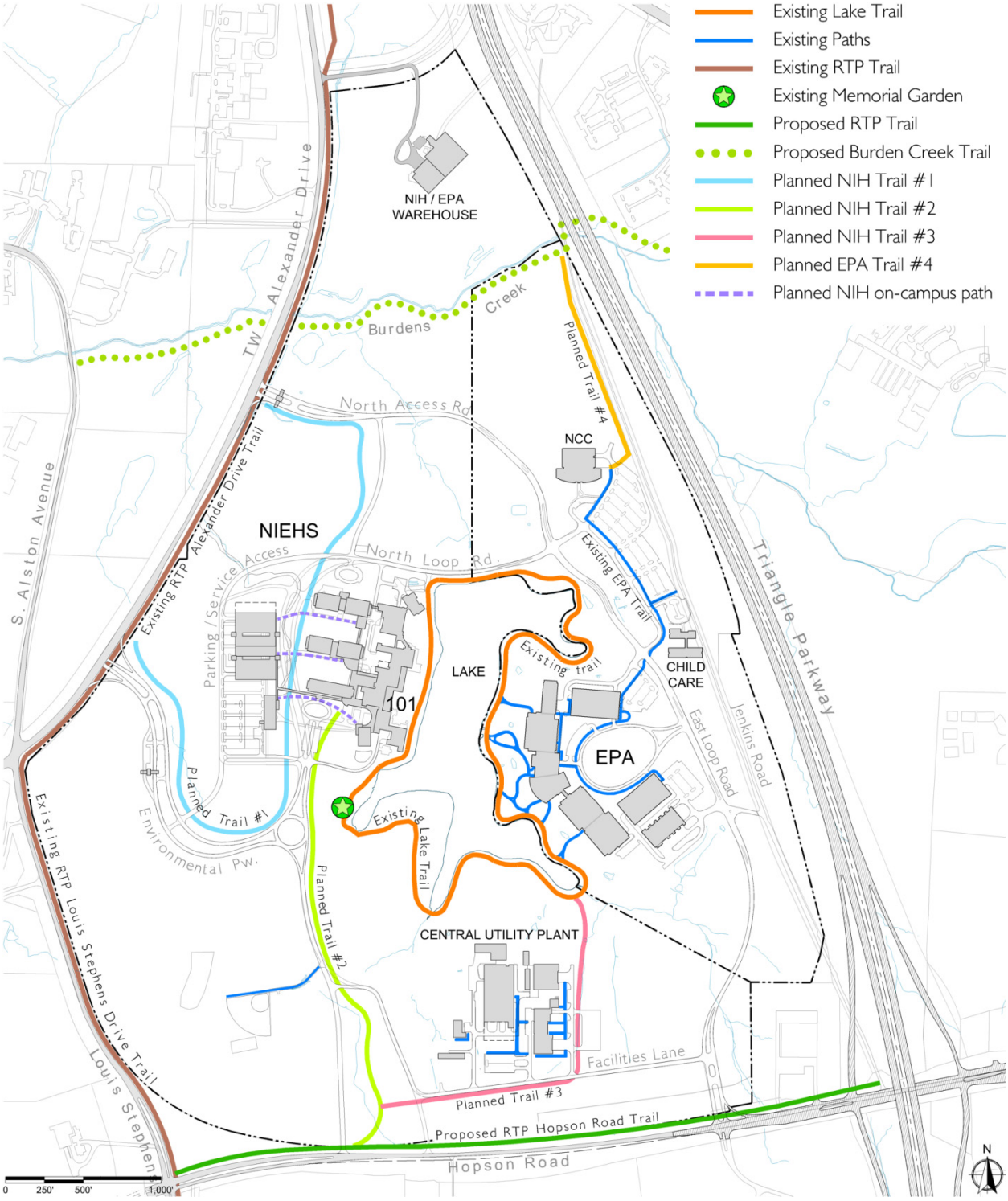
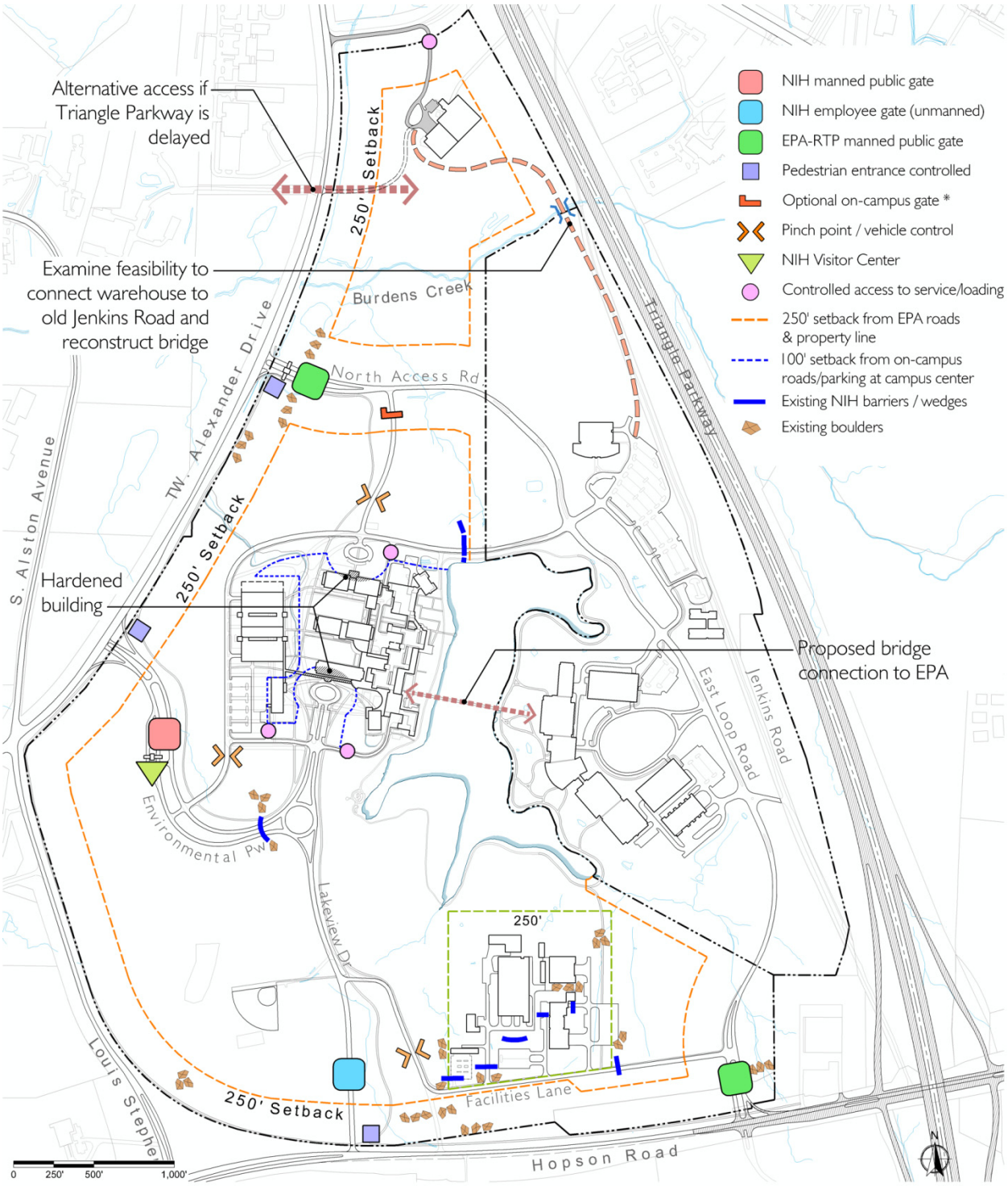


EXHIBIT 7.13: SECURITY PLAN



(*) *Optional gate for after hour operations if NIH/EPA implement separate access security strategies*

7.12 Security Improvements Plan

The NIH-RTP campus is well positioned to provide a secure environment for NIH employees, visitors, and facilities. The site has the advantage of limited and controlled access points, and a large land area that allows setbacks from public roads and visual screening of campus facilities from the outside by the existing stands of trees. However, security requirements for government facilities have changed in the past several years, and a well-defined security plan and strategy for the campus are an important part of the master plan. The NIH and NIEHS have developed a Security Upgrade Document for this campus and its recommendations have been considered in the physical planning of the campus.

A. Campus Access for Credentialed Personnel (Entrance Gates)

The Master Plan envisioned the provision of another gate off Hopson Road, which should have been operational when the Triangle Parkway opened in December of 2011. This gate was planned to be unmanned with restricted access for credentialed NIH personnel only. The remaining three gates, with guards, will implement site access procedures based on Homeland Security Presidential Directive/HSPD-12 regulations in which only personnel holding validated ID's will be allowed to enter the campus. All entrances would be equipped with electronic vehicle identification. Pedestrians and bicyclists would have a separate and controlled entrance where their ID's will be checked.

B. Campus Access for Non-Credentialed Personnel (Visitors Center)

The visitors' center will function as the primary screening facility for non-credentialed visitors. The NIH visitors' center is slated to be located on Environmental Parkway near the NIH T.W. Alexander Drive entrance. All non-credentialed personnel and vehicles will be directed to the visitor's center where individuals will go through a scanning process and their vehicles inspected before being allowed to enter the campus. Buses will be allowed, and screened on or off site. TTA buses will be boarded by security guards who will follow the protocols set by NIH/EPA. It is unclear at this time if EPA would follow similar site access procedures as NIH. As stated earlier in this report, the two agencies must adopt a common security strategy if they want to establish an open environment within the campus. This Master Plan shows a similar Visitor's Center provision for EPA, although its implementation and location are hypothetical and subject to discussion.

C. Commercial Vehicle Access

The NIH and EPA have discussed the possibility of constructing a common warehouse on campus on a parcel north of Burdens Creek. It is the intent of both agencies that all campus deliveries would be made to this warehouse. Delivery trucks would be screened and off-loaded here and on-campus distribution would be handled by each respective agency. NIH is planning to consolidate its on-site shipping/receiving in Building 104 within the common warehouse. Access to the warehouse would be from the abandoned NC 147.

The Master Plan also recommends a future on-site connection between the warehouse and the main campus using the now abandoned Jenkins Road. This connection would require reconstructing a bridge over the Burdens Creek. A planning study for the bridge replacement and upgrade of the road was prepared for EPA in 2000. The agencies could examine the feasibility of this project.

For service or delivery trucks essential to visit the main campus, NIH and EPA should establish a protocol by designating one of the manned entrance gates (Security Upgrade Document identifies EPA Hopson Rd) where such trucks can be screened after obtaining permission from NIH or EPA to allow access.

D. Vehicular Access to Buildings

The Master Plan is based on the assumption that a 100-foot vehicle setback from all buildings would be maintained. This affects access driveways, lay-by lanes, and entry courtyards. At select building entrances including the Clinic, the Master Plan provides for a reduced vehicle setback of less than 100 feet. Setbacks for the conference center, offices, parking areas, and passenger drop-off at building entrances would be determined at the time of detailed facility design.

E. Protection of Critical Assets

The two NIH buildings that fall under the category of critical assets are Building 101 and the Central Utility Plant (CUP). The Master Plan identifies logical locations for "pinch points," using active and passive vehicle barriers that can establish of 250 feet when needed to prevent vehicles coming any closer to the critical buildings.

At this stage NIH is using active wedges west of the circle as well as on Facilities Lane and Lakeview Drive (North Loop Road) to allow protection of the CUP and Building 101 independent of each other. The Plan also shows additional "pinch points" on full build-out. The EPA main building already meets the criteria for standoff while the other two buildings have a secure building design.

F. Parking (Employee and Visitor)

The Master Plan provides for a phased removal of parking areas that are less than 100 feet from any building, from areas adjacent to Building 101 and from the CUP complex. In addition, no vehicular parking can be planned within or under any occupied building.

G. Loading Docks

The Master Plan recommends a new loading dock and receiving facility to service Building 101, including construction of a new loading dock facility adjacent to or attached to the existing facility. The plan also provides access to the loading docks from service yards that can be enclosed by a secure fence or wall, with a power-operated sliding gate. Security at new loading docks will be provided with separate air handling systems sealed off from the building, and blast protection provided by location or structural design.

H. Perimeter Pedestrian Barrier

A perimeter pedestrian barrier such as a fence or wall with at least 8 feet between potential horizontal footholds, or other anti-climb measure, is typically required around any NIH facility. However, the Master Plan does not apply fencing requirements to the site. Fencing the entire site, or a portion of the site, can be undertaken in the future, based upon current threat assessments.

I. Operational Improvements

The use of extensive CCTV cameras, lighting, bollards, and video integration with access control alarms has recently been implemented.

8.

MASTER PLAN:

UTILITY FRAMEWORK

8. MASTER PLAN: UTILITY FRAMEWORK

The NIH-RTP campus is served by the following central utility systems: chilled water (CHW), high temperature hot water (HTHW), electric power, potable water, fire water, sanitary sewer, storm sewer, and natural gas. These utilities also serve the EPA campus.

As a separate task, the NIH engaged Sud Associates to develop a Master Utilities Plan (MUP) for comprehensive evaluation of the existing major utilities and their distribution systems including CHW and HTHW for both campuses. The intent of the MUP is to address future loads due to expansion, and their impact on the additional generating equipment capacity and main distribution system size.

This Master Plan, based on the concept developed, outlines future utility loads, load phasing and the location of the site utility connections to the new buildings. Based on the anticipated future growth Sud Associates evaluated the impact on the utility systems and established the required increase in generating equipment capacity and main distribution system size in the final MUP.

8.1 CHILLED WATER (CHW) SYSTEM

A. Existing Chilled Water System

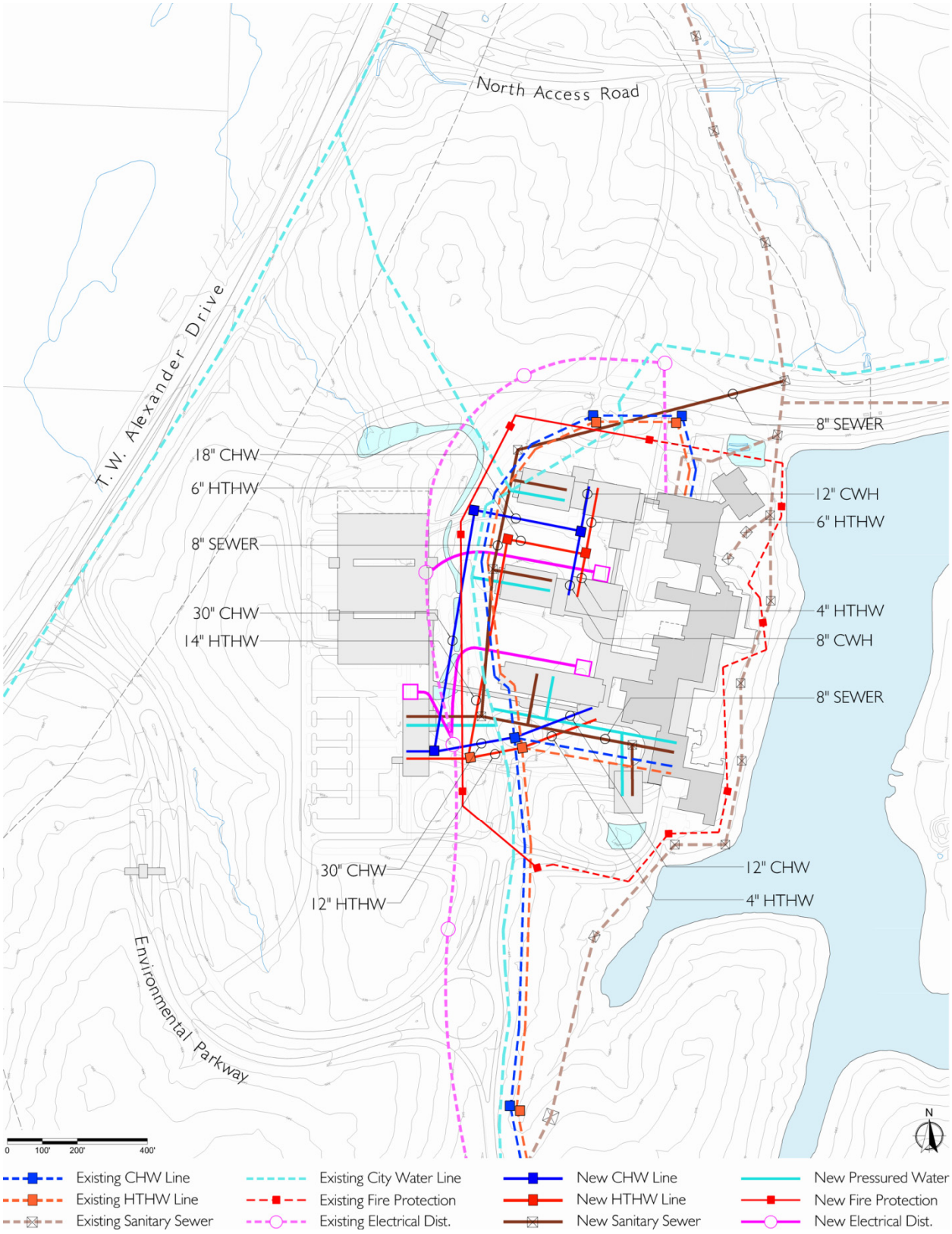
The NIH and EPA campuses are served with chilled water (CHW) from the Central Utility Plant (CUP) Building 105. The cooling equipment in the CUP consists of six centrifugal chillers, two originally rated at 2,500 Tons each and four rated at 3,500 Tons each. The 2,500 ton chillers and one 3,500 ton chiller serve the NIH buildings. The 2,500 ton chillers were installed in 1978 and had a major maintenance overhaul performed in 1999 that resulted in a reduction in capacity to 2,150 Tons when they were converted from R-22 to R-134a. The 3,500 ton chiller was installed in 1997. The 2,150 Ton chillers are past their original service life, but were overhauled in 1999 and should provide an additional 15 years of reliable service. The 3,500 Ton chiller should provide reliable service through the end of its useful service life in the year 2022.

Three 3,500 ton chillers were installed in 1998 and serve the EPA buildings. The chilled water system is configured as one system, but is operating as two independent systems, one to serve NIH and one to serve EPA. Each chiller has one constant volume, horizontal split case primary pump. Three variable- volume, horizontal split case secondary pumps with variable frequency drives serve the NIH campus and three variable volume, horizontal split case secondary pumps with variable frequency drives serve the EPA campus. Two cooling towers serve the chillers. One tower is a three-cell tower with a capacity of 8,500 tons that serves both 2,150 ton chillers and one 3,500 ton chiller. The other tower is a four-cell tower with a capacity of 10,000 tons that serves the three newest 3,500 ton chillers. Each chiller has one constant volume cooling tower water pump.

The chillers, cooling towers and associated pumps should be considered for replacement at the end of their useful life as summarized in Exhibit 8.2.

The existing chilled water system in the Central Utility Plant (CUP) has a number of operational and energy deficiencies that need to be addressed (refer to MUP for detailed description and recommended modifications). A secondary-tertiary bridge piping operational issue at the EPA building needs to be corrected to allow the operation of the EPA and NIH plants as a single plant. The EPA chilled water plant and the NIH chilled water plant need to be hydraulically connected and operated as a single plant to provide adequate firm capacity to serve the projected loads through Phase 2. If the EPA and NIH chilled water plants are not operated as a single plant, a 2,150 ton chiller, cooling tower and associated pumps and appurtenances should be replaced in Phase 1 with a 3,500 ton chiller, cooling tower and associated pumps and appurtenances to meet the projected Phase 1 loads.

Exhibit 8.1: Illustrative Plan Showing Existing and Future Utilities



The second 2,150 ton chiller, cooling tower and associated pumps and appurtenances should be replaced in Phase 2 with a 3,500 ton chiller, cooling tower and associated pumps and appurtenances to meet the projected Phase 2 and 3 loads.

The chilled water distribution system has adequate capacity to serve the Phase 1 through Phase 3 additions.

EXHIBIT 8.2: SUMMARY OF MAJOR CHILLED WATER EQUIPMENT INSTALLED AT THE CUP[1]

Equipment	Capacity	Capacity	Year Installed/ Overhauled	Replacement Year[2]
Chillers:	**Tons**	**GPM**		
#1 (NIH)	2,150	4,000	1978/1999	2013[3]
#2 (NIH)	2,150	4,000	1978/1999	2013[3]
#3 (NIH)	3,500	5,600	1997	2022
#4 (EPA)	3,500	5,600	1998	2023
#5 (EPA)	3,500	5,600	1998	2023
#6 (EPA)	3,500	5,600	1998	2023
Primary Chilled Water Pumps:	**HP**	**GPM**		
CHP-1, CHP-2 (NIH)	100	4,000	1978	Phase1 MP
CHP-3 (NIH)	125	5,600	1997	2017
CHP-4, CHP-5, CHP-6 (EPA)	150	5,600	1998	2018
Secondary Chilled Water Pumps:	**HP**	**GPM**		
CHWSEC-1 (NIH)	150	4,000	1978	Phase1 MP
CHWSEC-2 (NIH)	150	4,000	1987	Phase1 MP
CHWSEC-3 (NIH)	200	5,600	1997	2017
CHWSEC-4, CHWSEC-5, CHWSEC-6 (EPA)	200	5,600	1998	2018
Cooling Towers:	**Tons**	**GPM**		
CT-1 (NIH)	8,500	20,750	1996	2016 (P1)
CT-2 (EPA)	10,000	26,250	1998	2018
Cooling Tower Pumps:	**HP**	**GPM**		
CWS-1A, CWS-1B (NIH)	250	6,000	1996	2016 (P1)
CWS-1C (NIH)	400	8,750	1996	2016 (P1)
CWS-2A, CWS-2B, CWS-2C (EPA)	400	8,750	1998	2018

[1] This table is from the Master Utility Plan dated October 2009 by Sud Associates
[2] Equipment Life as reported by ASHRAE and other Industry Accepted Sources
[3] These two chillers were overhauled in 1999. So anticipated replacement year is 2013.

The chilled water distribution system consists of direct buried, cement-lined ductile iron pipe of 30" and 36" in diameter. The piping system has manholes that contain isolation valves for take-offs to individual buildings. There have been no reported problems with the underground piping distribution system.

According to MUP final report developed by Sud Associates:

- The existing firm capacity of the central chilled water plant, if operated as one plant, is 14,800 Tons without the largest chiller on line. When operated as separate plants as is the current mode of operation, the NIH plant has a firm capacity of 4,300 Tons and the EPA plant has a firm capacity of 7,000 Tons without the largest chiller on line for each plant.
- The historical peak chilled water load recorded at the CUP has been 10,894 tons with a peak chilled water load for the NIH loop of 3,386 tons and for the EPA loop of 7,508 tons. The EPA loop includes the main EPA complex and NCC, 6,858 Tons and 650 Tons, respectively. When operated as separate plants, the NIH plant has firm spare capacity (N+1) and the EPA plant does not have firm spare

capacity. There is approximately 3,906 Tons of spare firm chilled water generation capacity available for future growth, if the plants are operated as a single plant.

- The current combined peak chilled water flow for the NIH and the EPA campuses is 17,431 GPM. The current peak chilled water flow for the NIH campus is 5,418 GPM and for the EPA campus is 12,013 GPM for the 36-inch pipe. The flow for the main EPA complex is 10,973 GPM for the 30-inch pipe. The flow for the NCC facility is 1,040 GPM for the 10-inch pipe. Both campus flows are based on a temperature difference of 15°F.
- The piping mains that serve the NIH campus have spare pipe capacity of approximately 522 GPM to accommodate additional growth on the NIH campus. The piping mains that serve the EPA campus have spare pipe capacity of approximately 13,307 GPM and 1,910 GPM for the main EPA complex and the NCC, respectively. The main pipe before separating from the 36-inch to 10-inchs and 30-inches has a spare capacity of 22,927 GPM for accommodating growth on the EPA campus.

B. CHW Implementation Plan

The existing 30" chilled water mains that serve the NIH Building 101 should be extended to serve the new buildings in each phase. Based on a velocity of 15 feet per second and a temperature difference of 15°F, the 30" mains have adequate capacity to accommodate the build-out for Phases 1, 2 and 3. The projected loads are:

Phase 1	1,037 Tons (1,659 GPM)
Phase 2	903 Tons (1,445 GPM)
Phase 3	1,377 Tons (2,203 GPM)

This results in a total additional projected load of 3,317tons (5,307 GPM), refer to Exhibit 8.9.

Phase 1 includes routing new 12" mains to serve the Office building and vivarium expansion and routing new 30" main extension to a new manhole to the west to minimize future construction activity near the new entry loop/visitor drop off.

Phase 2 includes routing 30" mains to a new manhole to the north and new 18" mains to from the new manhole to a manhole to serve Phase 2 and 3 additions. In Phase 2, new 8" mains would be routed to serve the Research Building I and 8" mains would be routed to the Research Clinic.

In Phase 3, new 12" mains would be routed to serve Research building 2. Exhibit 8.5 shows the recommended piping sizes for connection.

8.2 HIGH TEMPERATURE HOT WATER (HTHW) SYSTEM

A. Existing High Temperature Hot Water System

The NIH CUP generates 400°F HTHW at 315 psig for distribution to the NIH and EPA campuses. Originally the heating equipment consisted of five 40 MBTUH output generators. A new generator has been installed to replace the previous two original generators and is awaiting commissioning. The resultant four are all natural gas fired with #2 fuel oil as secondary back up. On commissioning of the new generator, two of them are planned to serve the NIH buildings and other two EPA buildings. A project is currently underway that includes the installation of crossover piping to allow the plants to operate as a single plant. After completion of the project the generators would provide firm capacity of the plant, but the system does not have spare capacity to serve any future loads.

Hot water generator#2 (the new generator that replaced the old NIH one) and generator #3 are planned to serve the NIH facilities while hot water generators #4 and #5 serve the EPA. Generator #3 has a constant volume primary pump with a standby pump and a variable volume secondary pump and a standby pump.

Generators #4 and #5 have three primary pumps and four secondary pumps. All of the secondary pumps are equipped with variable frequency drives.

The hot water generators and associated pumps should be considered for replacement at the end of their useful life as summarized in Exhibit 8.3.

The distribution system provides HTHW to the individual buildings where it is used to generate hot water for heating, domestic, laboratory and animal facility uses, and in the generation of steam for use in humidification and process systems.

