PNNL 2017
RICHLAND CAMPUS MASTER PLAN

Pacific Northwest
NATIONAL LABORATORY

Proudly Operated by Battelle Since 1965

Richland, Washington

DISCLAIMER

PACIFIC NORTHWEST NATIONAL LABORATORY
operated by
BATTELLE
for the
UNITED STATES DEPARTMENT OF ENERGY
under Contract DE-AC05-76RL01830

Printed in the United States of America

Available to DOE and DOE contractors from the
Office of Scientific and Technical Information,
P.O. Box 62, Oak Ridge, TN 37831-0062;
ph: (865) 576-8401
fax: (865) 576-5728
email: reports@adonis.osti.gov

Available to the public from the National Technical Information Service
5301 Shawnee Rd., Alexandria, VA 22312
ph: (800) 553-NTIS (6847)
email: orders@ntis.gov <http://www.ntis.gov/about/form.aspx>
Online ordering: http://www.ntis.gov

Approvals:

Gary S. Watkins, Division Manager
Campus Planning & Projects

05/15/17
Date

Roger E. Snyder, Manager
Pacific Northwest Site Office

05/18/17
Date

Pacific Northwest National Laboratory
Richland Campus Master Plan

May 2017

Prepared for
the U.S. Department of Energy
under Contract DE-AC05-76RL01830

Pacific Northwest National Laboratory
Richland, Washington 99352

Acronyms and Abbreviations

APEL	Applied Process Engineering Laboratory
BMI	Battelle Memorial Institute
BSF	Biological Sciences Facility
CMP	Campus Master Plan
CSF	Computational Sciences Facility
DHS	Department of Homeland Security
DOE	U.S. Department of Energy
DOE SC	U.S. Department of Energy, Office of Science
DOE EM	U.S. Department of Energy, Office of Environmental Management
DOE RL	U.S. Department of Energy, Richland Operations Office
EMSL	Environmental Molecular Sciences Laboratory
ETB	Environmental Technology Building
GSF	Gross Square Feet
IGPP	Institutional General Plant Project
ISB1	Information Sciences Building 1
ISB2	Information Sciences Building 2
LSB	Laboratory Services Building
LSL2	Life Science Laboratory 2
NEPA	National Environmental Policy Act
MOU	Memorandum of Understanding
MSL	Marine Sciences Laboratory
NSB	National Security Building

NNSA	National Nuclear Security Administration
PNNL	Pacific Northwest National Laboratory; Laboratory
PNSO	Pacific Northwest Site Office
ROB	Research Operations Building

Contents

Figures

1.0 Introduction

Based in Richland, Washington, Pacific Northwest National Laboratory (PNNL) is one of 10 United States (U.S.) Department of Energy (DOE) Office of Science (SC) national laboratories. PNNL is DOE's premier chemistry, earth sciences and data analytics Laboratory, delivering vital mission impacts in energy resiliency and national security. PNNL has 19 core capabilities, each a powerful combination of world-class staff, state-of-the-art equipment, and mission ready facilities. These capabilities represent a collective set of skills and a body of world-leading scientific and engineering work that provides exceptional value and mission delivery to DOE, the National Nuclear Security Administration (NNSA), the U.S. Department of Homeland Security (DHS), and the missions of other federal agencies and industry through strategic partnership projects.

Operated by Battelle Memorial Institute (Battelle), PNNL has more than: 2.3 million gross square feet and 4,400 staff members. PNNL is implementing a rolling 10-year campus strategy (initiated in FY 2013) designed to deliver the foundation for the multidisciplinary science and engineering expertise, equipment, instrumentation, facilities, and infrastructure required to continue providing exceptional value and mission delivery. PNNL's annual ten-year plan is published with SC's Ten-Year Plans for the Science National Laboratories. The most recent publication is available at: https://science.energy.gov/lp/laboratory-planning-process/.