The HTHW distribution system is direct buried and constructed of pre-fabricated, pre-insulated service piping (Perma-Pipe) of 14" diameter (nominal) meeting ASTM A53, Gr. B, seamless, standard weight specification. The service pipe is enclosed in a 3" insulated, 10 gauge jacket. The conduit coating is 30 mil coal tar urethane outside and black primer inside. The distribution system has a cathodic protection system. The piping system has manholes that contain isolation valves for take-offs to individual buildings. There have been no reported problems with the underground piping distribution system serving the NIH campus.

EXHIBIT 8.3: SUMMARY OF MAJOR HIGH TEMPERATURE HOT WATER EQUIPMENT INSTALLED AT THE CUP[1]

Equipment	Capacity	Capacity	Year Installed	Replacement Year[2]
Hot Water Generators:	*Mbtuh (Input)*	*GPM*		
#3 (NIH)	40,000	660	1995	2018
#4 (EPA)	40,000	660	1998	2021
#5 (EPA)	40,000	660	1998	2021
New #2 (NIH)	40,000	660	2008	2032
Primary Hot Water Pumps:	*HP*	*GPM*		
PBR-3 (NIH)	15	660	1995	2015
PBR-4, PBR-5, PBR-6 (EPA)	20	660	1998	2018
PBR-7 (NIH)	15	660	2008	2028
Secondary Hot Water Pumps:	*HP*	*GPM*		
BR-SEC-1, BR-SEC-2 (NIH)	60	660	2005	2025
BR-SEC-3 (EPA)	60	660	1995	2015
BR-SEC-4, BR-SEC-5, BR-SEC-6 (EPA)	40	660	1998	2018
BR-SEC-7 (NIH)	200	2,745	1998	2018

[1] This table is from the Master Utility Plan dated October 2009 by Sud Associates
[2] Equipment Life as reported by ASHRAE and other Industry Accepted Sources

According to MUP final draft report:

- The existing installed output capacity of the central HTHW plant is 120 MBTU. The installed firm capacity is about 80 MBTU - the maximum output without the availability of the largest individual unit. On installation of the new 40 MBTU output HTHW generator total installed capacity of the plant would be 160 MBTU and the firm capacity 120 MBTU.
- The historical peak HTHW demand has been 95.7 MBTU. The historical peak load for the NIH loop is 25.9 MBTU and for the EPA loop is 69.8 MBTU. The central HTHW plant has spare generation capacity for future growth. However, another 40 MBTU boiler will need to be installed to maintain an N+1 configuration, i.e. firm capacity plus spare or back-up.
- The current combined peak hot water flow for the NIH and the EPA campuses is 1,640 GPM. The current peak hot water flow for the NIH campus is 460 GPM and for the EPA campus is 1,080 GPM.
- The piping mains that serve the NIH campus have a spare capacity of approximately 3,500 GPM to accommodate additional growth on the NIH campus. The mains that serve the EPA campus have spare pipe capacity of approximately 2,900 GPM to accommodate additional growth on the EPA campus.

B. HTHW Implementation Plan

The existing 14" HTHW mains that serve the NIH Building 101 would be extended to serve the new buildings in each phase. The 14" mains presently have adequate capacity to accommodate the build out for Phases 1, 2 and 3. The projected future loads are (refer to the Exhibit 8.9):

Phase 1	15.9 MBTU (265 GPM)
Phase 2	13.3 MBTU (222 GPM)
Phase 3	21.3 MBTU (355 GPM)

Phase 1 includes routing 4" mains to serve the Office building and vivarium expansion and the 14" mains shall be extended to a new manhole to the west to minimize future construction activity near the new entry loop/visitor drop off.

Phase 2 includes routing the 14" mains to a new manhole to the north and 6" piping to a new manhole to serve the Phase 2 Research Building 1 and future Research Building 2 in Phase 3. 4" piping would be routed to the Research Clinic.

Phase 3 includes the extension of 6" piping to the Research Building 2.

On completion of Phase 1 the NIH projected peak load is projected to be 41.8 MBTU and 2 generators at 40 MBTU input/32 MBTU output each almost meet the firm capacity needed by NIH. EPA existing peak load 69.8 MBTU, so an additional new 40 MBTU input generator would be required in Phase 1 to provide firm capacity for both campuses. A 40 MBTU new generator and associated pumps should be added in Phase 3 to provide firm capacity of the ultimate build out.

8.3 CHW and HTHW Distribution Loop

The CHW and HTHW loops are not closed between the NIH and the EPA campuses on the north side of the lake. The closing of these loops was originally planned as a part of the project when the EPA building was constructed, but value engineered out at the time. The existing situation presents a significant redundancy/reliability issue. There could be a problem (e.g. a break or a leak) that requires a shutdown of the main piping systems serving either of the two campuses. Depending on where the problem occurs, one or more buildings may have to be shut down until the problem is resolved. One way to correct this deficiency is to install new piping to connect the North end of the two loops. For this concept to be successful, the existing CHW and HTHW distribution pipe sizes should be sufficient to allow both the NIH and the EPA buildings to be served from either side if there is a blockage in the distribution piping. The looped distribution system would also allow the utilization of existing mains to connect new buildings in the Master Plan expansion without increasing the existing piping size.

Exhibit 8.4: Recommended CHW and HTHW Link

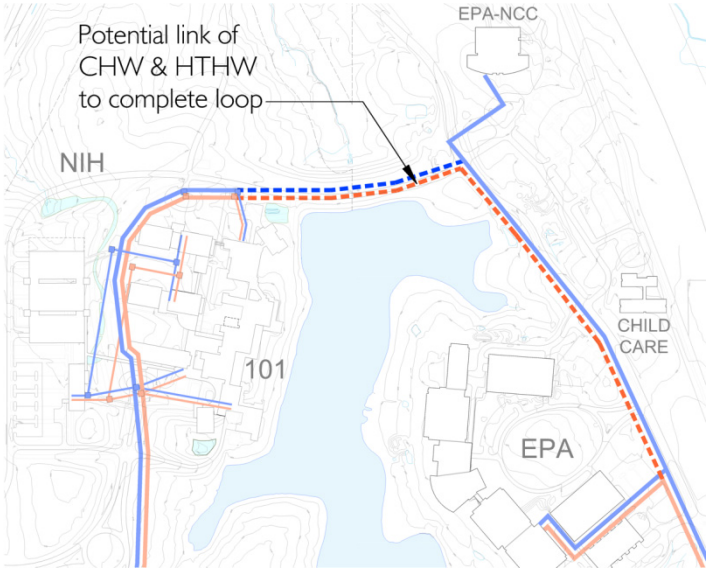
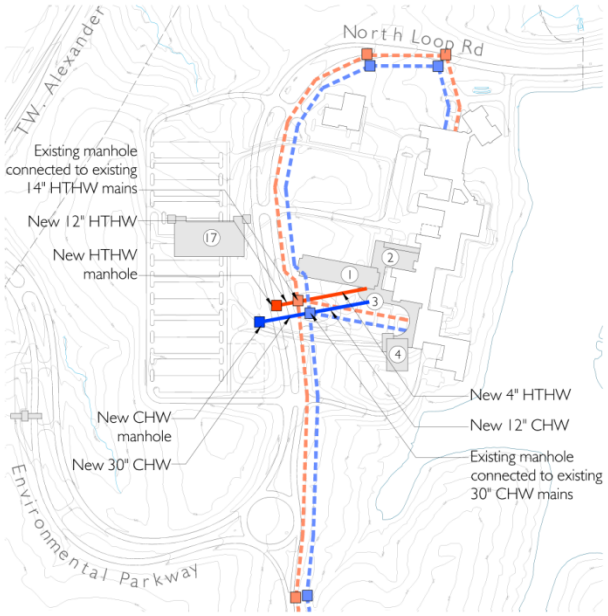
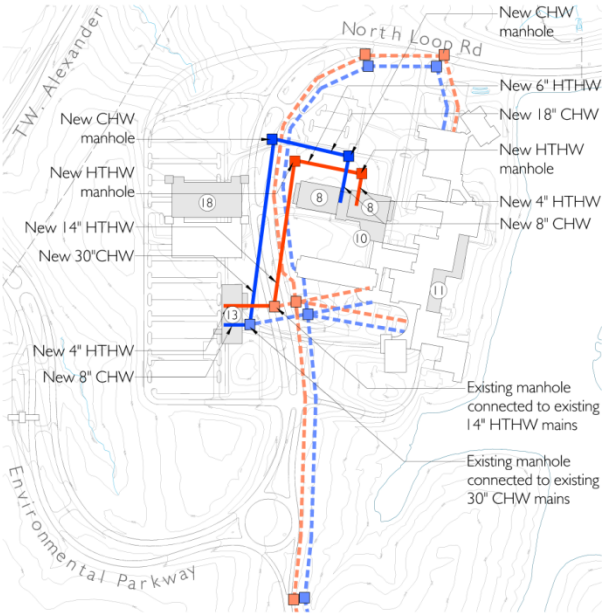


EXHIBIT 8.5: PLANNED CHILLED WATER & HIGH TEMPERATURE HOT WATER BY PHASE

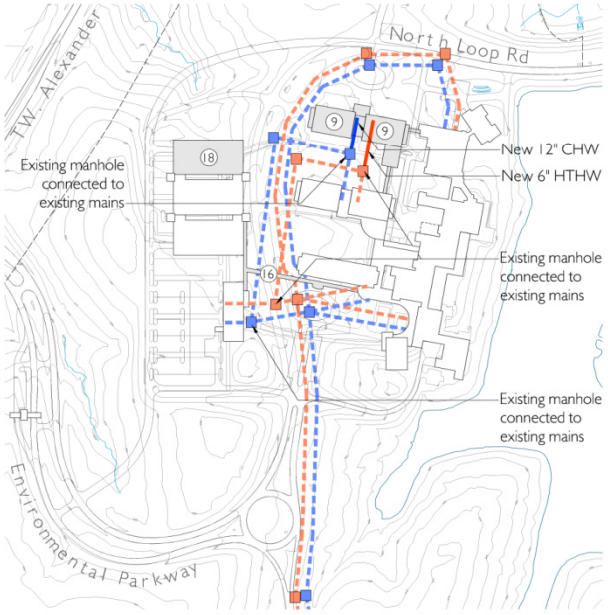
Phase I



Phase II



Phase III



Existing CHW line and manhole
Existing HTHW line and manhole
New CHW Supply
New HTHW Supply

(1) Office Building
(2) Animal facility expansion
(3) New main entry, lobby and elevator
(4) Conf. facilities w/ fitness center below
(8) Research Building 1 (Lab+Office)
(9) Research Building 2 (Lab+Office)
(10) Employee amenity space/food serv.
(11) Bldg.101 ground FL improvements
(13) Research Clinic
(16) Covered walkway
(17) Phase 1 parking structure
(18) Phase 2&3 parking structure

(Building numbers related to Campus Center elements in exhibit 5.6)

8.4 ELECTRICAL DISTRIBUTION

A. Existing Electrical Distribution System

Campus Substation

The campus electrical distribution system was established in 1980 from two redundant 100 kV overhead transmission tap lines from Duke Energy, which tie into two 100 kV overhead transmission lines located across from Hopson Road. The two dedicated 100 kV transmission tap lines enter the on-campus substation, which is operated by Duke Energy. Two 30/40/50 MVA rated OA/FA/FO transformers in this substation transform the voltage down to 13.8 kV. These two transformers are currently operating at the 30 MVA rating, which means that the cooling of the transformers is only by Oil/Air convection. The higher MVA ratings of these transformers can be achieved through the operation of fans (Forced Air) and by the operation of oil pumps (Forced Oil). According to the Master Utility Plan, the forced air and forced oil/air is an automatic control process, as a function of temperature rise; hence, the two transformers (each) have a capacity of 50 MVA.

With the total campus metered demand of slightly over 20.6 MVA, either transformer can easily provide all the campus power requirements. In addition, the transformers individually can provide for campus electrical load growth up to 200% without any changes in the Duke Energy substation other than the operation of the fans and pumps. One transformer can carry the present and future (10.1 MW) loads. The average power factor is .911; hence, the future load would be 11.05 MVA. The total load of the campus after phase 3 would be approximately 31.7 MVA, and one transformer could carry the campus load in the forced air or forced air and oil operation (see page 5-8 of the Master Utility Plan). Both Busses in the substation, building 107, are rated for 72 MVA/3000A.

The Duke Energy substation has a 400 Amp neutral grounding resistor which reduces the available fault current throughout the campus. This lower available fault current is essential to the safe operation of electrical system and conformance with NFPA 70E Standard for Electrical Safety in the Workplace.

Duke Energy is responsible for the operation and maintenance of their substation and incoming 100 kV transmission line. Their maintenance protocol is effective and the condition of their equipment in the substation appears reliable for the foreseeable future.

Switch House Building

Two redundant 13.8 kV electrical circuits from the Duke Energy substation provide electric power to the redundant NIH owned main distribution switchgear in the Switch House Building No. 107. A total of four parallel electric distribution duct banks, arranged in two tiers, extend via the South Distribution Branch to the Central Utility Plant (CUP) and Shop/Administrative Office Building 102. A total of two electric distribution duct banks arranged in two tiers extend along the West Distribution Branch to the Building No. 101. The equipment also appears to be in good operating condition although does show some wear with age.

Aside from the Duke Energy portion of the substation, there is limited redundancy in the existing 13.8 kV distribution. However some unconventional circuit modifications have been made to provide redundancy for the 13.8 kV distribution feeds to the NIH.

The transformer in the 107 building that provides power internally to the building is fed normally from one of the two busses. This transformer can be fed from either bus, but if it is fed from both busses simultaneously (there is no interlock to prevent the human error), it can cause a dangerous backfeed of electricity from one bus to the other and ultimately back to the Duke Energy 100 kV system. Close coordination with Duke Energy is mandatory to prevent hazards to personnel and damage to electrical equipment.

Campus Electrical Distribution System

The 13.8 kV electrical distribution system throughout the campus is via 500 kcmil cables in ductbank. The insulation of these cables is rated at 133% and the loading of the cables is less than 50%. This portends good reliability in that the cables are not overloaded and the higher insulation rating limits any potential cable failures. There are a total of 25 miles of 15 kV rated cable throughout the campus running mainly in underground ductbanks adjacent to the main roads of the campus. The phase to ground voltage of a 13.8 kV system is 7.9 kV so the 15 kV rated cables are not operating close to their dielectric limit. Parts of the 13.8 kV electric distribution system are nearing 30 years old which is near the end of their useful life. These cables should be replaced in the near future.

MUP Recommended Improvements

The Sud Associates study identified a number of improvements to the electric distribution facilities throughout the campus (see table below). The items recommended in their study have been characterized with a 1 or a 2, indicating their priority for implementation. Priority 1 items should be implemented within 2 years, and priority 2 items are recommended to be implemented within 4 years. Failure to implement these items may jeopardize the reliability of the electric supply throughout the campus and could result in major extended electric service outages.

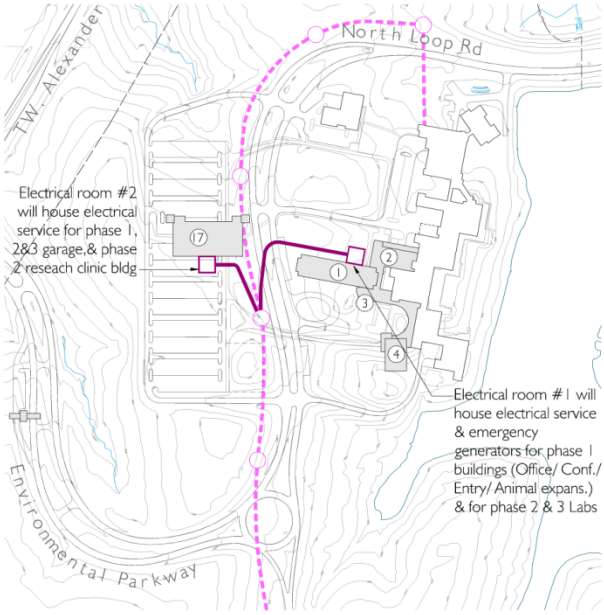
When implemented, the improvements would provide sufficient capacity and a higher degree of redundancy to provide reliable and adequate electric service to the new facilities in all three (3) phases of development outlined in this report. The redundancy and capacity improvements are essential for a reliable on-campus electrical distribution system and should be considered mission critical.

EXHIBIT 8.6: SUMMARY OF RECOMMENDED ELECTRICAL IMPROVEMENTS

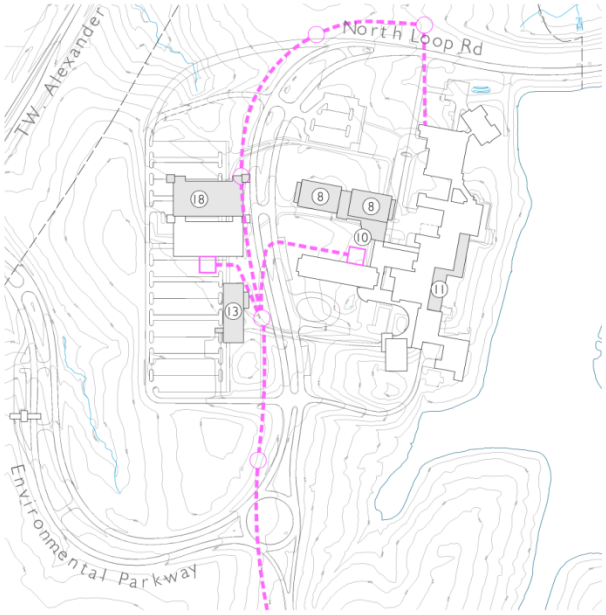
Description of Recommendation	Priority
Switchhouse Building 107	
Structural Evaluation & Concrete Repair	2
New Auxiliary Power Supply & Distribution	1
Switchgear, Labeling & Emergency Power	1
Sleeves & Penetrations	1
Cable Splices in Switchgear Vault Keyed Interlocking Hardware Remove 105 Feeder	1
Central Utility Plant Original Building 105	
2 tier redundant Distribution System 1000kW Standby Generator	2
Ductbank & Manhole System	
Close South Loop Distribution along North side of the Central Refuse Building 106	2
New Sump Pumps at 5 selected manholes	1
Cabling & Topology	
1000 feet of 15kV cable	1
Closed Ring Cable Topology – 3 stages	2
Rall Building Distribution Upgrades	2
CUP Distribution Upgrades	1
NCC Distribution Upgrade, Sump Pump	1

EXHIBIT 8.7: PLANNED ELECTRICAL DISTRIBUTION BY PHASE

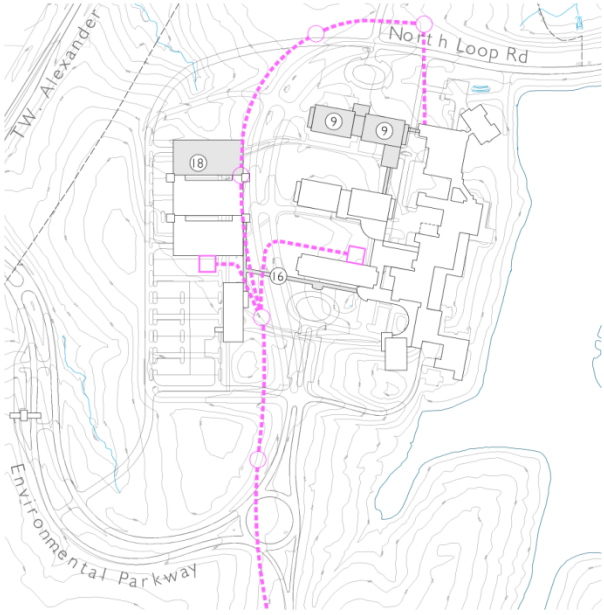
Phase I



Phase II



Phase III



Existing Electrical Distribution

New Electrical Distribution

1. Office Building
2. Animal facility expansion
3. New main entry, lobby and elevator
4. Conf. facilities w/ fitness center below
8. Research Building 1 (Lab+Office)
9. Research Building 2 (Lab+Office)
10. Employee amenity space/food serv.
11. Bldg.101 ground FL improvements
13. Research Clinic
16. Covered walkway
17. Phase 1 parking structure
18. Phase 2&3 parking structure

(Building numbers related to Campus Center elements in exhibit 5.6)

B. Electrical Distribution to Planned Facilities

Primary Service (13.8 kV)

The Master Plan electric power supply scheme recommends the installation of a single transformer (at a minimum) and a single 13.8 kV underground electric distribution tap to the transformer for each new building, although it is prudent to install two redundant transformers and two redundant 13.8 kV feeders. With this approach, the failure of any single transformer or feed to a transformer would prevent a complete loss of electric power to the facility.

Transformers and Switchgear

Two new transformer/switchgear locations would provide 480 volt availability to the various load centers constituted by the development plans.

a. Transformer/Switchgear Room No. 1 –. The new electrical room would be sized to accommodate the two new generators being replaced in Building 101 (Please refer to the Section 9 for details), an additional generator(s) to meet increased Building 101 needs and two (2) new 1500 kVA transformers and associated switchgear to serve Phase 1 buildings and structures. The Room No. 1 would be sized to provide the additional space for two (2) new 2500 kVA transformers and associated switchgear and emergency generators primarily to serve Phase 2 and Phase 3 laboratory buildings. One (1) 2500 kVA transformer and switchgear to be installed during Phase 2 work, with the second transformer and switchgear to be installed in Phase 3.

b. Transformer/Switchgear Room No. 2 – The new electrical room would be sized to accommodate two (2) new 1500 kVA transformers and associated switchgear and emergency generator to serve Phase 1 and 3 of the western-most site developments, including the Research Clinic and Parking Structure. It should be located within the Phase I parking structure. One (1) 1500 kVA transformer and switchgear to be installed during Phase 1 work, with the second transformer and switchgear to be installed in Phase 3.

c. Added circulation area on the east side of Building 101 is planned to receive electrical service from existing Building 101 transformer/switchgear facilities.

d. Primary electric service to each of the new transformers, required to feed the new facilities, would be provided from 13.8 kV electric distribution feeders by tapping the existing cables in existing manholes and extending new cabling to each new transformer/switchgear location. Each new transformer should be connected in configuration allowing for electric service from any two (2) of the three (3) electric distribution feeders, with care taken to distribute the loads across all three (3) electrical distribution feeders as evenly as is feasible. This two source (redundant) methodology for providing primary 13.8 kV electric power to each transformer assures a high degree of electric service reliability in the event of a failure in an underground cable.

Secondary (480 Volt) Feeder Circuits

Secondary 480 Volt electric power would be distributed from all transformer/switchgear buildings to electric distribution equipment located in the infrastructure for each facility as part of the construction of those facilities, via underground 480 Volt duct banks, or indoor conduit systems as appropriate to the circumstances.

C. Alternate Approach to Electrical System Maintenance and Operations

The Master Plan recommends the installation of new transformers, switchgears, and generators as well as the expansion of the 13.8 kV electrical distribution system. The current electrical system, although well maintained, is vulnerable to failures and may require capability and resources that currently do not exist at NIH.

Duke Energy has a program for the installation of new equipment, and operation and maintenance of electric distribution facilities beyond the metering point. NIH may consider contracting operations and maintenance of the electric distribution system to ensure reliable service to its facilities.

8.5 Potable water

The campus potable water is supplied from the City of Durham's municipal water system. The system is connected at two supply points. One meter vault is located on TW Alexander Drive approximately 1200 feet north of the NIH entrance and the other is located on Hopson Road at the East Loop Road intersection. The campus distribution main is 14 inch. The City has ongoing system upgrades that will meet increasing demand in the area and allow a higher pressure to be maintained at the NIH campus.

Phase 1 and 2 development would not impact the underground potable water main. As the development and demand should be nominal, appropriately sized laterals may be extended from the campus water distribution main as the development requires. The Phase 3 Labs/Lab support/Vivarium building location would require the campus water distribution main to be rerouted around the building expansion.

Total campus potable water usage, based on meter readings, averages 270,000 gallons per day (gpd). The Master Utility Plan calculates that approximately 26% (70,000 gpd) is attributable to NIH, and 16% (43,700 gpd) to the CUP. The remaining demand comes from EPA, the Daycare Facility and NCC.

The campus fire flow demands are based on the requirements of the City of Durham and on the fire sprinkler flows. The classification of the NIH buildings is Ordinary Hazard Group II, with a sprinkler demand of 750 gpm. For sprinklered non-industrial uses, the City requires that the system deliver 2,500 gpm to the fire hydrants, with a 20 psi system residual pressure in addition to the sprinkler flows and the potable water demand. The MUP included an evaluation of the system using EPANET modeling, and determined that the residual pressure is generally adequate, except at the CUP and Warehouse, and at the lakeside of Building 101. Here the residual pressure drops below 20 psi.

The existing water supply system has the capacity for the Master Plan expansion. However, because of inadequate fire flow capacity, the distribution system would not support the increased demand near Building 101 and the CUP, without system upgrades. There is a planned 14"main segment that would complete the water system loop between the CUP and the East Loop Road (at the South Loop Road). The MUP recommends that this be constructed, and calculates that this would provide the required 20 psi of residual pressure.

Completion of the water system loop would also address a distribution reliability issue for the potable water system. Currently, the NIH buildings and the CUP are fed by a main along the West Loop Road, with a single water main feed. Disruption of this single main feed would interrupt the potable water supply and fire protection for the NIH buildings and the CUP.

8.6 Sanitary sewer

The campus sanitary sewer system is a gravity system of 12 and 15 inch sewers which run along both sides of the campus lake and join together in an 18 inch interceptor which flows across the North Access Road to the Durham County Burden Creek interceptor sewer. Treatment of the sewage is provided at the Durham County Waste Water Treatment Plant. The MUP found no significant deficiencies in the systems, and reported that the Durham County WWTP is operating at less than 50% of its permit limits.

The MUP analyzed the system and calculated the wastewater flows. Based on their calculation, the existing NIH gravity sewers are operating at approximately 25% of the available system capacity. No upgrades are recommended for the Master Plan development.

A new north-south 8-inch sanitary sewer would be required and located in the utility corridor east of the central boulevard. As the main gravity sewer flows south to north, the extension would need to be installed in Phase 1. Phases 2 and 3 would extend appropriately sized laterals from buildings to the extension as the development requires.

8.7 Waste Management

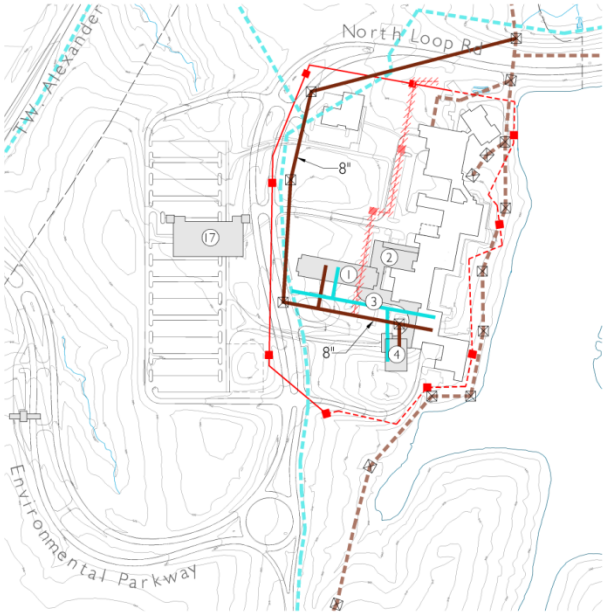
The NIH has an aggressive waste management program at RTP. It consists of both Solid and Hazardous Waste and the Institute adheres to the NIH established guidelines and protocols. NIH has defined classifications for management of wastes which include solid waste, medical pathological waste, radioactive waste, chemical waste and multi-hazard / mixed waste.

The NIH has two facilities which it utilizes for waste management. Building 106 (17,290 gsf) is an incinerator facility utilized by both NIH and EPA for the waste stream consisting of regulated medical waste, animal bedding, pathological waste, and non-hazardous Lab waste. The pathological waste incinerator has a capacity of 750 to 1000 pounds/hour. Building 108 (8,330 gsf) is a Waste Handling Facility with a 14,300 gallon capacity serving both NIH and EPA. It is designed and constructed as a RCRA Part B permitted facility.

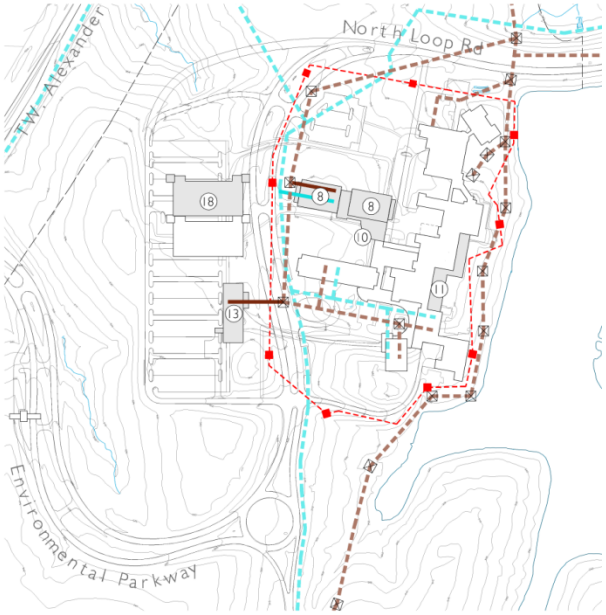
In discussions with NIH it was concluded that the facilities have enough capacity to easily handle Phase 1 growth and possibly Phase 2 also. A capacity assessment should be made once the actual program for Phase 2 buildings becomes concrete to determine if additional waste management requirements will be necessary. With NIH establishing its five to ten year goals to further reduce all types of waste generated, by promoting waste minimization, the initial phase of Master Plan growth should have no impact.

EXHIBIT 8.8: PLANNED POTABLE WATER AND SANITARY SEWER

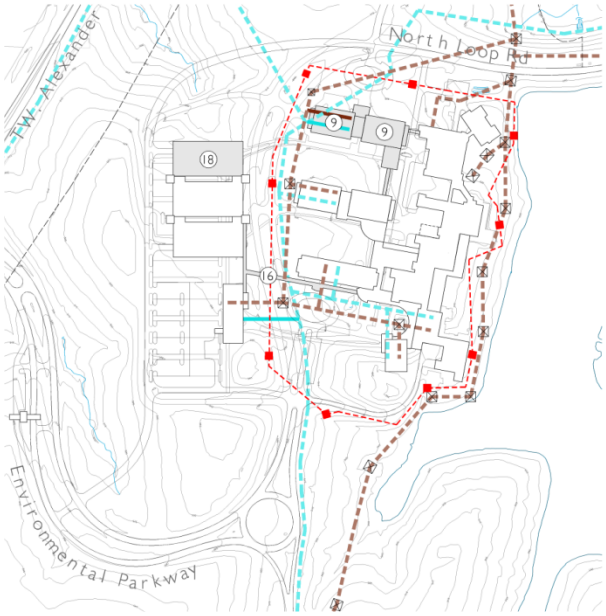
Phase I



Phase II



Phase III



Existing Sanitary Sewer
Existing City Water Line
Existing Fire Protection
Demo Fire Protection
New Sanitary Sewer
New Portable Water
New Fire Protection

(1) Office Building
(2) Animal facility expansion
(3) New main entry, lobby and elevator
(4) Conf. facilities w/ fitness center below
(8) Research Building 1 (Lab+Office)
(9) Research Building 2 (Lab+Office)
(10) Employee amenity space/food serv.
(11) Bldg.101 ground FL improvements
(13) Research Clinic
(16) Covered walkway
(17) Phase 1 parking structure
(18) Phase 2&3 parking structure

(Building numbers related to Campus Center elements in exhibit 5.6)

8.8 PROJECTED UTILITIES LOAD INCREASE

The following estimated utility loads summarized per the Master Plan phasing plan will be forwarded to Sud Associates (MUP consultant) for evaluation and recommendations for CUP expansion and main distribution piping modifications related to the Master Plan implementation.

EXHIBIT 8.9: PROJECTED UTILITIES LOAD INCREASE BY PHASE

Building	Sq Footage	High Temperature Hot Water (MBH)	Chilled Water (Tons)	City Water (GPD)	Sanitary Sewer (GPD)	Electrical (kW)
Office	99,600	3,984	285	24,900	24,900	1,195
Vivarium	30,000	9,000	545	90,000	90,000	900
Vivarium Interstitial	10,000	300	20	---	---	20
General Support	9,900	396	28	2,475	2,475	119
Common Amenities	40,600	1,624	116	10,150	10,150	487
Parking Structure	150,500	---	---	---	---	301
Design Integration	15,000	600	43	3,750	3,750	180
Total - Phase 1	355,600	**15,904**	**1,037**	**131,275**	**131,275**	**3,202**
Office	19,100	764	55	4,775	4,775	229
Clinical Research	50,000	2,000	143	12,500	12,500	600
Lab Expansion	61,100	7,332	489	15,275	15,275	1,528
Lab Interstitial	61,100	1,833	122	---	---	122
General Support	1,400	56	4	350	350	17
Common Amenities	1,700	68	5	425	425	20
Design Integration	30,000	1,200	86	7,500	7,500	360
Parking Structure	122,500	---	---	---	---	245
Delete Modular Clinic	-14,100	-564	-40	-3,525	-3,525	-169
Total - Phase 2	332,800	**13,253**	**903**	**40,825**	**40,825**	**3,121**
Office	26,300	1,052	75	6,575	6,575	316
Lab Expansion	68,000	8,160	544	17,000	17,000	1,700
Lab Interstitial	66,000	1,980	132	---	---	132
General Support	4,600	184	13	1,150	1,150	55
Common Amenities	6,500	260	19	1,625	1,625	78
Design Integration	10,000	400	29	2,500	2,500	120
Vivarium	30,000	9,000	545	90,000	90,000	900
Vivarium Interstitial	10,000	300	20	---	---	20
Parking Structure	217,000	---	---	---	---	434
Total - Phase 3	438,400	**21,336**	**1,377**	**118,850**	**118,850**	**3,755**
Total - Ultimate Build Out	1,126,800	**50,493**	**3,317**	**290,950**	**290,950**	**10,078**

* Warehouse loads are not included here as it will be an independent structure off main campus

EXHIBIT 8.10: LOAD FACTORS CONSIDERED FOR ESTIMATING LOAD INCREASE

Load Factors:	HTHW Btuh/sf	CHW Sq Ft/Ton	City Water/Sewer GPD/100 Sq Ft	Electrical Watts/Sq Ft
Office/Clinic	40	350	25	12
Support/Amenities/Design Integration	40	350	25	12
Vivarium	300	55	300	30
Lab Expansion	120	125	25	25
Interstitial Space	30	500	0	2
Parking Structure	0	0	0	2

Electrical Watts/Sq Ft do not include loads for chilled water generation, as chilled water is supplied from the CUP.

The thermal utility loads for the Visitor's Center/Entry facility has been included in the Master Plan Utility Requirements for planning purposes for the Central Plant and utility routing. The loads for this building are small and the building is quite remote from the chilled water and hot water distribution mains; extending the central utilities could be cost prohibitive. Closed-loop ground coupled geothermal systems can be utilized for the new Conference facility/fitness, and Building 101 Ground Floor Addition. A feasibility study and life cycle cost analysis should be conducted for ground source heat exchangers. Variables such as ground composition and soil properties need be investigated prior to designing closed-loop ground-coupled systems. Discussions with local drillers experienced in ground water system installation and ground water analysis would need to be conducted, and an actual ground water pressure test performed, if NIH chooses to utilize this system.

The geothermal system utilizing the lake as a heat source and heat sink should also be investigated.

9.

MASTER PLAN:

BUILDING 101 IMPROVEMENTS

9. MASTER PLAN: BUILDING 101 IMPROVEMENTS

The David P. Rall Building, Building 101, is the dominant campus feature at NIH-RTP. NIH has maintained the building well, and the facility provides high-quality research space. However, NIH is rapidly outgrowing the building and there is significant overcrowding. Since the construction of Building 101, the state-of-the-art in government laboratories has changed significantly, with a greater emphasis now placed on the quality of the workplace environment, opportunities for shared and collaborative work, and more employee amenity spaces. Furthermore, the Rall Building is a large-scale structure that fails to take advantage of its relationship to the lake and its campus setting.

Building 101 is a very important component of the master plan – it will continue to house a significant portion of the scientific research functions and shared facilities over the 20-year planning period. The building has been well maintained, although the campus Master Plan goals suggest modifications to the building. Some of these are envisioned as part of the Master Plan construction, others are recommended as part of ongoing upgrades. All modifications are aimed at improving the functionality of the building as a workplace and the quality and sense of place for the employees. All renovations to Building 101 would include sustainability as a goal, upgrading building systems for more efficient performance, incorporating daylight, indoor air quality and environmentally-friendly materials.

9.1 The Master Plan for Building 101

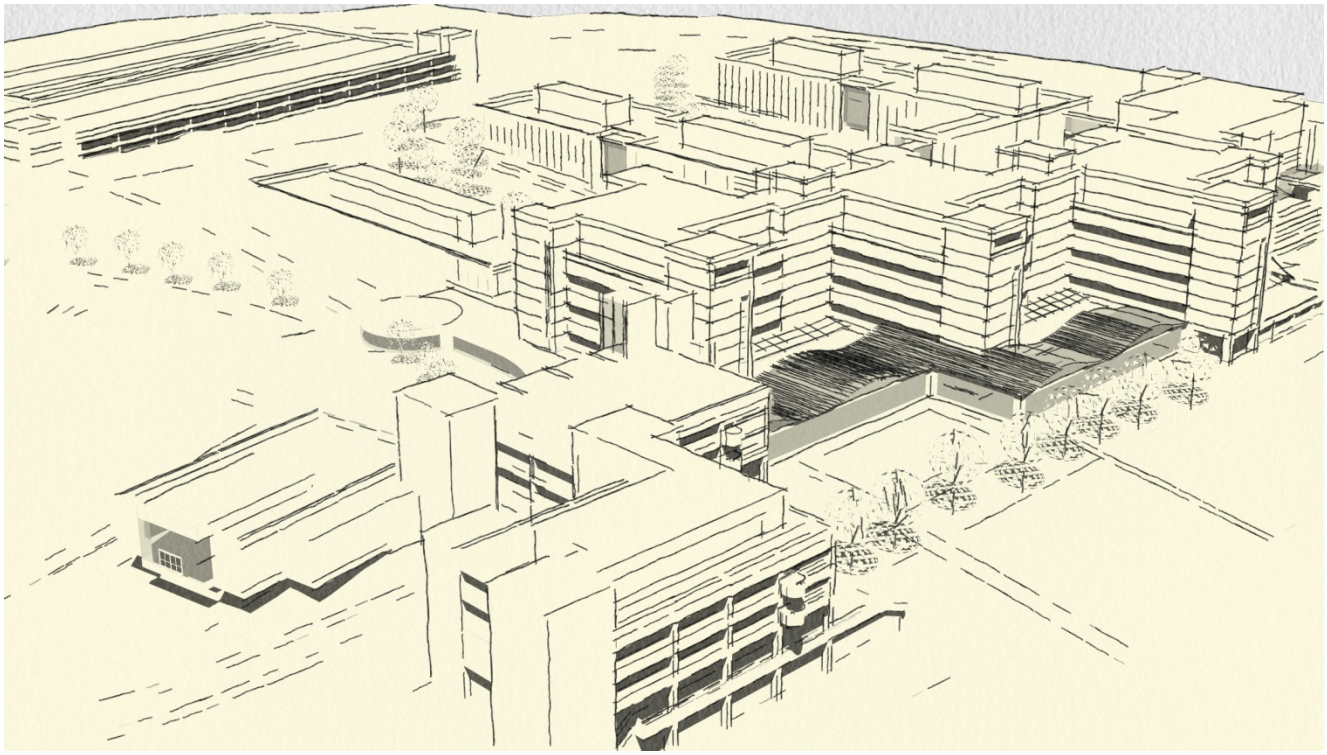
The Building 101 Master Plan creates a framework for change, to address infrastructure deficiencies, improve functional and research operations and enhance the quality of the public spaces. The approach develops a logical pattern in light of the Master Plan goals in Building 101; specifically, the Plan seeks to:

- Improve the main public entrance to Building 101 by providing an appropriate image, improved functioning, and greater visibility.
- Create a coherent circulation system and more amenity spaces, and cluster these amenity spaces along the main public circulation paths. A better ground floor circulation path would connect Modules A through F and improved vertical circulation would be provided in Modules A and B.
- Create better connections between ground floor public spaces and the campus outdoor spaces.
- Design for the environment, including improvements aimed at achieving energy savings.
- Comply with all applicable accessibility requirements.
- Organize the building functionally for appropriate workplace and social interaction, including the addition of break rooms and meeting areas on the lab floors.
- Upgrade infrastructure in the labs by replacing fume hoods, where needed, improving emergency power, and upgrading HVAC.
- Improve the security and safety of the building.

Accomplishing these goals requires consideration and mitigation of the constraints and building deficiencies that exist today. Some of the constraints that influenced the master plan strategies are:

- The form of the building is irregular and sprawling; and it is difficult to create a new set of buildings that relate directly to this form, either visually or functionally. Inefficient and circuitous circulation is a product of the staggered building plan.
- The existing organization of the building is difficult to change and dictates much of the master plan, especially the location of the existing main entry, conference, dining, and office facilities, and the location of the loading dock.
- Many of the elements in the facility represent substantial investments in physical plant, and are specialized spaces that are difficult to move. Examples include the animal facility and MRI building.
- Animal facilities, located at the basement level, are difficult to expand because of adjacent uses and site constraints
- Building features do not take advantage of the beautiful campus – building elements that limit views to the lake and many views from the building are blocked by the towers at the corners of the modules
- Building systems are in need of upgrade – typically HVAC and emergency power,
- Multiple loading docks serve the building and a conflict exists between the animal servicing and the regular loading dock functions

Exhibit 9.1: Building 101 and Future Development Concept



Master Plan strategies are described in the following sections, organized as follows:

- Functional Organization and Strategies
- First Floor Improvements
- Loading and Service
- Sustainable Renovation
- Engineering System Modification

9.2 Functional Organization and Strategies

The functional organization of Building 101 and its approach in the future is an essential piece of the Master Plan. The existing functional organization of the building includes the following:

- The building entrance and primary amenity and gathering spaces are located at the south end of the facility, rather than in the middle
- The laboratory functions in modules C through F are related to the animal facilities in the basement, loading areas on the west side of the building, and the MRI facility on the north. The fixed investment in laboratory infrastructure in these portions of the building requires that these areas continue to function as laboratories.
- All service and public access to Building 101 is from the west. The east is adjacent to the lake, and there is no vehicular access.
- The location of the main loading area west of the E Module is tied to the existing service elevator between the D and E modules, and the animal facility bedding and food infrastructure adjacent to loading

Based on these factors and the design concept for the Campus Center, a concept for the future functional organization of the building complex has been developed.

One of the most important master plan strategies for Building 101 is to establish a clear framework for integrating it with future campus growth, to ensure that each new building and addition over the years would work in harmony, add to the quality of the campus and not preclude the next step. Linking Building 101 to new lab and office functions was a very important consideration, and one that led to the selection of the compact master plan concept. NIH administration and research personnel put a high priority on collaboration and easy flow of people and materials.

Several significant growth patterns are established in the plan for the new construction attached or adjacent to Building 101. These include:

- New wings running east-west - A series of new building blocks oriented perpendicular to Building 101 is envisioned in the plan. This pattern is optimal for controlling sun glare as well as solar gain in the summer. The east-west blocks form fingers extending into the landscape, with views oriented north and south to the new facilities, rather than east and west to the loading areas of Building 101 and the parking areas on the west. Equally important, opportunities for good daylighting and views from Building 101 into the new campus quadrangles would be made possible by this pattern.
- Fit with topography - The recommended ground floor elevations of the new construction are intended to fit the new buildings into the landscape with minimal grading and excavation, while at the same time relate to the existing floor levels in Building 101 and allow continuous ground floor circulation through the combined facility without the use of lifts.

A. Organization of Program Components

First Floor Concept Plan

The functional organization of the first floor of Building 101, its future additions and connected buildings recognize the fact that the main building entry, conference, and dining area would remain in their existing locations. Thus, the plan calls for a new main entry to the building complex to relate to this primary public space, and to the new office building.

The new entry would tie to the entry plaza and drop-off, be closer to parking, and serve as the nexus of interior and exterior campus circulation. It would connect to a new vertical circulation core located at the southwest intersection of the B and C modules. The office building would have a secondary entrance at the west end for the convenience of clinical research center staff.

The other principal features of the first floor organization include development of laboratory blocks north of the new offices, in less public areas of the campus that also tie to the lab locations in the C, D, E and F modules of Building 101. A consolidated service court is indicated at the center of the building complex, which improves upon the existing loading area west of the D and E modules. This service court provides loading access to all existing and new facilities, except for the F Module, MRI Building, and the new, northernmost lab block to be located west of the F Module.

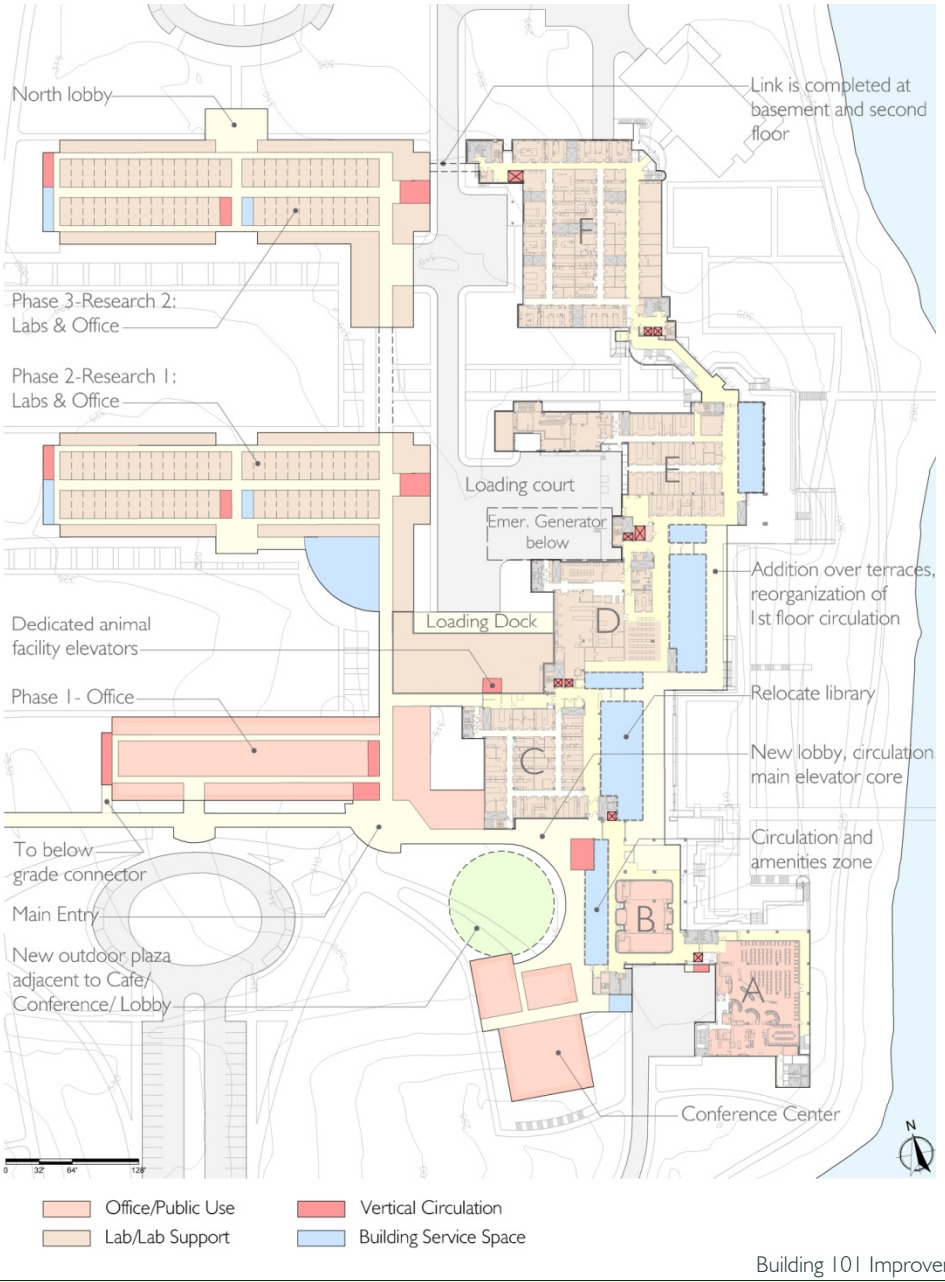


Exhibit 9.2: 1st Floor Concept Plan

Second and Upper Floors Concept Plan

The organization of the building complex on the second floor is based on strengthening the function and connections of the labs and offices.

Most of the floor space within the research modules C, D, E and F is occupied by labs. Floors are typically organized within each lab module around a central "racetrack" circulation corridor. The plan calls for a continuous second floor circulation link among all buildings. The new second/typical floor circulation link is created out of the existing corridor system and would establish both a sense of hierarchy in the circulation system and a more direct and linear path through the lab modules.

An important aspect of the reorganization is to create more support space adjacent to the labs on the existing typical floors, replacing break rooms and other ancillary space that have been subsumed over time. This would be achieved as new labs are provided in the new buildings shown on the plan, thus freeing up space in the existing C, D, E and F modules for increased support and amenity space.

The majority of office space in Building 101 is located on the second and third floors of modules A and B, with some administrative office space located in the basement level of Module A. The Master Plan program calls for some administrative office space (approximately 7,800 net assignable square feet) during the first two phases of construction/growth. The strategy for accommodating this growth includes some office expansion in the basement level of the A Module when the library is relocated to the first floor, and to either add offices to Module C by moving lab space to Research Building 1, or including this space in the program for the Phase 1 Office Building.

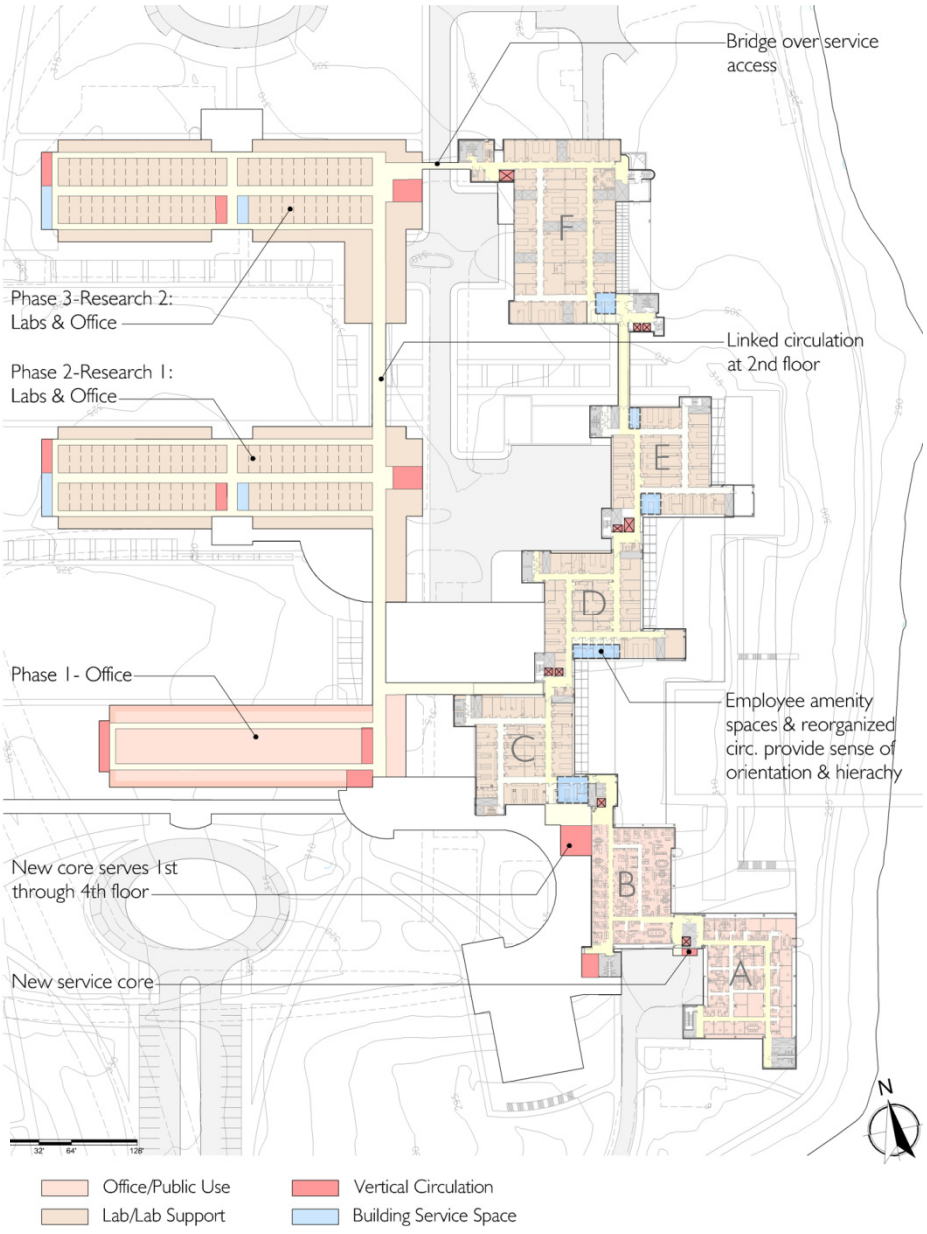


EXHIBIT 9.3: 2ND AND UPPER FLOORS CONCEPT PLAN

Basement Level Concept Plan

The organization of the basement level revolves around the animal facility, which is currently located in the basement of modules C, D, and E. The facility primarily houses small rodents, with a typical average daily census of approximately 27,000 animals. The facility is organized with a clean/dirty dual-corridor system. Personnel access to the clean corridors is through a locker/gowning/shower area. Two sets of these rooms (male and female in each set) serve the three modules that contain animal space. An additional by-pass corridor is planned, connected to the ground floor by an elevator at the building's west end, allowing clinical research center personnel to convey samples or medical equipment without using public corridors.

The Master Plan provides space for expanded animal facilities to allow for growth in this research function. As the master plan concepts were being developed a number of options for expanding the animal space were examined, ranging from construction of new animal facilities independent of the existing vivarium to contiguous expansion adjacent to and connected to the existing animal space.

The animal facilities expansion included in the Master Plan provides for new vivarium space contiguous with the existing facility. This approach has been adopted with the support of NIEHS, in order to provide the greatest flexibility to the institute in pursuing its research needs, and to minimize the duplication of facilities and staffing.

The animal facilities expansion also provides for an independent animal loading and support space area at the first floor level, with its own loading area, and a dedicated elevator connecting the animal facility to loading. It is possible that some staff and animal support space could be located at this level as well, allowing staff facilities to have natural light.

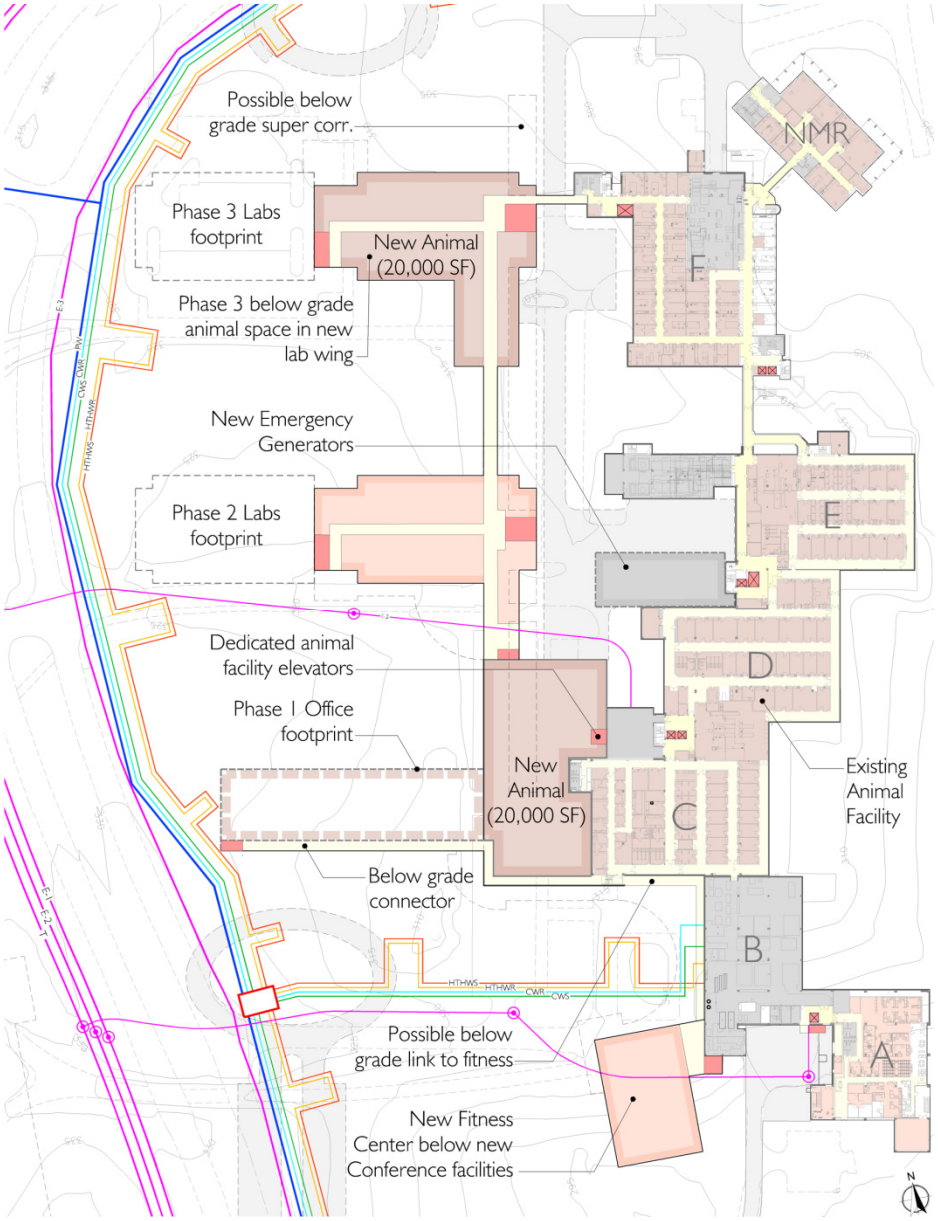


Exhibit 9.4: Basement Concept Plan

B. Switchgear/Generator Room Relocation

The animal facility expansion is planned adjacent to the existing animal facilities, which is the location of the existing main switchgear/emergency generator room. Relocation of the electrical service is driven by two considerations. The first concerns ventilation for equipment located in the basement electrical switchgear / equipment rooms for Module C, which would be cut off by any new above-ground construction. Secondly, there is concern regarding the high noise levels from generator-testing at animal holding rooms.

Two options for equipment relocation have been identified for review at the time of design. For both options special consideration should be taken related to the re-entrainment of the generator exhaust fumes into air intakes. Computative analysis and wind tunnel modeling of air re-entrainment should be conducted. Utilization of the mixed air flow fans for fumes dispersing should also be investigated. Any new or relocated fuel tanks should be located above grade.

Option 1 – Only Emergency Generator replacement in a new location

Under this option, only the emergency generators, appropriate appurtenances and associated equipment would be replaced in a new location. Since existing switchgear and equipment has been assessed to be in adequate operating condition, there is no urgent need to replace it. NIH should expect to have a number of years of service available from this equipment, with the exception of motor starting equipment (MCCs, starters, etc.). In Option 1 the new electrical room would be sized to accommodate the two generators being replaced, an additional generator(s) to meet increased needs, and new main switchgear associated with this Master Plan.

Option 2 – Both Emergency Generator and Main Switchgear replacement in a new location

Due to the age of the existing electrical equipment, as addressed in prior evaluations and studies, Option 2 considers full replacement of said equipment and all appurtenances in a new central location on the NIH campus. The new electrical room would be sized to accommodate new transformers and switchgear sized for current Building 101 needs and for future buildings identified in the Master Plan, two generators being replaced and an additional generator(s) to meet increased Building 101 needs and future Master Plan projects.

9.3 LOADING AND SERVICE

The Master Plan organizes the loading and service functions of Building 101 and the new research buildings into discrete and visually contained areas, with the primary loading zone located in a service court west of the D and E Modules. This service court provides vehicle maneuvering area for service trucks up to 55 feet in length. The existing loading dock on the north side of Module C is replaced by a new, above-grade addition containing animal facility support space. The animal facility would have a dedicated loading dock and elevator connection.

The main loading dock/service court has been studied with respect to several technical issues, including a possible relocation of the emergency generators as discussed above. The Master Plan recommends construction of a new emergency generator vault just to the west of the E Module loading dock, below the paving.

Air quality in the loading court caused by vehicle exhaust must be considered as new facilities are built. Currently, NIH experiences some re-entrainment of service truck exhaust in this area, which is unacceptable. As new buildings are developed around the service court, the air flows will need to be studied for potential problems. An alternative concept would locate the main loading dock to the north of the F Module, connected to the campus service elevators and support areas by means of a basement service corridor. This concept would remove vehicles and fumes from the middle of campus, and free more area for facilities expansion. The consolidated loading would be mechanically isolated, but not as convenient or efficient.

9.4 First Floor Improvements

Building 101 turns its back on the lake on its east side and the area fronting the lake. The plan would reorganize the lake side of the first floor, providing a more direct and enjoyable circulation path linking modules A through E. This new circulation element would include new construction on the east sides of the C and D modules, above the existing terraces located over the animal facility. The principal features of the new circulation spine in Building 101 include:

- location of the public circulation space on the outside edge of the building with views directly to the landscape and lake through continuous glazing
- inclusion of employee-oriented amenity spaces along the length of the circulation spine
- creation of a more direct route within the building, better orientation and linking of the public spaces

Improvements to the first floor of Building 101 are one of the most important elements in the renovation concepts for the building. The existing horizontal circulation system within the building is inefficient, with long and circuitous paths required to move from one point to another. The Master Plan develops a framework for circulation and location of program spaces on the first floor.

One of the key goals of the Master Plan is to encourage collaboration among scientists and provide spaces that foster interaction. Providing new shared amenities and relocating existing ones to the first floor creates a magnet for staff and multiple opportunities for meeting informally and sharing ideas. The renovated and expanded first floor is the "downtown" of the complex and includes the café, library, meeting rooms, employee store, copy center, lounge – and other services that would be used on a daily basis. Creating a clear circulation path past these amenities, with views to the lake and natural light, would reinforce this as the building's heart.

Phasing the First Floor Improvements

The diagram on the following page shows the suggested organization and components of the first floor expansion. This expansion is expected to happen in the second phase of construction, after the completion of the animal facility when animals can be moved to prevent their disturbance by construction above.

However, these first floor improvements are desired by NIH as soon as possible. Some interim improvements can be made to the first floor of the Module C when the new lobby and cyber café are constructed, with minimal impact on the animal facilities below, and bring in more natural light and partially realign the first floor circulation. The corridor would be moved to the exterior wall, relocating the occupied spaces inward. Existing functions could be replaced by employee amenities such as library periodicals, employee store or lounge. The exterior wall along the corridor would be replaced with insulated storefront glazing.

When the first floor of modules C and D are expanded in Phase 2, the exterior wall and corridor would move out eastward, allowing the interim amenity space to expand and accommodate the library and library staff.

Exhibit 9.5: Interim First Floor Improvements – Module C

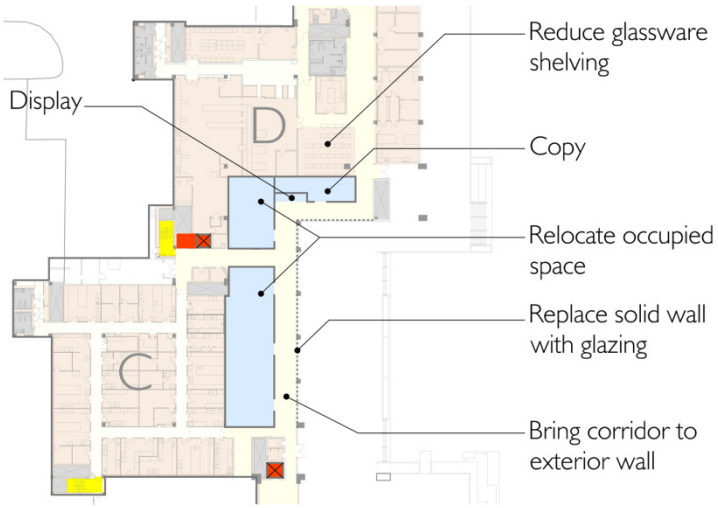
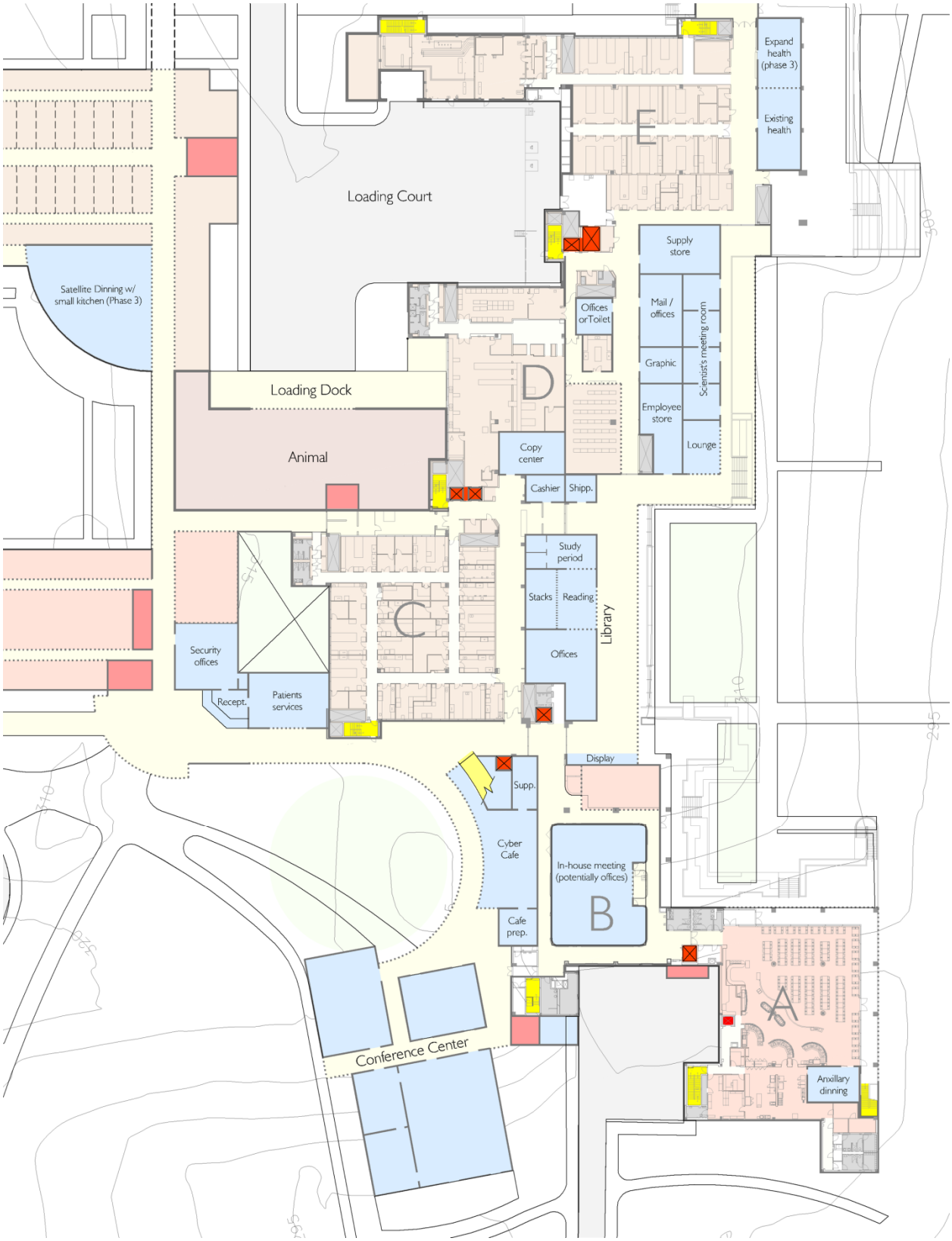


EXHIBIT 9.6: BUILDING 101 FIRST FLOOR EXPANSION AND REORGANIZATION



9.5 SUSTAINABLE RENOVATION

The renovation and upgrading of Building 101 fits within the overall sustainability goals for the campus in a number of important ways. Chief among these is the plan to retain and re-use the facility, rather than demolish and replace it. The sustainable design aspects of the campus plan and future development are detailed in the Master Plan descriptions and the design guidelines. A number of individual sustainable components and strategies for Building 101 are outlined below:

- High-performance lighting, good lighting design and controls
- Daylight incorporation with appropriate controls
- High-efficiency HVAC equipment, right-sized for current operations and equipment loads
- Consideration of energy conservation measures such as heat recovery in the vivarium; use of energy-efficient fume hoods; and review of indoor air quality, ventilation rates, pressurization and zoning
- Water-conserving fixtures in labs and restroom facilities
- Use of sustainable materials

MEP Systems Energy Reduction Strategies

A detailed engineering review of Building 101 identifies some specific measures that should be implemented for energy conservation. These are independent of Master Plan expansion items and can be done gradually or with renovation projects. They include the following:

a. Complete conversions of laboratory air flows from constant volume to variable volume.

b. Reduction of supply air and exhaust air flows to laboratories from present air change rates to eight (8) air changes per hour during occupied hours and to four (4) air changes per hour during unoccupied hours for energy conservation.

c. Replace all remaining existing auxiliary air fume hoods with constant volume high performance fume hoods.

d. Complete replacement of existing pneumatic controls system with Metasys DDC control system for energy efficiency and enhanced system performance capabilities.

e. Replace existing air handling unit cooling coil control valves with pressure independent control valves for energy conservation.

f. Replace glycol run around heat recovery system for improved energy conservation.

g. Replace/repair all damaged ductwork and piping insulation on supply ductwork, chilled water, hot water, steam and cooling coil condensate piping for condensation control and energy conservation.

h. Replace light fixtures with energy efficient ballasts and lamps as per EPAct 2005, which required phased elimination of several types of fluorescent and incandescent lamps.

i. Provide dual switches for lighting in offices and conference rooms.

j. Install occupancy sensors on lighting switches in all enclosed offices, toilet rooms and other spaces where configuration and usage make them effective.

k. Replace all incandescent fixtures with compact fluorescent fixtures.

l. Replace existing step-down transformers with energy efficient TP-1 rated step-down transformers to improve lighting levels in cubicle areas.

m. Install energy efficient light fixtures/task lamps to improve lighting levels in cubicle areas.

n. Replace any high bay metal halide fixtures with high bay fluorescent fixtures – reduces energy usage by 50% with no light level reduction.

9.6 Engineering System Modifications

While Building 101 has been very well maintained, many of its existing systems are nearing the end of their useful life and are in need of replacement. Equally important, accessibility and fire and life safety codes have changed significantly since construction of the building. Many of the bathrooms, elevators, doors, exit stairways, drinking fountains, and other components of the building are no longer code compliant. The Master Plan recognizes that these items would need to be addressed as renovation of the building proceeds. Appropriate strategies to address Building 101 deficiencies would need to be developed on a case-by-case basis, in conjunction with the renovations, additions, and new facilities considered.

A. Engineering System Deficiencies

Energy conservation - The original HVAC system is a constant volume dual duct system with constant volume mixing boxes and pneumatic controls. The retrofit is in progress – motor starters for dual duct air handlers are being replaced with new motors with variable frequency drives; air handler controls changed from pneumatic to DDC, constant volume mixing boxes are being replaced with pressure independent terminals with DDC controls. But the systems are being set up to operate in the constant volume mode.

HVAC Equipment - There are 51 air-handling units and associated exhaust fans which are original. These have exceeded their life expectancy and need to be replaced. Most of the heat exchangers and pumps are also original and need to be replaced. NIH conducted Facility Assessments and Facility Renewal Forecasts which also recommend the replacement of the HVAC equipment. Any replacement has to be done in phases with minimum research interruption.

Fume Hoods - Most of the fume hoods are auxiliary air type; they utilize tempered make up air introduced directly on the top of the hood; during the summer this air is not cooled and creates a high humidity problem in the labs. Original fume hoods are being replaced with high performance type hoods at the rate of four (4) hoods per year.

Emergency Power - Currently the building accommodates almost 700 freezers, many of them, in particular -80° freezers, require emergency power. Exhaust fans servicing fume hoods are not on emergency power.

B. Infrastructure Replacement

Recommendations from prior Facility Assessments and Facility Renewal Forecasts are included below. Phasing of the systems modifications/replacement would be required to provide continuous service to the facility during the construction activities. Phasing should take into consideration: space utilization, seasonal replacements that minimize impacts from utility outages, new construction swing space opportunities, to allow existing spaces to be vacated during system modifications, etc.

The Building 101 system modifications are recommended to reduce energy consumption and minimize potential system failures and resulting service interruptions; and include the following detailed items:

a. Replace existing vivarium air handling units (AHU-TRH/C-AN-1, AHU-TRH/D-AN-1, AHU-TRH/C&D-AN-1, AHU-TRH/E-AN-1, AHU-TRH/E-AN-2 with new units due to the age and condition of the existing unit.

b. Replace existing auxiliary air handling units with new heating/cooling air handling units and replace the existing laboratory dual duct air handling units in modules C, D and E. Replacing auxiliary air handling units would provide an additional airflow to allow the replacement of the laboratory dual duct air handling units during winter months. Unit replacement sequence should be as follows: AHU-AUX-C-L-1 and 2; AHU-DD/C-L-1 and 2; AHU-AUX-D-L-1 and 2; AHU-DD/D-L-1 and 2; AHU-AUX-E-L-1 and 2; AHU-DD/E-L-1 and 2.

c. Replace six single zone air handling units serving animal bed & feed receiving, cage and glass wash areas in modules D & E.

d. Replace AHU-TRH unit that serves 1st Floor Conference area in Module B.

e. Replace module A & B air handling units AHU-VAV/A-AD-1 and AHU-VAV/B-AD-1.

f. Replace A&V units serving penthouse and basement mechanical spaces in modules A, B and E.

g. Replace existing chilled water pumps with new pumps of adequate capacity to serve all cooling loads in modules A, B, C, D, and E.

h. Replace existing heating hot water heat exchangers and associated hot water pumps with new pumps of adequate capacity to serve all heating loads in modules A, B, C, D and E.

i. Replace existing domestic hot water heaters, circulation pumps and associated controls, piping, etc.

j. Replace 100 ton air cooled condensing unit (back-up unit for fan coils units) on the roof of Module A.

k. Replace sump pumps in basement of Module E.

l. Replace steam PRV's in modules B, D and E.

m. Replace deteriorated exhaust fans.

n. Replace fan coil units in interstitial space due to equipment condition.

o. Replace animal water systems in modules C, D and E.

p. Replace contaminated laboratory piping systems.

q. Replace R-12 refrigerant cold room systems with HFC refrigeration systems to eliminate CFC's.

r. Replace existing distilled water system with RO water system due to age and condition of existing distilled water system.

s. Replace electrical floor box cover plates in interstitial space due to failures.

t. Replace existing motor control centers.

u. Replace emergency lighting.

v. Provide additional emergency power capacity to meet current emergency power needs.

w. Perform infrared scan of all wire connections and electrical equipment for potential failures.

x. Check ground resistance of building ground.

y. Provide double wall containment vessels for chemical treatment system in Module B mechanical room to provide secondary containment.

C. Code Compliance Issues

a. Complete installation of wet pipe sprinkler system and enclose fire pump in fire rated room to comply with NFPA.

b. Relocate heating hot water supply and return piping from above electrical panels in basement of Module D to meet NEC requirements.

c. Add fire pump in fire rated room in Module B due to inadequate standpipe pressure to meet NFPA requirements.

d. Provide tempered water system for safety showers to meet ANSI Z358.1.

e. Insulate piping underneath sinks in restrooms to comply with UFAS 4.24.6.

f. Provide stair well pressurization system in exit stairwells in modules A, B, C, D and E to meet the NC Building Code.

g. Provide fire separation and code compliant penetrations throughout vertical pipe and duct shaft assemblies to meet the NC Building Code.

h. Provide vacuum breakers on sinks, hose bibs and lab sinks to comply with NC Plumbing Code.

i. Provide air gap fittings between indirect waste pipe and trap seal of the waste pipe for equipment drains to comply with NC Plumbing Code.

j. Replace non GFCI receptacles in restrooms within 6' of sinks with GFCI receptacles as required by NEC.

k. Provide weatherproof GFCI receptacles near rooftop equipment as required by NEC.

l. Identify all emergency electrical equipment as required by NEC.

m. Label all electrical equipment and provide accurate panel breaker listing inside each panel.

n. Place Arc Flash warning labels on electrical equipment that identify the category of PPE as described in NFPA 70E required of all qualified personnel.

o. Install new exit signs as required to replace non-compliant and non-existing ones as required by code.

p. Bring all electrical wiring and protective equipment into compliance with 2008 National Electrical Code

D. Other Modifications to Building 101: Summary

Accessibility Upgrades Needed (Modules A through E)

- Wall-mounted water fountains
- Elevator controls and signals
- Finishes and fixtures in existing restrooms
- Knob-type interior door hardware
- Lack of compliant handrails in some exit stairs
- Third floor ramp between B and C modules not compliant
- Signage and egress identification for rooms, elevators, and emergency egress routes

Fire and Life Safety Upgrades Needed (Modules A through E):

- Lack of GFCI receptacles in wet locations
- Stair pressurization not provided
- Emergency lighting fixtures and equipment not marked for identification

Fire and Life Safety Upgrades Needed (Module F and the MRI Building):

- Fire sprinkler system does not cover all sections of Module F
- Module F fire pump not located in a fire rated room
- Throughout the electrical distribution system in the MRI Building, there are conduit penetrations in walls, floors, and ceilings which need fireproofing treatment.
- Loading dock and one electrical room in the MRI Building do not have a fire sprinkler system

Other Upgrades Needed

- No service elevator serving A and B modules

10.

IMPLEMENTATION PLANNING

EXHIBIT 10.1: SUMMARY OF PHASED IMPLEMENTATION

Phase 1	Phase 2	Phase 3
5 to 10 Years	10 to 15 years	20 Years
Buildings		
Campus Center New entry lobby/circulation Conference Facilities/Fitness Employee Amenities (interim 101)	Lakeside Addition/ 101 renovation	Amenity/Food Service Expansion with Research Building 2
Animal Facility (Vivarium) Expansion	Research Building 1 Lab Growth, Shortfall / ancillary Office growth/shortfall & support New Clinical Research Building [1] Remove Modular Clinic	Research Building 2 Lab Growth,/ ancillary Office growth & support Animal Facility (Vivarium) Expansion
New Office Building [3] replaces leased facility temporary quarters for shortfall		
Structured Parking	Structured Parking	Structured Parking
Visitor Center	--	
Warehouse (with EPA)	--	--
Bldg. 101 general improvements	Bldg. 101 general improvements	Bldg. 101 general improvements
Landscape, Site & Utilities		
New Pedestrian Drop-off at 101 Add vehicular entrance at Hopson Rd.	Partial North Loop Road Re-alignment Pedestrian Bridge to EPA	Final North Loop Road Re-alignment New North Entrance/Drop-off
Replace visitor/ADA parking	Modify surface parking	Modify surface parking
Main Entrance plaza & plantings	Landscaped Service Quad Lakefront Landscape /terraced lawn	Landscaped Science Quad Sports area by the lake Site-wide sustainable landscape
Stormwater bioretention	Stormwater bioretention	Vegetated swale and bioretention
Chilled/hot water mains extended New piping for buildings	Chilled/hot water mains extended New piping for buildings	New piping for buildings
Replace CHW and HTHW equipment and upgrade electrical as per MUP recommendations[2]	Replace CHW and HTHW equipment and upgrade electrical as per MUP recommendations[2]	Replace CHW and HTHW equipment and upgrade electrical as per MUP recommendations[2]
Electrical transformers/switchgear	Electrical transformers/switchgear	
--	--	Potable water main relocated
Sanitary sewer—new north/south sewer	Extend sewer	Extend sewer
Master Utility Plan (MUP) upgrade[2]	Master Utility Plan (MUP) upgrade[2]	

[1] A permanent clinical research center is planned for Phase 2, replacing the modular clinic

[2] The Master Utility Plan (MUP) for the NIH-RTP campus has been prepared and submitted separately by Sud Associates. Upgrades to the mechanical/electrical equipment in the Central Utility Plant (CUP) would be an outcome of that study.

[3] Early Action Item. This Master Plan plans for the office currently in leased space to return to campus when the lease is ended (2018). This goal requires that planning begin immediately.

10. IMPLEMENTATION PLANNING

The Master Plan is a look into the future and a structured plan to build and renovate facilities in order to meet anticipated needs. Twenty years is the timeframe for this NIH-RTP Master Plan, and the changes have been prioritized and structured into three development phases. As with any institution, NIH-RTP's program growth and construction are dependent on many factors – e.g. funding, direction of scientific research, NIH mission and agency-wide priorities. The Master Plan therefore, needs to be thought of as living document, setting a framework that remains flexible and sensitive to the timing and composition of specific projects. The phasing of NIH-RTP's plan is organized to meet the following implementation goals:

- Prioritized space and functional needs are included in Phase 1
- Phase 1 construction establishes the core elements of the Campus Center concept
- Phase 1 concentrates budget spending on needed facilities and priority improvements to Building 101 entrance.
- The Plan is able to accept variations in timing and project groupings
- Phasing is organized to minimize disruption inherent in the chosen consolidated Plan
- The Master Plan appears "complete" at the end of each phase or significant addition.

The purpose of the Master Plan is to guide future development; it does not represent the pre-approval of any individual facilities project or the particular needs of specific programs to be accommodated on the campus. The financing of such projects and programs must be addressed within the annual HHS budget processes and the HHS Capital Investment Review Board mechanisms. Furthermore, the Master Plan it is not a commitment for the agency to build these facilities within a specific timeframe, ie, the 20-year framework set forth in this document. Implementation of these plans requires that funding be available and that NIH's research commitment remains the same. Sometimes a twenty-year Master Plan becomes a thirty-year plan, yet the facilities do finally get built, and the framework for this development remains valid.

10.1 Phase 1

The first phase of new construction establishes the Campus Center nucleus by creating a new entrance and circulation core, and clustering shared-use and more public functions around it (see the preceding chapters).

A. Components

There are ten key components in this phase:

- Conference center, with the fitness center /aerobics on the lower level.
- New Office Building to replace the off-campus leased space when the lease is up
- New entrance to the building, atrium and circulation core, plus renovation of adjacent 101 space
- Vivarium expansion, connecting to the existing animal facility on the lower level
- Entrance plaza, drop-off and landscape
- Stormwater management features, including the first bioretention area, south of new conference center
- Utility extensions and CUP upgrades
- Warehouse, replacing leased space and shared with EPA
- Parking Structure – Module 1
- Visitor Center, part of the security screening program for the main entrance (precedes Phase I)

B. Order of Implementation

Each of the new buildings can be constructed independently, and in any order, although the order of the above list is preferred if the entire phase cannot be constructed at one time. The new entrance, atrium and circulation core would link the Office Building and the Conference Center to the existing Module B, and should be included in the project scope of one or the other. A first module of structured parking would be required for returning office staff. The entrance would include a new circular drive, visitor/ADA parking, and a landscaped plaza. Partial renovation of Module B would occur with the atrium and circulation core. Interim improvements to the ground floor can occur. The Vivarium expansion would include renovation of the adjacent loading dock area.

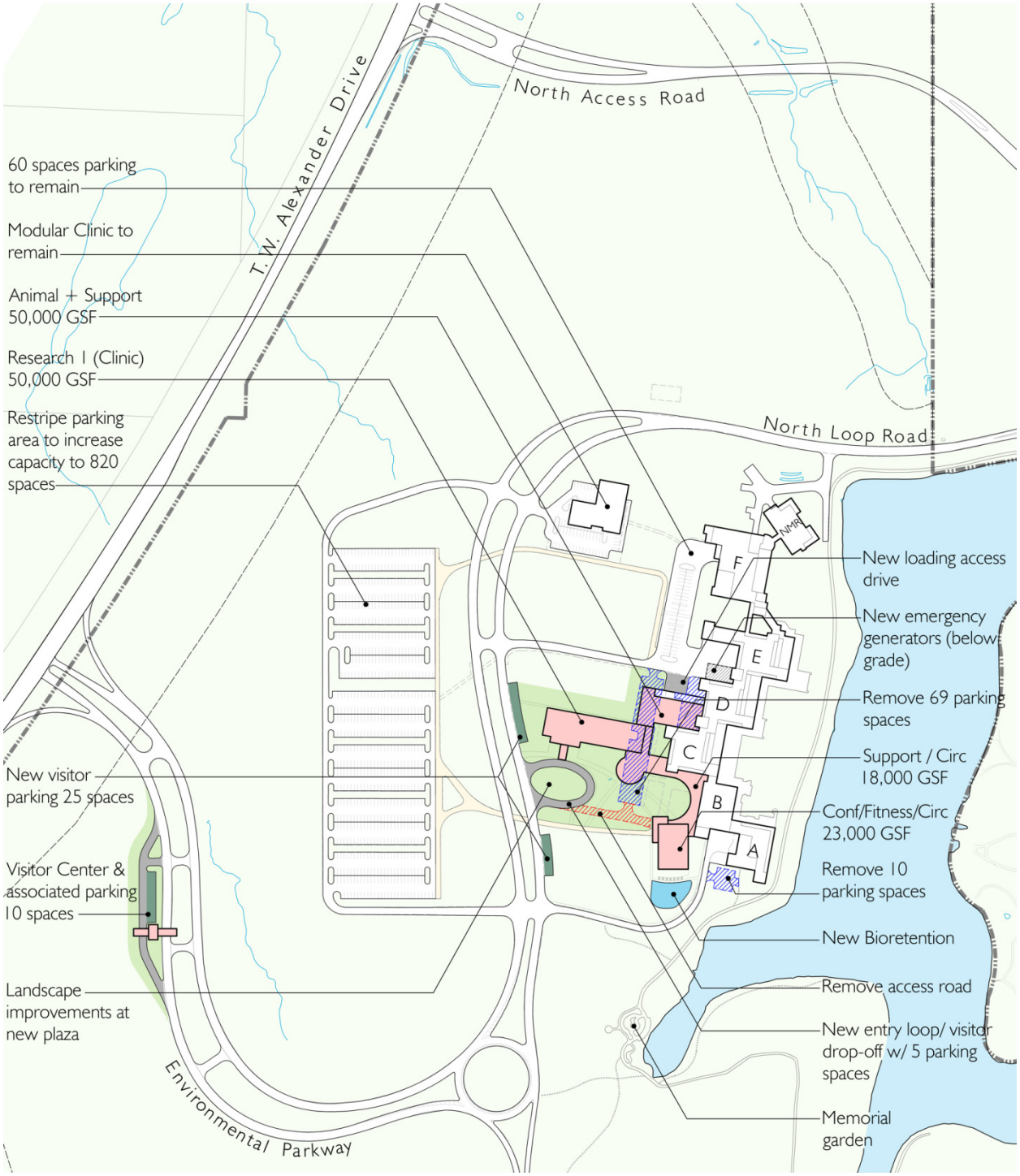
The Visitor Center is a security screening facility located at the main entrance. It is in an advanced planning stage by NIH and is expected to precede MP Phase 1. The Warehouse, a shared facility with EPA, is in the concept design phase, and planned for Phase 1.

C. Disruption

All construction adjacent to the existing Building 101 would cause some pedestrian and vehicular circulation changes, and nearby parking spaces would be lost with each of these Phase 1 buildings. Construction of the Office Building and the Conference Center can be accomplished without major disturbance to Building 101 function, using appropriate barriers and construction controls. The new entrance, atrium and circulation core would interrupt the day-to-day operation of Module B and require a temporary entrance, as well as interior safety separations and system controls. Exiting from one of the stair towers would need to be changed. The structured parking module would be built on existing surface parking; a temporary lot or restriping of existing lot to increase capacity may be necessary during construction in Phase 1 only. The existing security center is located in the construction zone and would need to be isolated from the construction. The Vivarium expansion would require relocation of the emergency generators.

Combining all the Phase 1 components into one project would be more efficient for the contractor(s), result in less disruption overall and shorten the time period of disturbance (warehouse and visitor center independent).

EXHIBIT 10.2: PHASE 1 IMPLEMENTATION



10.2 Phase 2

The second phase of construction builds off the Campus Center nucleus to add needed office and laboratory expansion, creates the first campus courtyard and adds outdoor amenity space (see preceding chapters).

A. Components

There are seven key components in this phase:

- Research Building One (Lab and Office), accommodating personnel and program growth.
- Clinical research Center, replacing the temporary modular structure
- Lakeside addition to Building 101, plus renovation of space adjacent to this new addition
- Parking Structure; Module 2
- Courtyard and lakeside landscaping
- Stormwater management features, including two bioretention areas, one northwest and one northeast of Building 101
- Utility extensions

B. Order of Implementation.

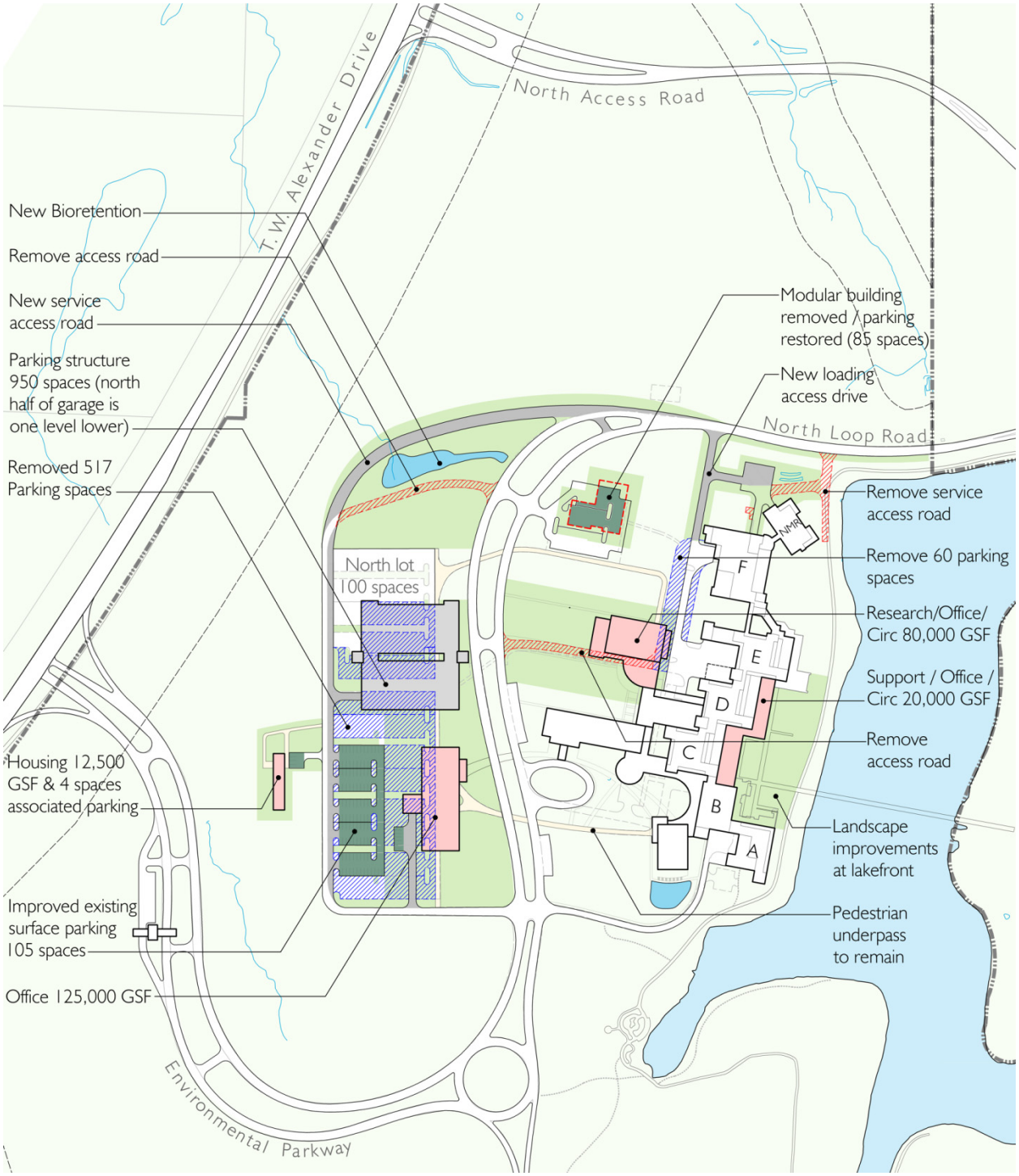
The research building and the Lakeside addition are independent projects, with the former addressing growth in staff and programs, and the latter addressing circulation and organizational problems in the existing building. When the research building is constructed, a landscaped courtyard would be developed for quiet recreation. The lakeside addition project should include the riparian and aquatic plantings by the lake, and a terraced lawn area for recreation and events. The parking garage extension would be needed to accommodate the growth in staff, and this needs to be built before, or at the same time as Research Building One and the Clinical Research Center. Further surface lots are strongly discouraged for environmental reasons (stormwater / vegetation). Although the new Clinical Research Center is independent and can be constructed when needed, the parking structure would need to be in place because the building would sit on the existing surface lot

Ideally, the lakeside addition would be done in Phase 1 because it is part of the circulation improvement and consolidation of shared facilities of the Campus Center. However, it would be located above existing Vivarium space, and there is concern that construction may disturb the animals. Vivarium expansion is planned for Phase 1, and there would be swing space for animals at its completion. Alternately, animals could be moved off-site during construction and the lakeside addition implemented earlier.

C. Disruption

The research building can be segregated from the operations of Building 101 during construction, although some existing parking would be lost. The Clinical Research Center is an independent building and would not disrupt operations at Building 101. The new parking module has been located so that it interrupts the fewest parking spaces, while not taking any "virgin" land. The removal of the temporary modular clinic, and restoration of its parking lot helps meet the parking requirement of this phase. The lakeside addition to Building 101 can be built outside the exterior walls, but its integration and the renovation of adjacent spaces for shared functions would require phasing and segregated circulation on the first floor of Wings C and D. As stated above, animals directly underneath should be moved to avoid disturbing them.

EXHIBIT 10.3: PHASE 2 IMPLEMENTATION



10.3 Phase 3

Phase 3 construction adds additional office and laboratory space to accommodate growth as well as the remaining program for the vivarium. The final module of the structured parking along with the stormwater management system is also completed in this phase.

A. Components

There are seven key components in this phase:

- Parking Structure, Module 3
- Research Building Two, accommodating personnel and program growth.
- Vivarium expansion under the new research building
- North campus entrance, with drive, visitor parking and ornamental planting
- Courtyard and recreation landscaping, as well as site-wide sustainable landscaping
- Eco-commons, a natural landscape and bioswale for stormwater management
- Utility extensions

B. Order of Implementation

Phase 3 reflects additional growth of office and lab functions, plus the realization of the campus eco-commons and pedestrian circulation.

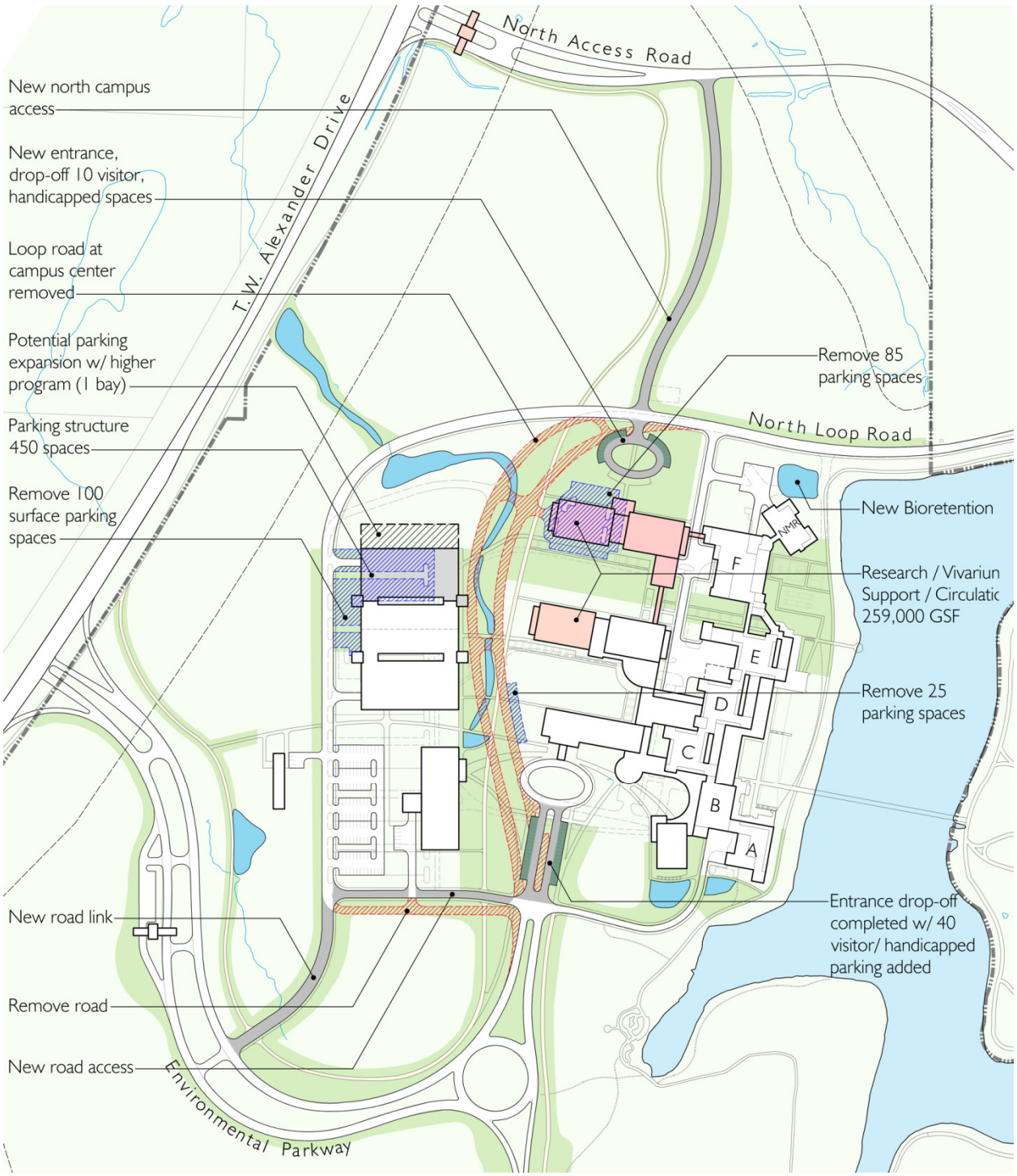
Implemented first should be the remaining parking structure, to accommodate the growth in staff. Next would be the Research Building (lab and office), which is linked to Vivarium expansion, expected to be built under the lab building (If vivarium space is needed sooner, it could be built under the 2nd phase lab building.) This construction would require the additional Module 3 structured parking.

Phase 3 completes the site and landscape modifications of the Master Plan, including relocating the existing road that separates Building 101 from surface parking, which would open up the campus heart, create the Eco-commons and complete the stormwater management features. The new road link should be built with the parking structure. Site modifications to return the campus to a more natural landscape may begin at any time.

C. Disruption

Construction of these buildings can be accommodated without serious compromise to the operations of the existing buildings. The parking structure would interrupt the remaining surface parking lot, but the existing structured parking in Phase 2 has potential for additional capacity to absorb the loss in surface parking. A temporary lot of pervious paving would be created near the planned new entrance drive/loop on the northern edge of the campus. After the garage construction, the temporary lot can be replaced with the planned drive and landscaping. The site improvements and road removal would require a phased plan that protects pedestrians and does not interrupt service vehicles.

EXHIBIT 10.4: PHASE 3 IMPLEMENTATION



11.

DESIGN GUIDELINES

11. DESIGN GUIDELINES

Creating a sense of place, a new campus image and an environmentally sensitive campus at NIH-RTP would require a consistent design focus on several important landscape and architectural elements. Each new project should reinforce a controlled set of design themes that have a campus-wide meaning and impact. The purpose of the design guidelines is to define important design parameters guiding campus growth. The illustrative plan indicates the preferred Master Plan growth, but the plan recognizes that there needs to be flexibility in its implementation; the design guidelines are the tools that provide that flexibility. The guidelines define the ways in which the urban design of the campus is realized, and how the architecture, open spaces, streets, and landscape design assemble into a cohesive whole. The guidelines address both functional and aesthetic issues, and the aesthetic direction of the guidelines is to focus on place-making: creating attractive indoor and outdoor spaces.

These guidelines are intended to provide enough specificity to ensure the creation of a family of related buildings and open spaces, yet provide enough flexibility to allow designers creative latitude in responding to aesthetic and programmatic issues. Many architects and landscape architects have a tendency to resist the constraints of guidelines, and argue that guidelines limit creativity. It is intended, however, that these guidelines would enhance creativity, by laying out in advance, logical design patterns for building entrances, circulation, service areas, building height, and design context, thus allowing the designer more time to focus on the qualitative aspects of individual buildings and landscapes.

These design guidelines cover five different realms of design that would be encountered as the campus develops:

1. Campus Open Spaces
2. Architecture
3. Landscape Architecture
4. Circulation
5. Parking

Almost any project undertaken on the campus would involve at least two of these areas of consideration, and often all five areas. The guidelines developed here are specific to the NIH-RTP campus, and are intended to supplement the NIH Design Policy and Guidelines, which provides extensive recommendations for NIH building design. In 2002 NIH also undertook a "Sustainable Design Initiative" (SDI) for the Bethesda campus. However, the full document also has relevance to NIH-RTP, and should be consulted as new projects are undertaken.

11.1 Open Space Guidelines

The open spaces defined in the Master Plan each have different characteristics, and perform different functions within the campus.

The landscape treatments should be used to both distinguish each landscape character zone as well as unify the overall landscape of NIH-RTP. The following landscape character zones have been recommended:

- Entrance Zone
- Eco-commons
- Courtyards
- Lakeside Landscape
- Natural Area Conservation
- Support Facilities

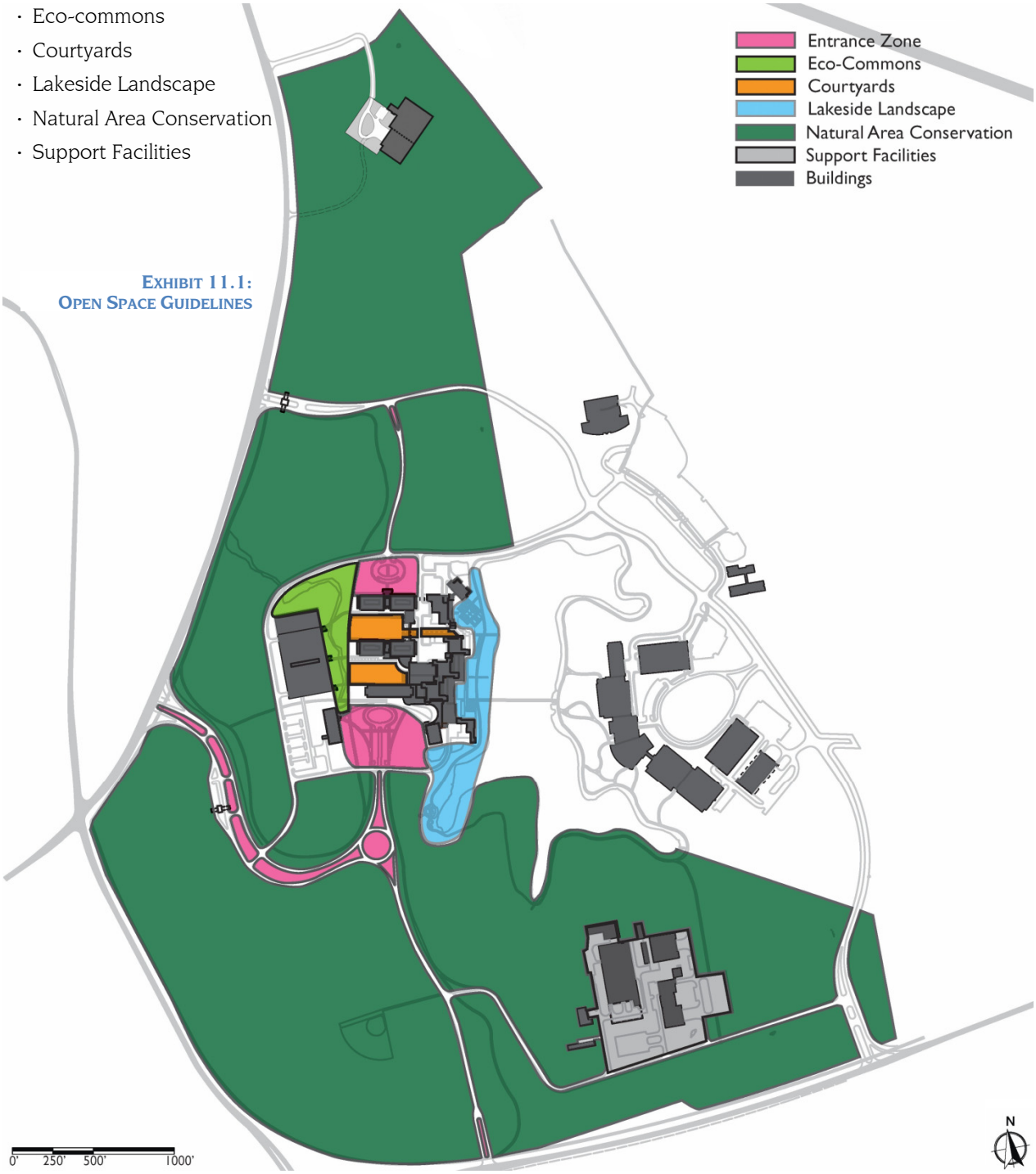


Exhibit 11.1:
Open Space Guidelines

A. Entrance Zones

There are three entrance zones envisioned in the NIH-RTP Master Plan: the first begins at the intersection of T.W. Alexander Drive and Environmental Parkway and runs the entirety of the parkway, through the roundabout, and into a new southern main entrance where there would be an oval roundabout at the public entries to the campus buildings. This entrance zone is framed by the first buildings upon arrival into the campus. The second entrance zone is located on the northern side of the Campus Center, and includes another oval roundabout at the north building entry. This is a secondary entrance, and allows users to enter through the Phase 3 lab portion of the NIH campus. The third and southernmost entrance into the campus is the new access road that connects to Hopson Road. The entrance zones would be distinguished by landscape treatments including signage, plantings, hardscape, lighting, and site structures. These treatments would lead the user into the landscape, provide information, and create the initial character impression for the entire NIH campus. Key features include:

- Public face of the campus: create a new, welcoming image for NIH-RTP, a symbol of collaboration and scientific endeavor
- Entrance that creates an obviously recognizable place
- Public functions located within and near the entrance zone
- Nexus of campus circulation: walkways to parking, drop-off from cars/buses, bicycles
- Entrance character: transparent, sunny, identifiable architectural form, surrounding facades important
- Visually link the entrance to the lake
- Visitor orientation to building entrances
- Waiting/outdoor sitting areas for pick-up and public transportation
- Clear connections to trails
- Bike racks

B. Courtyards

The courtyards will create the "campus feel" within the heart of the NIH complex. Rectangular in shape, they are intended to be framed by contemporary architecture, and highlighted with both existing woodlands and colorful ornamental vegetation. The courtyards will serve as quiet areas for recreation, outdoor dining, and social gathering. A ladder pattern of concrete pavers and ornamental gardens would provide a repetitiveness that creates a comfortable structured environment. The ornamental gardens would be complemented by a mowed lawn that users utilize for sitting or lounging, shaded by existing trees. The courtyards contain tree save areas that include some of the original woodland. Key features include:

- Quiet, outdoor dining, casual collaboration (outdoor rooms)
- Sense of enclosure, and a proportion of courtyard width to building height that allows good solar access
- Attractive views into courts from buildings

C. Lakeside Landscape

The lake, an important focal point and environmental element of the NIH-RTP campus, should be preserved and enhanced. The lakeside landscape zone spans the entire eastern side of the Campus Center, reaching up into the recreational courts and down to the memorial garden. The water-side setting should serve as a tranquil backdrop for events, gatherings, picnics, and recreation. A bridge connection between the NIH campus and the EPA campus is under consideration. Several recreation courts are suggested at the top of the lakeside landscape zone to provide space for playing bocce ball, volleyball, and basketball. Small mowed lawn areas that

look out toward the lake along the eastern side of Building 101 would serve as tranquil dining areas. The southernmost portion of the lakeside landscape zone would include aquatic and riparian plantings along the lake edge which will help to filter stormwater runoff, provide essential habitat, and form a landscape edge for pedestrians walking along the lakeside trail. Key features include:

- Transition from the large mass of Building 101to the pedestrian path and lake's edge
- Environmental management
- Pedestrian movement across grade changes
- Event area for NIH gatherings, picnics, recreation spaces
- Activity spaces for picnics, leisure

D. Eco-commons

The Eco-commons is to be located between the new parking garage and the new buildings of the Campus Center, and stretch south down to the main entrance area. It would serve as an important environmental and water management area on campus, and as a transition between the landscaped and the natural settings of the campus. A bio-swale, which is planted with water-loving vegetation, meanders through the Eco-commons zone, collecting stormwater. The bio-swales become part of the campus as an interpretive element, and are intended to filter silt, inorganic materials, and other pollutants through native vegetation and soil before releasing them into the watershed. Pedestrians exiting the parking garage and heading into the campus would traverse the Eco-commons zone before entering the more structured environment of the courtyards. Thus, the Eco-commons would also serve as an intermediate, transition landscape between the more formal courtyards and the more natural open spaces of the campus.

E. Support Facilities

The support facilities on campus are located at the northern portion of the site, which currently includes the warehouses of stored supplies, and on the southern portion of the site at the CUP or facilities management buildings. These utilitarian landscapes would utilize these sustainability techniques: permeable pavers, porous asphalt, and concrete; new savanna plantings that maximize the natural environment and filter stormwater pollutants; and elimination of mowed lawns.

F. Natural Areas Conservation

The natural area conservation zone covers the majority of the site. The development of new campus buildings was designed to remain at the core of the already developed site in order to conserve the expansive forested areas of the campus. The conservation and open space areas would be buffered by savannas and open edges replanted with native trees and shrubs. Key features include:

- Visual buffer
- Overall campus setting
- Trails through forests
- Environmental management: bio-mass, forest succession

11.2 ARCHITECTURAL GUIDELINES

The architectural guidelines of the Master Plan define the form, bulk, and locations of the principal buildings ; the organization of the circulation within the buildings, and the principal design considerations for the building facades. The diagrams included here show the architectural directions the individual new buildings should take, but are not literal building designs, and there is a good amount of latitude within the constraints described.

A. Massing

The massing guidelines help to define important spatial relationships between buildings and open spaces. The massing guidelines define building form and the corresponding outdoor spaces of the campus – relating the bulk and placement of new buildings to existing buildings, topography, and the sun.

Simple and flexible building envelopes are preferred, producing buildings that can accommodate a multitude of uses (or lab reconfigurations) over time. This approach is recommended for the majority of new buildings on campus; reserving more highly articulated building masses, grand-scale gestures, and unusual building forms for special function buildings. For most of the buildings, simple and straightforward clues to the important components of the building – its entrances, ground floor use, and internal circulation – are encouraged.

The massing diagrams generally indicate simple, rectangular building forms, with straight, linear facades. These forms are in keeping with the modular nature of laboratory construction. Flat roofs are generally shown on the taller buildings, as these areas will be used for mechanical equipment. Varied roof forms are encouraged on the lower rise buildings housing collective functions, indicating the importance of these buildings in the campus framework, and providing more attractive roofs to look at from the taller buildings.

Massing Guideline 1: Building Footprint

The building footprint is important in establishing the form and enclosure of the campus open spaces, and the performance of the building massing with respect to natural daylight. The illustration shows the limits of the buildable areas recommended in this plan. The footprints indicated here allow flexibility in the actual facility design, depending on program and functional requirements.

All regularly occupied spaces are to be naturally lit, unless there is a programmatic requirement for controlled lighting. Narrow building footprints will make it easier to optimize natural lighting/daylight. If a wide building footprint is used, introduce an atrium space with natural lighting on the interior. If a building taller than the recommended height is proposed, the minimum distance between buildings should be increased.

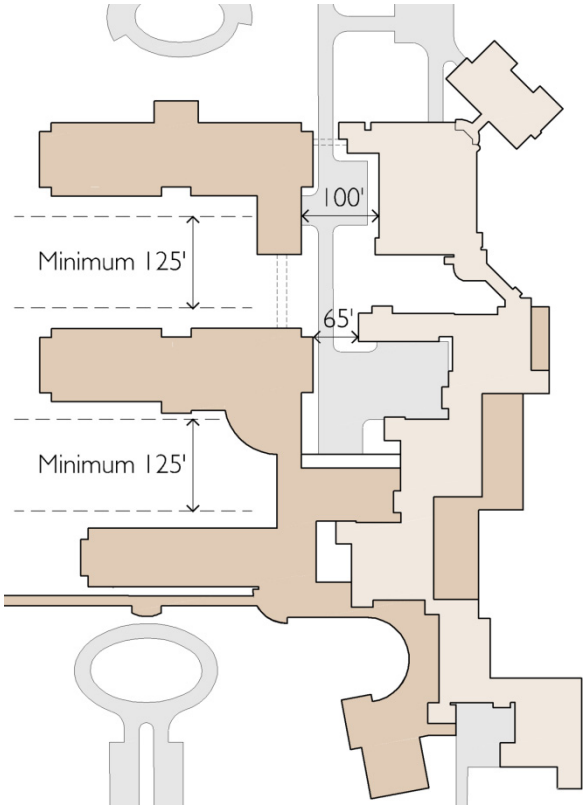


EXHIBIT 11.2:
RECOMMENDED MINIMUM SPACING

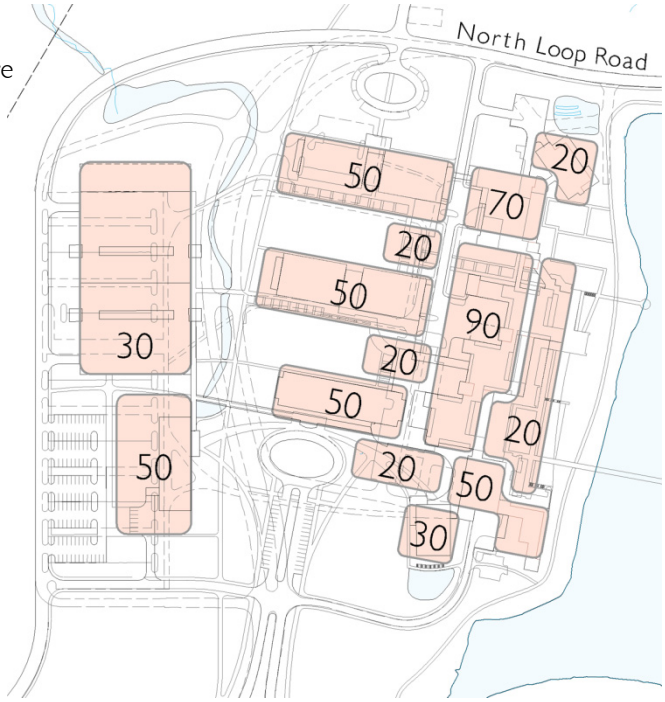
Massing Guideline 2: Orientation

The Master Plan arranges most of the new buildings such that their long axis has an east-west orientation. This arrangement, in conjunction with the narrow building footprints described above, will place the majority of the building's windows on the north and south facades, where natural lighting can be optimized and solar heat gain and glare better controlled. The exception to this orientation guideline in the Master Plan is the clinical research building on the west side of the entrance court, which is oriented with its long axis north-south, to strengthen its relationship with Building 101 and better frame the entry space. The east and west facades of this building will require well considered facade and natural shading.

Massing Guideline 3: Building Heights

Maximum recommended building heights (in feet) are shown in the diagram. These lower building heights are designed to allow solar access to courtyards. In addition, lower massing on west side of Building 101 buffers the large mass of 101 and allows views out from the existing buildings to the new open spaces.

EXHIBIT 11.3: BUILDING HEIGHTS



Massing Guideline 4: Floor-to-floor Height

Floor elevations of the new buildings are recommended in the Building Circulation Guidelines (later in this section), set to allow continuous internal circulation throughout the complex. The first floor interstitial spaces would be the same height as neighboring Building 101, although the second floor interstitial could be higher.

B. Facades

The façade guidelines provide recommendations for the design of building elevations based on proportion and scale, areas that require focus, and the use of materials. The building facades facing the campus quadrangles and entry plaza will be important walls defining the outdoor rooms of the campus, and are thus of just as much importance as the ground plane in establishing the quality of these spaces.

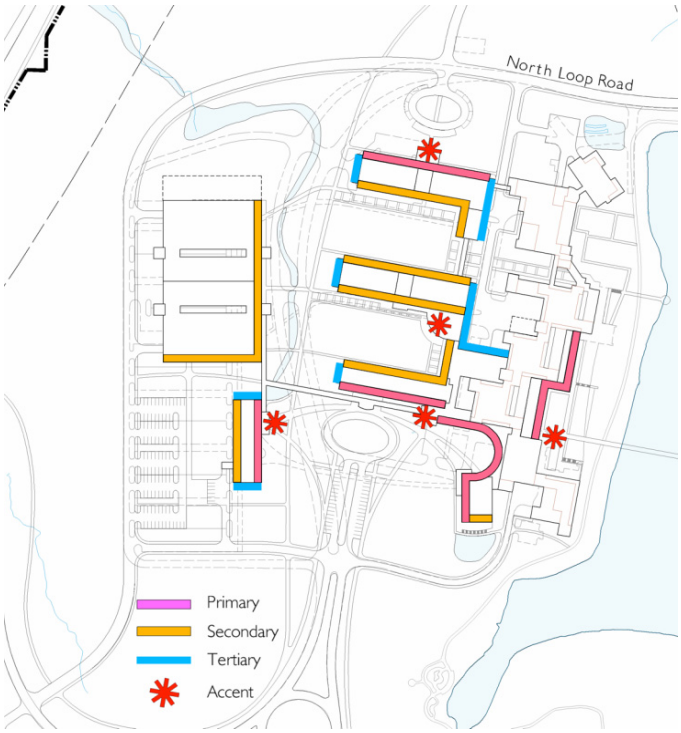
Principles for façade design include several key issues:

- Human scale: because pedestrian circulation through the campus is encouraged, the building facades facing the important campus open spaces should maintain a design scale, rhythm, proportion, and detail related to the pedestrian.
- Response to context: an important design issue is the integration of the new buildings into the existing campus context. The massing guidelines begin this integration by requiring compatible building heights and footprints so as to maintain views and light to all buildings. The façade guidelines can further assist this integration by recommending material palettes relating to Building 101.
- Response to environment: the orientation of the varying facades to the sun, and the effects of shading on the façade are important design determinants. Consideration of orientation represents a systematic and environmentally sound approach to building design. The building design responds directly to the environmental conditions with a corresponding reduction in energy use and operating costs.

Façade Guideline 1: Façade Organization

In conjunction with the Master Plan vision for new open spaces, primary and secondary facades are defined. Primary facades generally have more articulation, more glass area/fenestration, and face the important public spaces of the campus. Secondary facades generally have less fenestration, are the short ends of the long and narrow massing blocks, or face the less important campus spaces including loading areas. This hierarchy of façade types is shown in the diagram. In addition, the diagram indicates façade priority areas which define entrances, face people spaces, and relate to landscape features and other campus elements.

EXHIBIT 11.4: FAÇADE HIERARCHY



Façade Guideline 2: Fenestration

The organization of the building fenestration is important both functionally and aesthetically. The guidelines recommend:

- Maximizing fenestration on facades facing north and south into the courtyards and entry plazas;
- Use of high performance glazing with high visible transmittance
- Maximizing the vertical dimension of the individual window with high ceilings is preferred to allow daylight penetration. Ceilings can be stepped up at the façade to allow higher windows, and/or light shelves can be used to maximize daylight penetration. Windows should be appropriately shaded for their orientation, to prevent glare in work areas.

Façade Guideline 3: Materials

The materials utilized in new buildings at NIH-RTP will play an important role in defining the character of the architecture and open spaces. It is important that the primary building facades strengthen the connection between indoors and outdoors, which will animate both the interior and exterior spaces on campus. The materials guidelines recommend the following:

- Use of people-friendly materials on the primary facades of the buildings, in conjunction with the courtyards and landscape design;
- Utilize a mixed palette of brick, stone, precast, glass, and metal to respond to both the existing architecture of Building 101, and the goals for a more contemporary architectural development of the new buildings. Avoid reflective and tinted glass.

Façade Guideline 4: Special Features and Considerations

Where possible, special features should be incorporated into the building facades, to emphasize human scale and detail. These can include doors, canopies, and wall surfaces at building entrances, lighting, color, and other devices to provide interest, scale, and variety in the façade design.

Façade Guideline 5: Garage

The garage is intended to be naturally ventilated, with open facades. However, visual screening is desired and it is recommended that this be done with vegetation, such as edge planters and trees. Natural lighting should be an important consideration, with the inclusion of light wells and other openings.

C. Building Circulation

The purpose of the circulation guidelines is to organize movement through the campus buildings in way that provides a sense of orientation and way-finding, functional connections and enjoyment. The guidelines are intended to help clarify building entrances, and main public areas, to enhance the functional organization of the building and to work in harmony with the main public spaces within the campus buildings.

Circulation Guideline 1: Circulation Loop

Developing a primary circulation loop will help organize the circulation and provide pleasant, efficient circulation for staff and service. The circulation loop should link research and office buildings together, both new and existing.

First Floor Circulation System

The first floor circulation framework is the primary public space inside the building complex. This loop should link existing and new elevators and stairs, as indicated in the diagram. See Building Circulation Guideline 3 for first floor elevations that set this up.

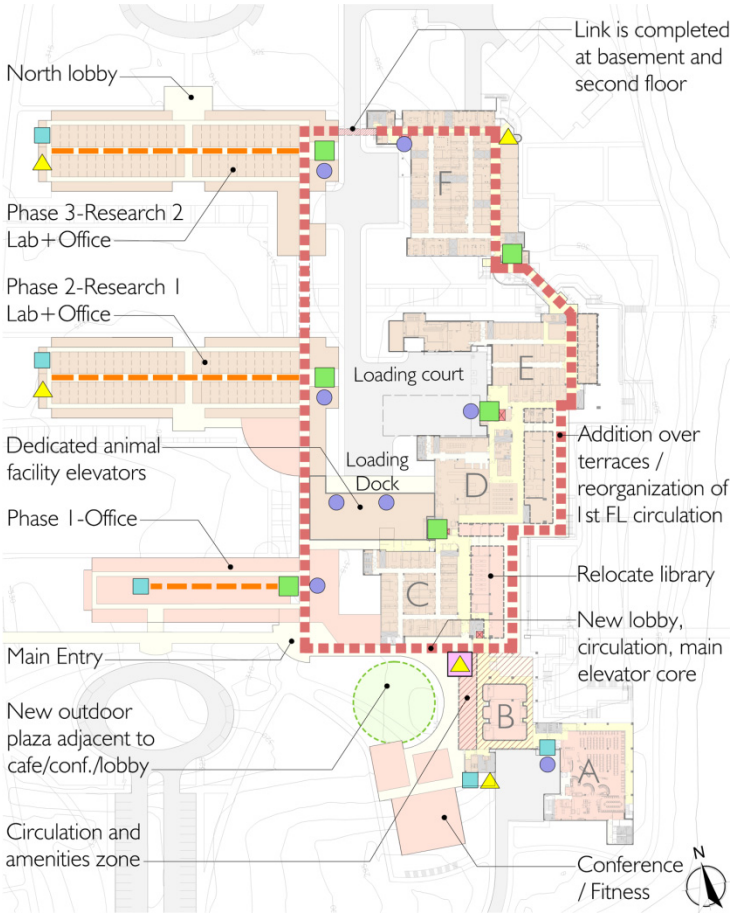
Second Floor Circulation System

A circulation loop is planned for the second floor, linking the research buildings and improving the confusing circulation through the existing Building 101. Renovation in 101 should establish a clear primary path through the wings, opening up to the outside when possible. Refer to Chapter 9 for circulation diagrams.

Basement Level Circulation System

The basement level circulation is a critical component in servicing the building complex and accessing the vivarium and other core facilities. The basement loop provides service circulation linking the lower levels and connecting the service elevators and loading docks. Clinical Research Center staff should be able to enter the west end of the office building at the ground floor and access the basement circulation by elevator (transfer of samples or equipment without using public corridors). Refer to Chapter 9 for circulation diagrams.

Exhibit 11.5: 1st Floor Circulation

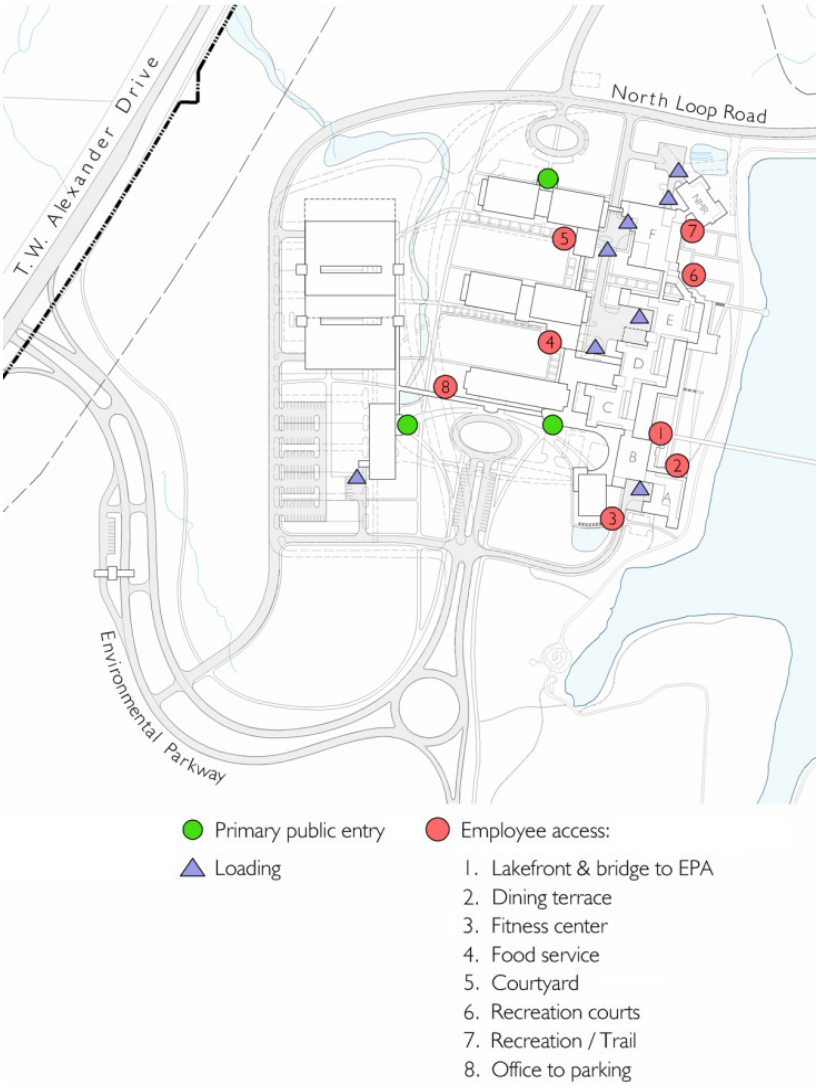


Circulation Guideline 2: Building Entries

The diagram illustrates the building entry points recommended in the plan. These entries are coordinated with the primary circulation loop, outdoor open spaces, campus trail system, and parking. Three types of building entries are indicated:

- Primary public entries with main lobbies, security, directories, and easy access to the main circulation loop and public spaces in the building;
- Employee access, providing employee connections to important outdoor spaces; and,
- Loading access connections to service courts and loading docks.

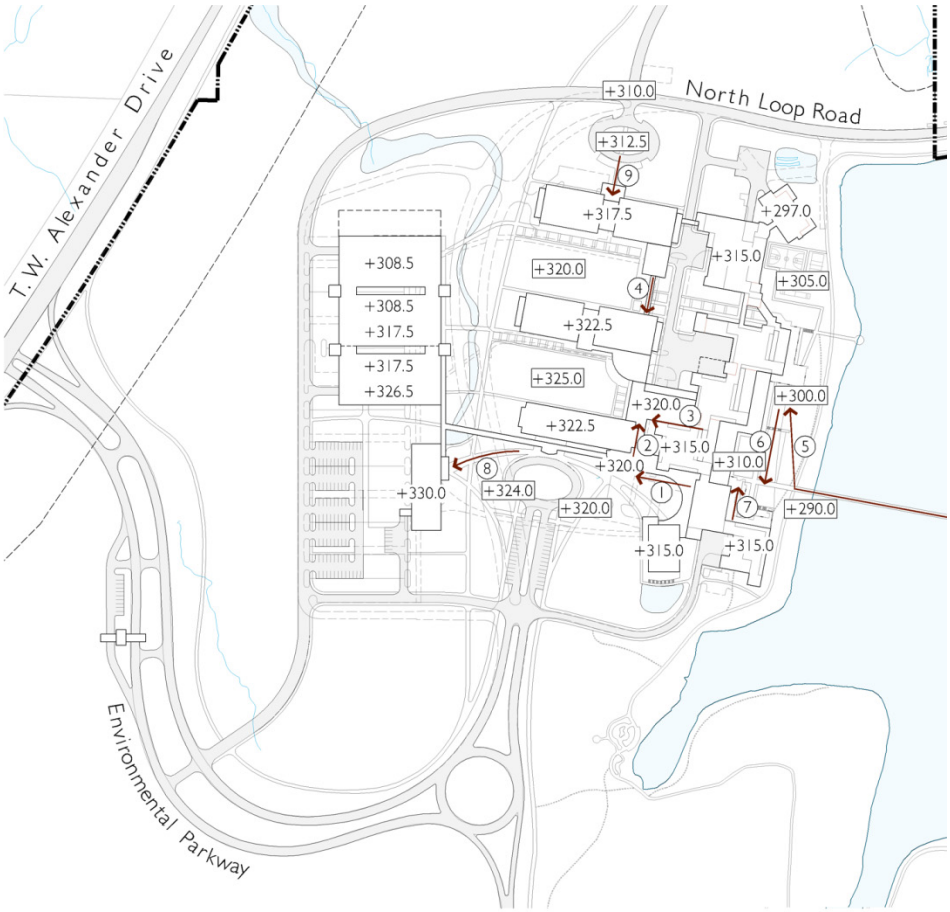
EXHIBIT 11.6: RECOMMENDED ENTRY POINTS



Circulation Guideline 3: Floor Levels/Ramps

The Master Plan is based on floor elevations that respond to the natural topography of the site, and ensure that as growth occurs, all buildings will be able to be linked without difficult grade transitions. The diagrams define recommended first floor levels that allow for first floor connections between buildings without requiring stairs or elevators, and utilizing ramps only.

Exhibit 11.7: Floor Levels and Slopes



+315.0 Interior floor elevation
+310.0 Exterior elevation
Ramp / direction

	Length	Slope	El. change		Length	Slope	El. change
1	100'	5%	15'	6	120'	8.3%	10'
2	30'-50'	5-8.3%	2.5'	7	100'	5%	5'
3	150'	5%	7.5'	8	150'	4%	6'
4	100'	5%	5'	9	100'	5%	5'
5	200'	5%	10'				

11.3 Landscape Guidelines

The organization of landscape treatments would distinguish each landscape character zone based upon both its function and location. Since the individual zones share many similar landscape treatments, the treatments are described here by topic, rather than broken down into character zones, and include Plantings, Hardscape Types, Site Structures, Site Furnishings, Lighting and Signs.

A. Plantings

New planting within the NIH complex should complement the native landscape, reduce maintenance costs by eliminating mowed lawns, and improve water quality. The plants chosen are intended to complement the existing natural environment of NIH. Planting types can be found within the following zones: (refer to Exhibit 6.1 for zone locations.)

Entrance Zone: Structured/Formal Plantings, Ornamental Plantings
Eco-commons: Bio-swale plantings, Savanna Plantings
Courtyards: Ornamental Plantings, Mowed Lawn, Structured/Formal Plantings, Green Roofs
Lakeside Landscape: Aquatic Plantings, Riparian Plantings, Mowed Lawn
Natural Area Conservation: Reforestation, Savanna Plantings, Bio-swale Plantings
Support Facilities: Savanna Plantings

Plantings Guideline 1: Aquatic Plantings

The goal is to coordinate the rehabilitation of the lake with EPA to improve the habitat and increase plant and animal diversity. Aquatic plantings enhance beauty and also function as a filter for pollutants associated with stormwater runoff. These plantings are lush and thick, providing a floral arrangement at the water's edge that is aesthetically pleasing.

- Provide colorful plantings along the lakeside walkways to filter stormwater runoff before it enters the lake
- Use aquatic plantings to prevent erosion and restore vegetative habitats
- Use plantings that are native to North Carolina. *NOTE: Several NC native plants can become invasive in ponds and lakes if not maintained and taken care of, such as cat tails; therefore, the usages of native non-invasive plants are preferred. Invasive plants can sometimes degrade the water quality and destroy other beneficial but diverse plants.
- Line the perimeter of the lake with a consistent planted edge.
- Recommended aquatic species include:
  1. Blue-flag Iris I*ris versicolor*
  2. Soft Rush J*uncus effuses*
  3. Pickerelweed P*ontederia cordata*
  4. Lizard's Tail S*aururus cernuus*
  5. Arrow Arum P*eltandra virginica*

Plantings Guideline 2: Riparian Plantings

Riparian forests are wet-oriented transition zones that buffer forests and watersheds and help to restore the natural ecology of the site. These forests filter stormwater runoff from the built impervious surfaces before reaching the stormwater management lake, and enhance the natural characteristics of the lakeside edge.

- Locate riparian forests along the western shore of the lake to provide a buffer between the stormwater management lake and the forested areas
- Recommended riparian tree and shrub species that are native to North Carolina[1] include:
  1. River Birch B*etula nigra*
  2. Bitternut Hickory C*arya cordiformis*
  3. Sycamore Platanus occidentalis
  4. Southern Sugar Maple A*cer floridanum*
  5. Swamp Rose Rosa palustris

Plantings Guideline 3: Bio-swale Plantings

Bioswales are wide, vegetated channels which collect stormwater, remove impurities from runoff, and prevent erosion by creating a strong foundation of vegetation. Bioswales are easy to maintain and provide a vegetated alternative to filtering stormwater before allowing it to enter watersheds or storm sewers. The lake serves as the primary stormwater management facility.

- Place adjacent to parking lots and roadways in order to collect stormwater runoff from the impervious surfaces
- Install native plantings to help improve water quality
- Recommended species include the following:
  1. Fringe Tree C*hionanthus virginicus*
  2. Beautyberry C*allicarpa americana*
  3. Buttonbush C*ephalanthus occidentalis*
  4. Willows S*alix spp*.
  5. Joe Pye Weed E*upatorium dubium*

[1] Hall, Karen, "Riparian Vegetation Resource List, Piedmont Region." NC State University Stream Restoration Program. January 2001. <http://www.bae.ncsu.edu/programs/extension/wqg/srp/piedmont_region.pdf>

Plantings Guideline 4: Reforestation Plantings

The goal of reforestation is to restore and rehabilitate the areas of woodland forest that may have been removed by construction associated with the NIH Master Plan. Forest making and reforestation helps re-establish habitats, repair impacted areas of the environment and reduce runoff. Pine trees are one of the fastest growing and easiest to establish species.

- Establish buffer areas with North Carolina native species
- Implement reforestation around the new parking facility in order to establish a natural transition to the existing forested area
- Collaborate with a professional forester for establishing reforested areas after site clearing and construction
- Recommended suggestions for reforestation include the following species[1]:
  1. Long Leaf Pine *Pinus palustris*
  2. Loblolly Pine *Pinus taeda*
  3. Shortleaf Pine *Pinus echinata*
  4. Virginia Pine *Pinus virginiana*
  5. Live Oak *Quercus virginiana*
  6. Willow Oak *Quercus phellos*

Plantings Guideline 5: Savanna Plantings

A savanna is a prairie-like area of land that is distinguished by grasses and a few, scattered trees. It serves as a transition from the built environment to the forested areas. The goal of the savanna is to provide an openness and natural quality throughout the campus that restores the ecology and natural habitat of the site. A savanna requires minimal maintenance.

- Establish savanna areas adjacent to public spaces such as trails, promenades, and plazas
- Encourage people to stay on the trails and not to enter into sensitive planting areas
- Recommended Savanna plantings include:
  1. Big Bluestem *Andropogon gerardii*
  2. Little Bluestem *Schizachyrium scoparium var. scoparium*
  3. Dropseed *Sporobolus heterolepsis*
  4. Switchgrass *Panicum virgatum*

[1] Hamilton, Rick A. "Reforestation of North Carolina Pines." North Carolina Cooperative Extension Service. August 14, 1997. <http://www.ces.ncsu.edu/nreos/forest/woodland/won-09.html>

Plantings Guideline 6: Green Roofs

A green roof provides environmental benefits as well as habitats. They are lined with a water-proofing membrane and filled with vegetative and aggregate materials that absorb rainwater that would otherwise run off. In addition, they provide an aesthetic quality to areas that are bare and unsightly. Green roofs are planned for four buildings on the NIH campus with the intention of providing a greater environmental and aesthetic quality to the site. Sedums are the recommended plants for green roofs and require little water after the first year of growth; recommended sedums include:[1]

1. Sedum album
2. Sedum acre 'Aureum'
3. Sedum bithynicum
4. Sedum 'Blue Carpet'
5. Sedum kamtschaticum
6. Sedum reflexum

Plantings Guideline 7: Structured/Formal Plantings

These plantings are generally located at primary entrances and other areas that have a need to be defined. The aligned, structured vegetation contrasts with the natural landscape and provide a "designed" landscape close to the new buildings.

- Use dense shrubbery as a security screen, at the plaza area located between the main entrance and conference center.
- Use formal gardens in the courtyards to connect with the landscaped focal points on the site and clearly articulate pedestrian pathways.
- Provide formal alignments of trees next to walkways in order to offer shade during warm months.
- Accentuate the garden and lakeside terrace areas and add color to the space with formal plantings.
- Recommended trees include:
  1. Red Maple *Acer rubrum*
  2. Tulip Poplar *Liriodendron tulipifera*
  3. Live Oak *Quercus virginiana*
  4. Green Ash *Fraxinus pennsylvanica*
  5. Honeylocust *Gleditsia triacanthos*
  6. Eastern Redbud *Cercis canadensis*

[1] Fairfax County Public Works and Environmental Services. "Recommended Plants Lists for Extensive Vegetated Roofs." February 1, 2007. < http://www.fairfaxcounty.gov/dpwes/publications/lti/07-03attach2.pdf>

Plantings Guideline 8: Ornamental Plantings

Ornamental plantings are located at the primary building entrances and within the courtyard areas. They are designed to create focal points and complement the architectural spaces.

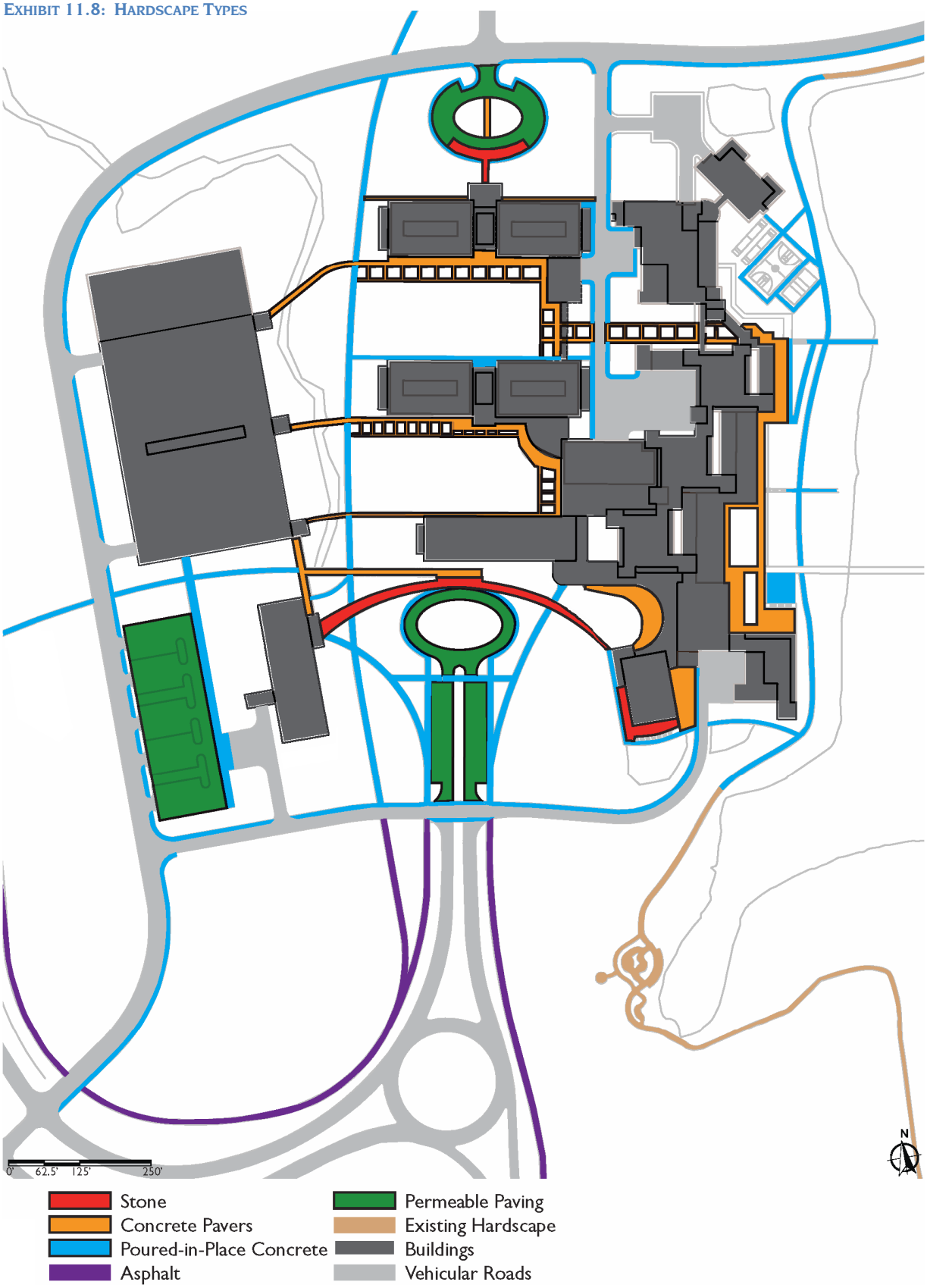
- Use ornamental plantings to provide color and texture as an inviting element into the more formal setting
- Provide ornamental plantings that are compatible with restoring the natural habitat and minimize the need for pesticides and chemicals
- Plant drought tolerant and non-invasive species such as:
  1. Butterfly Bush *Buddleja*
  2. Purple Coneflower *Echinacea spp.*
  3. Scented Sage Salvia guaranitica
  4. American Alumroot *Heuchera americana*
  5. Orange Coneflower *Rudbeckia fulgida*
  6. Black-eyed-Susan *Rudbeckia fulgida var. sullivantii*
  7. River-oats *Chasmanthium latifolium*
  8. Switchgrass *Panicum virgatum*

Plantings Guideline 9: Mowed Lawn

Lawn areas offer a clean, simple view into the site and complement the structural layout of the formal plantings. The main road into campus is currently lined with mowed lawn within the median and along the outer edges of the roadway. The intent is to remove the outer mowed lawn along the road to reduce maintenance costs as well as the use of pesticides and herbicides.

- Provide lawn areas inside roadway medians
- Reduce and limit lawn areas
- Use organic fertilizers

Exhibit 11.8: Hardscape Types



B. Hardscape Types

Hardscape materials have been chosen to promote both sustainability and compatibility with the existing NIH development. Where possible, recycled materials and low-environmental impact materials were selected. In addition, the various hardscape types are designed to complement the architecture, define spaces, and to create texture and interest. There are 5 main hardscape types that are recommended for the site. These include:

- Stone
- Concrete Pavers
- Poured-in-place Concrete
- Porous Asphalt
- Permeable Pavers

Hardscape Guideline 1: Stone

Stone is durable, maintenance free and can be designed in a contemporary manner that fits the context of the NIH campus architecture and landscape. Stone exists on the memorial site retaining wall, so keeping with this standard would complement existing conditions and also connect with the natural vernacular of the landscape.

- Locate stone at three of the primary pedestrian pathway areas to highlight architectural focal points
- Use high-quality bluestone or flagstone

Bluestone

Flagstone

Hardscape Guideline 2: Concrete Pavers

The goal here is to use concrete pavers with recycled content along major walkways, at entrances, in courtyards, and in lakeside zones, providing focal points and defined spaces. These are contained areas that are used as structured gathering zones; therefore, using a material that creates interest and color would complement the architecture and planting treatments. The materials used to create concrete pavers can contain fly-ash and other recycled materials. The use of light colored concrete pavers would help to reduce the heat island effect by reflecting solar radiation.

- Select pavers that are locally manufactured to reduce transportation costs and facilitate later purchases.
- Use concrete pavers to add contrast and texture to the existing exposed aggregate and paved pathways and courtyards
- Complement the new contemporary architecture with two types of concrete pavers, long and short, with slight variations in color, to create interest
- Use light-colored pavers that will reflect solar radiation

Long Concrete Paver Example
Photo Credit: Stepstone

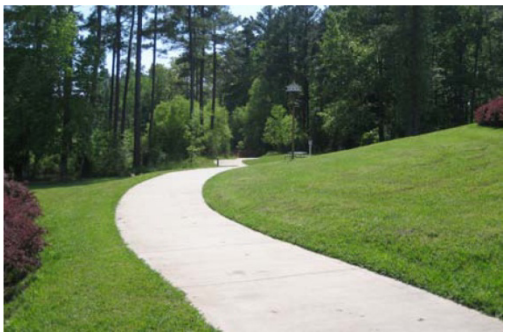
Hardscape Guideline 3: Poured-in-Place Concrete

Poured-in-place concrete can be manufactured with recycled fly-ash content, which makes a higher quality and more durable concrete. Light colored concrete helps to reduce the heat island effect and reflect solar radiation. Areas with poured-in-place concrete can support not only pedestrian traffic, but also the bearing capacity of emergency vehicles to and from buildings. The emergency access or service roads are 6.1 meters wide, and of poured-in-place concrete, providing vehicles the needed weight support.

- Pave major pedestrian thoroughfares within the central portion of the campus, including recreational gathering areas, bike and pedestrian sidewalks and trails, ramps, and lake edge walks with high quality, evenly scored poured-in-place concrete
- Use light-colored concrete that will reflect solar radiation
- Emergency access paths should be 6.1 meters wide, poured-in-place concrete, and should be located parallel to the lake edge on the eastern side of Building 101 and on the eastern side of the new parking garage that reaches from the northern portion of North Loop Road down to South Park Lane

Short Concrete Paver Example
Photo Credit: Stepstone

Poured-in-Place Concrete
at NIH-RTP Campus



Hardscape Guideline 4: Permeable Pavers

Permeable pavers are designed to reduce the amount of stormwater runoff across non-porous paved surfaces, by allowing rainwater to infiltrate through the holes and pores within the pavers into the groundwater. It was chosen for three locations: at the southern entrance roundabout and parking lot, the northern roundabout, and the large surface parking lot to the west of the office complex. These areas are heavily used by vehicular traffic, which emits pollution through fuel and gas fumes. Paving these vehicular areas with permeable pavers would help to minimize polluted stormwater runoff by filtering it through a gravel subgrade.

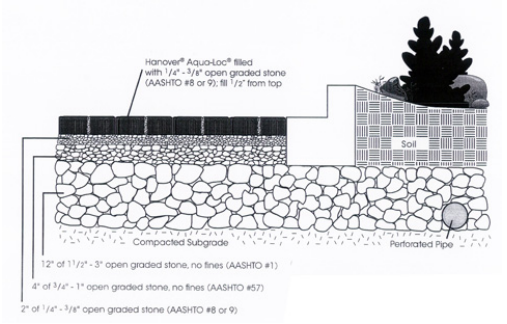
In an article by William F. Hunt, III, and Eban Z. Bean, titled NC State University Permeable Pavement Research and Changes to the State of NC Runoff Credit System, it is noted that after studying several permeable pavement areas of the NC Sandhills, Coastal Plains, and Coastal Regions, that "76% of the permeable pavement sites tested had surface infiltration rates (7.4 cm/h) at least as good as grass (6.35 cm/h). Therefore, 76% of sites tested had an equivalent grassed percentage of 100% grass, meaning they behaved as if they were 100% grass."[1]

There are currently, permeable pavers built and designed to withstand heavy vehicular traffic. One example is the Morton Arboretum in Lisle, Illinois which contains a permeable paver parking lot that serves 500 cars. With periodic maintenance, the life cycle expense is projected to be far less than that of standard asphalt.[2] In addition, as stated within the Lake County Forest Preserves Permeable Paver Research Summary, it is noted that an area of 40,000sf of permeable pavers costs $1,750 per 4 or 5 years to vacuum and sweep in order to restore permeability and $8,100 per every 25 years to replace the base and drain the pavers. The study indicates that in preliminary calculations the cost over 25 years for the installation, maintenance, and repair of the permeable pavers if $85,675 less than that of a standard asphalt parking lot.[3]

- Provide permeable pavers at parking lots and entrance areas that provide a texture contrast and create defined spaces for the vehicular user
- Provide a better environmental solution than that of standard asphalt paving by using permeable pavers, built to withstand heavy loads

Permeable Pavers
Photo Credit: Hanover

Permeable Paver Diagram
Illustration Credit: Hanover

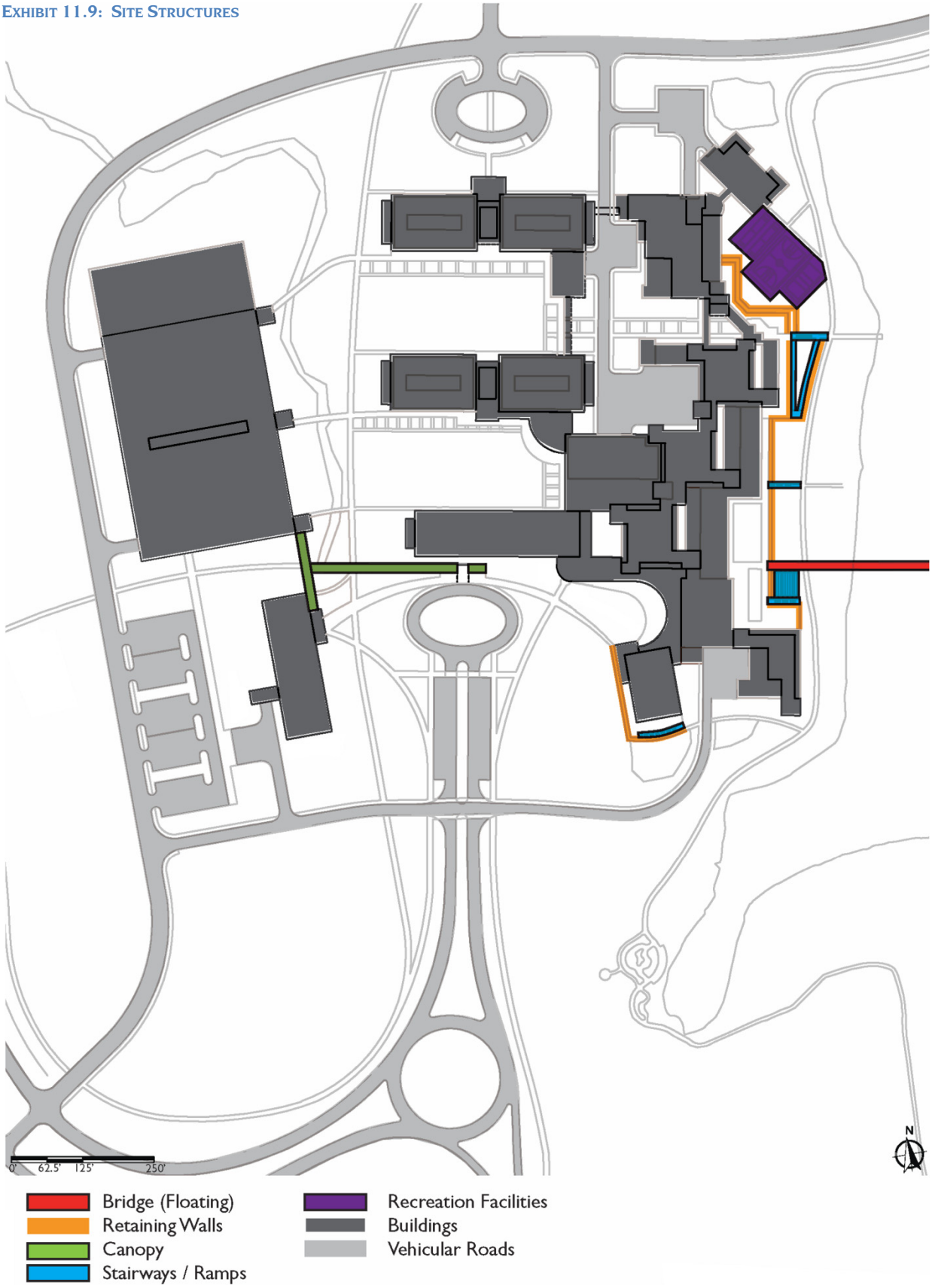


[1] Bean, Eban Z. and William F. Hunt, III. "NC State University Permeable Pavement Research and Changes to the State of NC Runoff Credit System." 8th International Conference on Concrete Block Paving, San Francisco, California USA. November 6-8, 2006. <http://www.perviouspavement.org/PDFs/ncsu_study.pdf>

[2] Lake County Forest Preserves-Planning, Conservation and Development Department "Permeable Paver Research Summary." February 2003. < http://www.co.lake.il.us/smc/regulatory/npdes/LCFPD_PPResearch.pdf>

[3] Lake County Forest Preserves-Planning, Conservation and Development Department "Permeable Paver Research Summary." February 2003. < http://www.co.lake.il.us/smc/regulatory/npdes/LCFPD_PPResearch.pdf>

Exhibit 11.9: Site Structures



C. Site Structures

Site structures should complement the natural elements of a site and create a dialogue between hard and soft materials, as well as a balance between the clean forms of modern design and the natural elements found in the environment. In this Master Plan, site structures are mainly located along the lakeside and the southern entrance of the NIH complex.

Site Structures Guideline 1: Bridges

The goal of the new pedestrian bridge is to provide a visually non-intrusive and ecologically viable pedestrian connection across the lake from the NIH campus to the EPA campus. The bridge is to be located along the western side of the existing Building 101 at the ramp and stairs where it reaches across to the EPA main campus.

- Connect bridges at easily accessible and predominately used pedestrian locations to both campuses
- Provide a universally accessible bridge
- Provide a floating bridge that is less intrusive visually to the lake as well as less expensive
- Construct the bridge of wood and steel materials that are environmental friendly and will not affect the lake's ecology

Site Structures Guideline 2: Retaining Walls

The visual goal of stone retaining walls is to provide a naturalistic feel that gives a sense of mass and weight. New stone retaining walls along the Building 101 sloped edge and along the western side of the new conference center should be considered. They are designed to withhold the grade in order to create level ground for walkways, gathering and recreational areas.

- Use natural stone walls that match the existing NIH stone walls
- Support steep slopes and grade changes with stone retaining walls
- Stone materials complement the existing stone retaining wall at the memorial site
- Retaining walls, where plausible, can be used seating elements for pedestrian users
- NOTE: Stone is preferred, but can often be expensive; therefore, an alternative material is board formed or rusticated concrete that provides durability, as well as texture and aesthetic interest

Floating Bridge Example

Stone Retaining Wall at NIH-RTP Campus

Concrete Retaining Wall at NIH-RTP Campus

Site Structures Guideline 3: Canopies

Canopied walkways are suggested to connect the parking garage and the Clinical Research building to the main entrance of NIH. They are intended to protect pedestrians from inclement weather, while providing a sculptural architectural element.

- Provide covered walkways at sidewalks connecting the parking garage and Clinical Research building to the main NIH entrance
- Harmonize with the adjacent architecture
- See images for possible examples for fabric canopies style and scale.

Fabric Canopy Example
Photo Credit: fabritec structures

Site Structures Guideline 4: Stairways

Stairways and ramps are located at key grade changes, primarily east of the existing NIH building along the lake. Bluestone or flagstone materials are highly durable, require little to no maintenance, and can be designed in a contemporary style to meet the overall site character.

- Combine stairways and ramps for universal access. Where there are steep grade changes, the ramp slopes are set at 8.33% and are a least 8' in width
- Ramps are preferred over stairs in most conditions because of their accessibility
- Stairways with ramp connections should be at least 8' wide
- Stairs with long run and low risers provide easier movement ability
- Provide bluestone or flagstone material that offers a durable and sleek quality

Trellis with Steel Example
Photo Credit: Fabritec Structures

Site Structures Guideline 5: Recreational Facilities

Recreational facilities offer users a place to exercise and congregate, providing opportunities for improved health and higher employee morale amongst those who take advantage. These facilities would be placed by the lake edge for its calming, aesthetic quality, as well as its proximity to pedestrian trails and western of Building 101. Bocce ball, basketball and volleyball are suggested, but NIH would plan and provide appropriate facilities desired by staff. Materials for each recreational facility should be consistent with the type of sport being offered.

- Locate recreational facilities by the lakeside
- Build courts to regulation sizes
- Porous asphalt may be used for the basketball courts
- Sand is probably the material of choice for outdoor volleyball courts, but synthetic turf or lawn may be used
- Bocce Ball can be designed with a small gravel mix that compacts well, or synthetic turf; synthetic turf is made of recycled material, requires little to no maintenance or watering, and can handle the wear and tear of heavy foot traffic

D. Site Furnishings

The site furnishings create comfortable amenities that allow for people to spend leisure time and relax while also providing functional areas for people to congregate and socialize. The site furnishings, when possible, should be made of environmentally-responsible materials and be located at gathering nodes within the campus.

Site Furnishings Guideline 1: Picnic Facilities

Picnic benches and tables provide an area for sitting and congregating during leisure time. These site furnishings are intended to complement the contemporary style of the surrounding architecture and site structures. Picnic benches located at the lake edge provide pleasant, natural views and are in close proximity to the cafeteria facilities, allowing users to enjoy the outdoors while dining.

- Use durable, low maintenance picnic benches
- Locate picnic benches at lakeside gathering areas
- Use minimally designed metal and wood picnic benches to accent the natural settings

Site Furnishings Guideline 2: Tables, Chairs and Umbrellas

These amenities should be placed by courtyard one and the main entrance areas to provide a slightly more formal dining opportunity, yet still provide a relaxing environment. Table and chairs are suggested to be a polished metal material that complements the contemporary theme of the site. The umbrellas offer color to the site and should harmonize with the adjacent architectural colors.

Site Furnishings Guideline 3: Garden Seating

Rows of benches should be of contemporary design and placed within the formal, ornamental courtyard areas. They are meant to line the pathways and provide areas for relaxation.

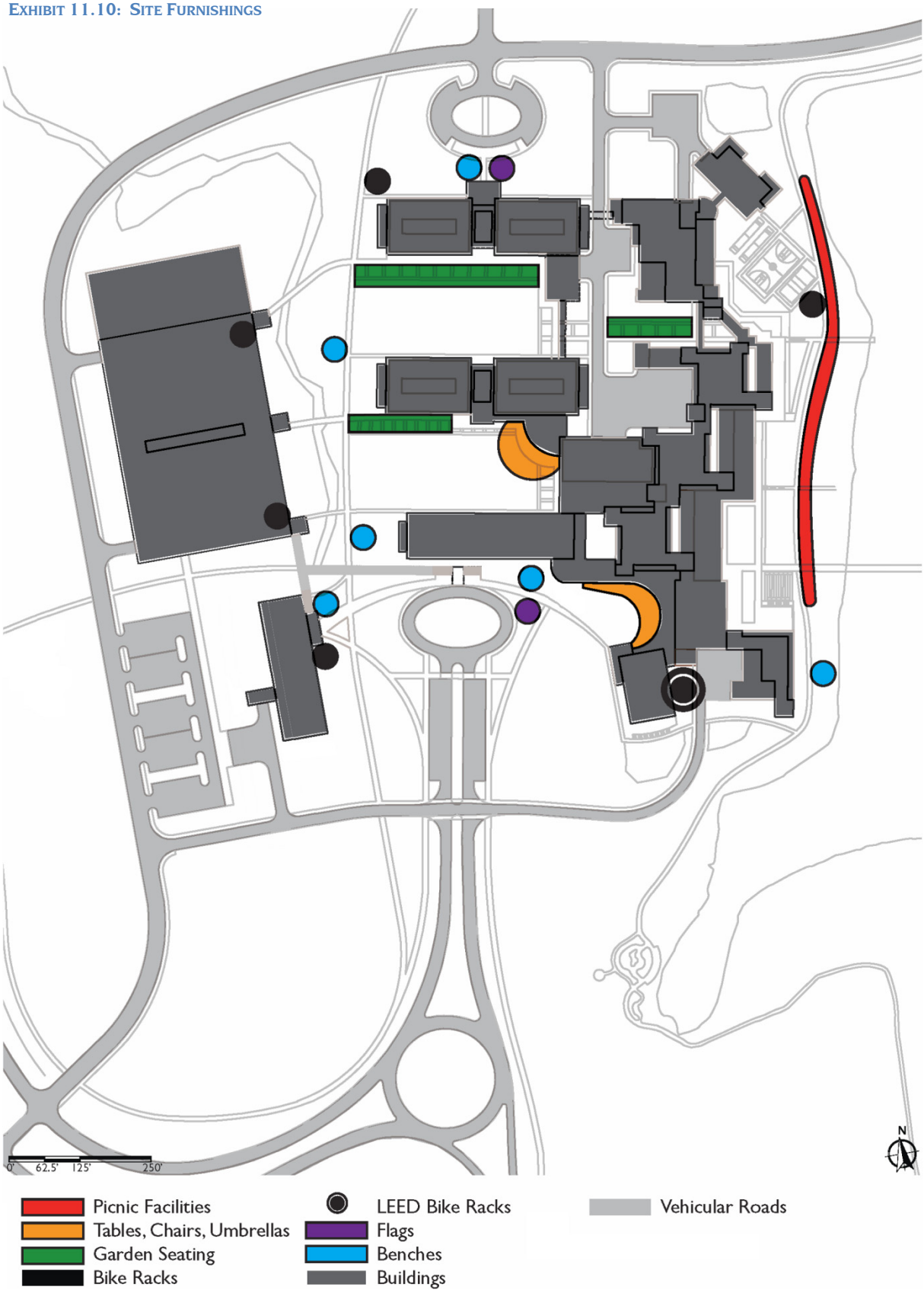
- Place at courtyards, pathways and ornamental garden areas
- Line the pathways to provide plenty of areas for sitting
- Provide site furniture that is simple and clear in design

Site Furnishings Guideline 4: Bike Racks

Bike racks are to be located at building entrances and parking garage facilities. Additionally, they should be located throughout the campus along the lakeside, at the recreational facilities, and within the parking garage. They should be durable in quality, of contemporary design, and provide a safe and secure way to store bikes. Providing bike racks for employees promotes healthy bike riding, as well as an energy efficient alternative to driving.

- Bike facilities should be placed in close proximity to buildings that have shower facilities to meet LEED criteria. The program calls for secure bike parking adjacent to or within the lower level of the conference center, by the aerobics room/fitness center locker rooms.
- NIH intends to seek LEED certification for new construction projects. The number and location of bike racks has been planned to meet current LEED criteria, but should be reviewed at construction.

EXHIBIT 11.10: SITE FURNISHINGS



Site Furnishings Guideline 5: Flag Poles

- Locate flag poles in central, highly visible locations at the two main entrances
- Use stainless steel flag poles that are durable and provide a polished, clean quality

Site Furnishings Guideline 6: Trash / Recycling Receptacles

Trash receptacles help to keep the NIH campus clean, and recycling containers offer an alternative to trash receptacles and promote sustainability. They should be of a contemporary design, durable, maintenance free, and recognizable. These furnishings are to be located at building entrances and along pathways.

- Place containers and receptacles at entries and along pathways
- Use recognizable receptacles that contrast with the natural environment
- Multiple adjacent receptacles or multi-compartment receptacles to be used, to support NIH recycling programs.

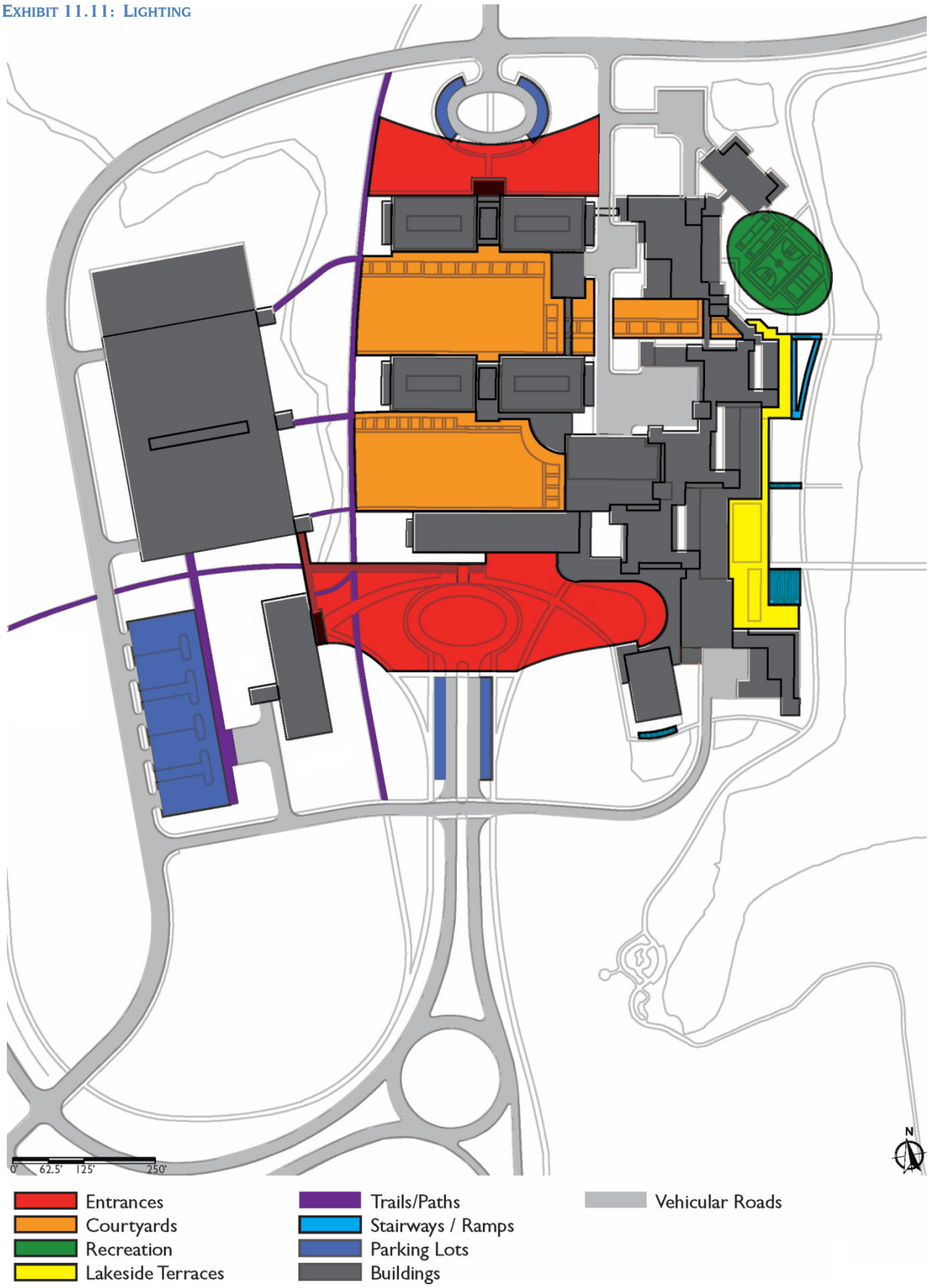
E. Lighting

Light pollution is created by lighting that is over-engineered and shines upward. Full cut-off lights are developed to only emit light below 90 degrees towards the ground to shield the night sky from light pollution. The goal of lighting at NIH is to use sustainable lighting fixtures made of recycled materials and manufactured with non-corrosive elements that utilize solar energy, provide full cut-off fixtures, and are timed or manually able to shut off. The design of site lighting must address several key factors; to meet the character and usage of each zone, address public safety needs and site security, and minimize light pollution.

Solar powered lighting is suggested for parking lots and vehicular roads. Light standards reach up to 18' in height and are offered in stainless steel designs that complement the site character.

- Use appropriate illumination levels for safety concerns
- Illuminate surface parking lots with solar powered lights

Exhibit 11.11: Lighting



Lighting Guideline 1: Entrances

Entrance lights increase visibility to the areas with high pedestrian traffic; and provide horizontal architectural elements that complement the architectural style. Entrance lighting should be 15' to 20' in height and located along pedestrian and vehicular lanes. . Lighting is placed at the main entrances to provide public safety and site security

- Provide sense of arrival and welcoming warmth
- Use full cut off lights that are 15' to 20' in height and of contemporary design.

Example - Entrances, Courtyards & Lakeside Terraces
Photo Credit: Architectural Area Lighting

Lighting Guideline 2: Courtyards

Courtyards are enclosed by buildings and often receive carryover lighting from these areas; therefore, smaller scale light fixtures are recommended. Lighting in these structured gathering areas should not be overpowering.

- Provide s light fixtures that are low level lights to illuminate contained areas
- Align the lights along pathways in a linear, structured layout
- Use lighting that is 12' in height, as well as low dome lights to highlight pathways
- Use full cut off lights or solar powered lights when possible
- Timeclock controlled shut-off for all but code-required lighting.
- See images for examples for lighting scale and style.

Example - Entrances, Courtyards & Lakeside Terraces
Photo Credit: Louis Poulsen

Lighting Guideline 3: Recreation

Recreational lighting, located at courts and fields, are areas that require a higher illumination and taller light fixtures. Since lighting for recreational facilities would not be used at all times, it is recommended that these areas have manual control, and full cut off lights to eliminate the usage of electricity when these areas are not in use. Recreational lighting is often very expensive, so fixtures should be dual mounted and kept to a minimum.

- Provide manual switches to turn off when not in use (occupancy controls to be provided with manual override).
- Use well-lit lighting to encompass the large recreational facilities
- Provide minimum foot candles to reduce the number of fixtures

Lighting Guideline 4: Lakeside Terrace

The terraces, located adjacent to the lake along Building 101, are in a more relaxing, tranquil environment that would be designed for congregational or recreational uses. The goal is to provide contemporary styled, soft lights that illuminate the area, but are not too obtrusive to the natural elements of the lakeside. Full cut off lights would help to eliminate glare and light pollution from the night sky in order to provide soft lighting. Step lights can also be mounted to retaining walls to provide a soft ambient glow across the ground plane.

- Minimize light pollution to natural habitat areas and night sky
- Provide a combination of lighting that is 15' in height in the congregational and paved areas, and step lights at the retaining walls.
- Use full cut off lightings to eliminate light pollution
- Chose a lighting frame that is constructed of durable steel and is of a contemporary style
- Photovoltaic controls are recommended

Lakeside Terrace and Stairway/Ramp Lighting Example
Photo Credit: Architectural Area Lighting

Lighting Guideline 5: Trails/Paths

The trail and path lighting is located along the primary paths within the central portion of the NIH campus. Pedestrians and bikers alike use the trails and paths; therefore, these areas should be lit to provide for safe wayfinding.

- Provide contemporary light fixtures that are full cut off
- Increase visibility to and from adjacent buildings
- Use solar lighting

Dome Lighting at Capital Gallery, Washington, DC

Lighting Guideline 6: Stairways/Ramps

Stair and ramp lighting is located at the eastern side of Building 101 and by the stairs leading from the conference center towards the lake. Mounted lights at stairways and ramps should be small in design and contemporary in style while providing enough illumination for easy accessibility.

- Provide built in stair and ramp lights that illuminate the walking areas for safety and accessibility
- Provide durable light fixtures with aluminum
- Photovoltaic controls are recommended
- See images for examples for lighting scale and style.

Trail/Path and Parking Lot Lighting Example
Photo Credit: SE/Lux

Lighting Guideline 7: Parking Lots

Solar powered lighting is intended for parking lots and vehicular roads. They reach up to 18' in height and are offered in stainless steel designs that complement the site character.

- Provide lighting that is well lit for safety concerns
- Illuminate surface parking lots with solar powered lights

F. Signage

New signage should keep with the existing signage format and be of modern design while providing clear and concise navigational directions. These icons should be unique in design and provide each area with a specific identity in a consistent and clear visual language. Signs constructed of recycled and vandalism resistant materials are long lasting and low maintenance and offer a sustainable solution to new signage.

Signage Guideline 1: Entrance

The entrance signage welcomes users into the space. Entrance signage should be located at the three major entrance intersections and are the first signs that vehicles and pedestrians would see for location and guidance. T.W. Alexander is to remain as the primary visitor entrance sign; smaller signage is to be located at the Hopson Road entrance and at the new street entrance on the northern portion of the NIH campus.

- Build new signage to meet the aesthetic of the existing signage
- Provide directional signs to major destinations on the NIH campus
- Offer aesthetically pleasing and eye-catching signage

Signage Guideline 2: Vehicular

These signs are intended to provide clear and concise directions that resemble the style of the existing signage. They are placed along the roads within the NIH campus.

- Provide signage that is consistent with the existing thematic and modern signage
- Offer large and easy to read lettering
- Clearly designate visitor circulation and parking
- Place at predominate access points and major intersections entering into the campus and at integral vehicular directional changes
- Vehicular signage should take into account the legal code requirements and placement for all signs including, speed limits, accessible parking, pedestrian crossing, loading zones, no access, warning, and directional signs

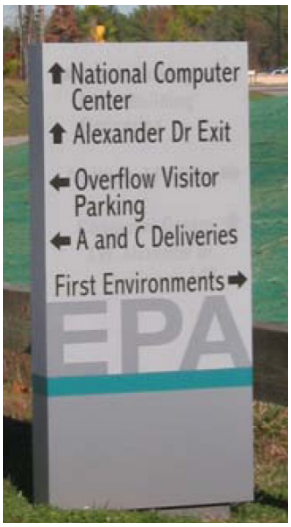
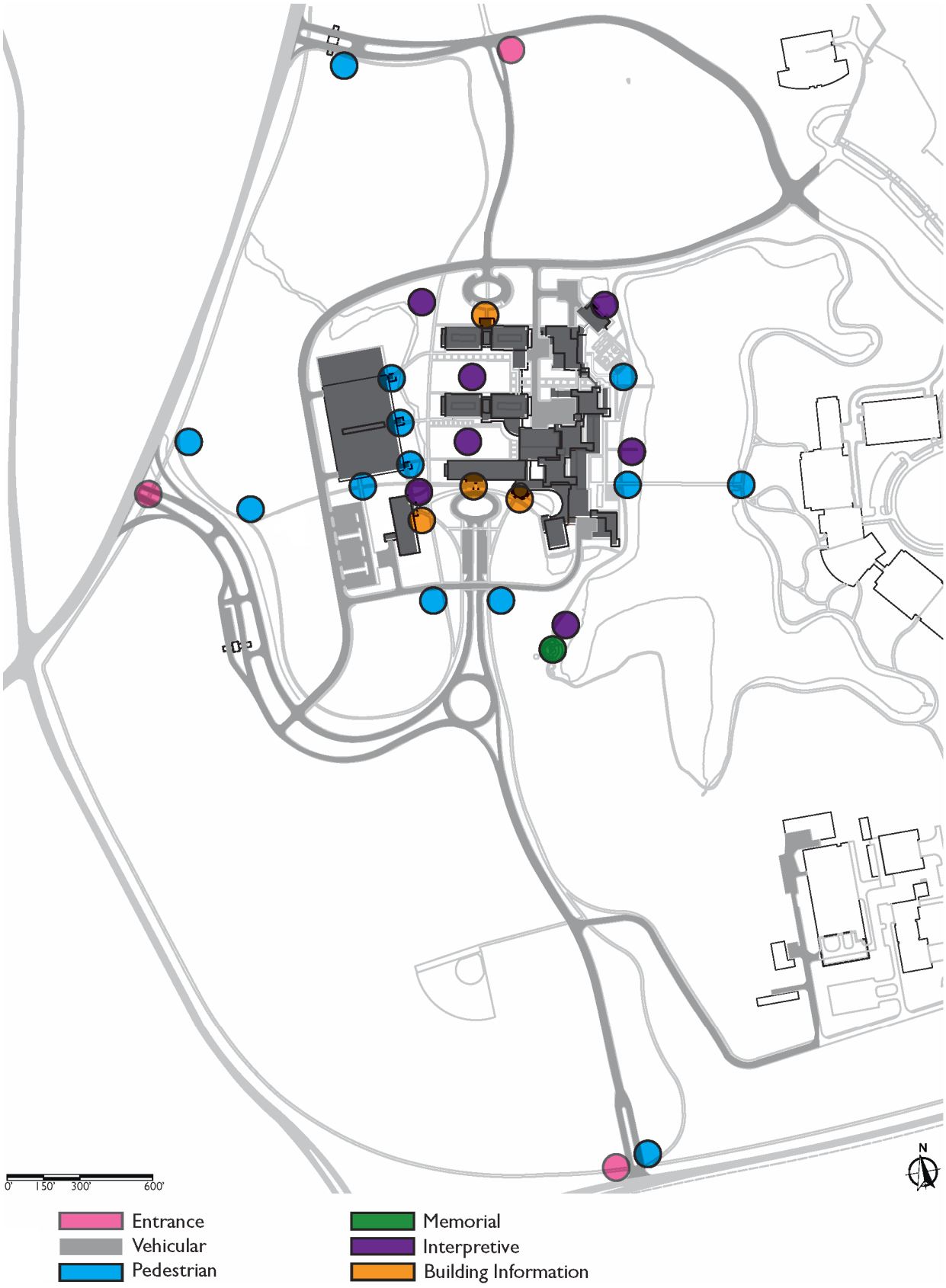


EXHIBIT 11.12: SIGNAGE



Signage Guideline 3: Pedestrian

Pedestrian signs are generally meant to be viewed in an "up-close" and more personal manner. They encourage users to walk or bike rather than drive. These signs are to be located throughout the campus, along trails and pathways, in order to orient pedestrians and provide clear directions.

- Provide signs to allow pedestrians to easily locate themselves with "You are here," points
- Use pedestrian and bike signage made with materials that are graffiti and vandalism resistant

Pedestrian Signage Example

Signage Guideline 4: Building Information

Building signage quietly works with the fluidity and form of the architecture. These signs are located at predominate entrances with high foot traffic in order to provide information and clear wayfinding.

- Place at arrival points with high foot traffic
- Provide a visual communication to the user without visually overpowering the architecture

Information Signage Example

Signage Guideline 5: Interpretive

Interpretive signage is designed to provide an emotional message that embraces and memorializes, as well as tells a story that creates a dialogue and educates the user. This signage is located at the memorial, along the bioswales, at the courtyard tree save areas, and along the lake edge in order to draw in the public and bring attention to the importance of these areas.

- Graphically represent surroundings and natural context
- Organize along natural and historical areas in order to draw attention to the importance of these areas and provide a storyline for public understanding of the space
- Provide clear and consistent graphic quality to reflect on the dynamic landscape

11.4 Campus Circulation Guidelines

The campus circulation guidelines identify typologies for campus roadways based on the Master Plan design and the existing site conditions. Four road types are identified here, as well as pedestrian crossings.

Campus Circulation Guideline 1: Four-lane Boulevard

The Four-lane boulevard serves as the primary access point to the campus. The roadway type is based on the existing Environmental Parkway, which is a divided parkway from its intersection with T.W. Alexander Drive to the interior roundabout. The existing cross section of Environmental Parkway consists of a pair of 24-foot roadways separated by a grassy median with trees, although a narrower, 12 foot lane in each direction should be sufficient for projected vehicular traffic. A bicycle path currently exists along the north side of Environmental Parkway, thus, provisions for marked bicycle lanes along the roadway are not required. No on-street parking should be allowed along the roadway.

Campus Circulation Guideline 2: Two-lane with Grass Shoulder

A two-lane roadway with grass shoulders is consistent with the existing Lakeview Drive and would serve as the circulation element through the wooded and open areas of the site. This road type is planned for roadway segments away from structures and parking lots, and is to be constructed of two, 12-foot lanes in an undivided section, with grassy shoulders and ditches for drainage.

Campus Circulation Guideline 3: Two-lane with Curb and Gutter

A two-lane roadway with curbs and gutters would serve as the primary access roadway to the parking deck, as well as circulation south of the office building and north along the dam. It is recommended that the roadway consist of two, 12-foot lanes in an undivided section, with curb and gutter.

Campus Circulation Guideline 4: Service/Emergency Access Roads

Service roads are intended to provide access to the interior of the facility for loading/unloading on a day to day basis. In the event of emergencies, the service roads will double as emergency access roads to provide internal access to the building for fire and rescue vehicles and personnel. These roads should be constructed with a twenty foot pavement width and curb and gutter.

Campus Circulation Guideline 5: Pedestrian Crossings

Pedestrian crossings of campus roadways should generally occur at safe locations with adequate sight distance. The existing network of pedestrian walkways crosses the roadways at several locations. The crossings should be clearly signed and well-lit, with the crossings accentuated with raised and/or textured crosswalks, striping or other appropriate marking devices. Vehicular traffic should be required to yield to pedestrians in the crosswalk; however, vehicles should not be required to stop if the crossing area is clear. With the removal of Lakeview Drive from the center of campus in Phase 3, There will be limited need for pedestrians to cross campus roadways.

11.5 Parking Guidelines

Parking for the employees and visitors will primarily be provided in the parking deck on the west side of campus. A portion of the existing surface parking lot will remain. Additional small parking lots are provided for visitors at the north and south entrances. Accessible parking for people with disabilities should be located as close to the campus buildings as possible. On-street parking should be prohibited along all roadways.

The parking structures and surface lots planned in the Master Plan will be an important part of daily experience on campus. The guidelines included here make recommendations to enhance the parking areas, emphasizing natural light, shading, well-organized pedestrian walkways, and visual screening of the parking structures.

Parking Guideline 1: Parking Structures

Parking structure design should incorporate a number of elements that can reduce energy consumption and enhance the user experience, including the following:

- Introduce natural light into the garage through light wells and openings
- Incorporate natural ventilation through the same devices as for natural lighting
- Design circulation to allow easy pedestrian circulation to the main elevator and stair cores
- Provide planting along exterior walls to screen the garage from campus spaces
- Consider incorporation of solar panels over the upper level of parking structures to provide energy production and possibly shading

Parking Guideline 2: Surface Parking

Surface parking should be designed to include features as follows:

- Utilize a high percentage of tree cover to shade vehicles and reduce the heat island effect of large parking areas
- Incorporate best management practices for localized storm-water management
- Carefully design pedestrian circulation through parking lots and incorporate dedicated walkways
- Utilize light colored paving and permeable paving whenever possible