This edition of the PNNL Richland Campus Master Plan (CMP) is an update to the 2012 CMP.

2.0 Purpose and Strategic Objectives

The fundamental purpose of DOE real property asset planning and management is to ensure the necessary land, facilities, and infrastructure are available, utilized, and in a sustainable condition to accomplish the DOE mission. This CMP is PNNL's guide for making balanced campus development decisions. These decisions must simultaneously enable accomplishment of the current scientific mission and support the efficient operation and stewardship of the land, facilities, and infrastructure needed to continue to provide exceptional value and mission delivery to DOE, the National Nuclear Security Administration (NNSA), the U.S. Department of Homeland Security (DHS), and the missions of other federal agencies and industry through strategic partnership projects.

PNNL's Richland Campus development decisions are most evident in the processes to locate and invest in facilities and infrastructure through capital acquisition and construction, operations and maintenance, recapitalization or disposition. Summary steps in this approach include: 1) understanding the scientific mission need; 2) assessing the state of condition of the site, facilities, and infrastructure; 3) determining the gap between need and current state; 4) assessing alternatives to close gaps; and 5) developing and implementing the siting and investment or exit strategy consistent with PNNL's campus development strategic objectives and guiding principles. The resulting decisions are implemented through project-specific facility and infrastructure execution plans.

PNNL Richland Campus Development Strategic Objectives

PNNL will continually make proactive campus renewal investments to acquire new and/or renew PNNL's existing facility and infrastructure assets for ***long-term value*** and adaptability that support the following objectives:

- Deliver current and future **mission alignment** by providing the physical environment that meets current and emerging research needs required to deliver vital mission impacts in energy resiliency and national security.
- Optimize the **functionality, reliability, utilization and operating costs** of facility and infrastructure capabilities to enable research operations.
- Embrace the guiding principles for developing a **modern, collaborative, flexible, and sustainable campus** by providing or incorporating:
    - State-of-the-art space and infrastructure to promote creativity; develop technical leaders; and encourage staff members to be bold in their research.
    - A connected campus to enable institutional and individual collaborations and research operations that accelerate high-impact research.
    - Flexibility in design and space use to rapidly respond to changing research needs.
    - Consideration for environmental, social, and economic costs in the design, construction, allocation and use of space to optimize energy and materials usage while enabling research.
- Balance the intentions for long-term value from a mission-aligned, functional, reliable, fully-utilized, modern, collaborative, flexible, and sustainable campus with what's **reasonable and achievable** given available time, investment, and operational resources.

3.0 PNNL Richland Campus Development Approach, Background and Context

PNNL's approach to PNNL Richland Campus development begins with an understanding of the Laboratory's scientific mission. It takes into account the Laboratory's physical characteristics derived from past development and existing land, facility, and infrastructure assets; PNNL's strategic objectives and guiding principles for campus development; and assumptions about the institution's future. The result is a roadmap for maintaining today and developing into the future an effective, efficient, complete, and cohesive campus.

3.1 Location and Context

PNNL is based in Richland, Washington; conducting operations on and within federal- and non-federal-owned land and buildings. Operations are also conducted at the Marine Sciences Laboratory (MSL) in Sequim, Washington and several other locations across the country (Figure 3.1). The mix of federal and non-federal real properties approved for PNNL use include: PNNL Richland Campus, Hanford 300 Area, PNNL Marine Sciences Laboratory, and PNNL Other Areas. These areas are further defined in Appendix A, – PNNL Geographical Entities.

Figure 3.2 illustrates the PNNL Richland Campus; Hanford 300 Area; and PNNL Other Areas located in Richland.

This CMP focuses on the developable land within the PNNL Richland Campus as outlined in Figure 3.2 . A separate CMP will be developed for the PNNL Marine Sciences Laboratory in Sequim. CMPs will not be developed for the Hanford 300 Area or the PNNL Other Areas. Development in those areas will be addressed on a case-by-case basis.

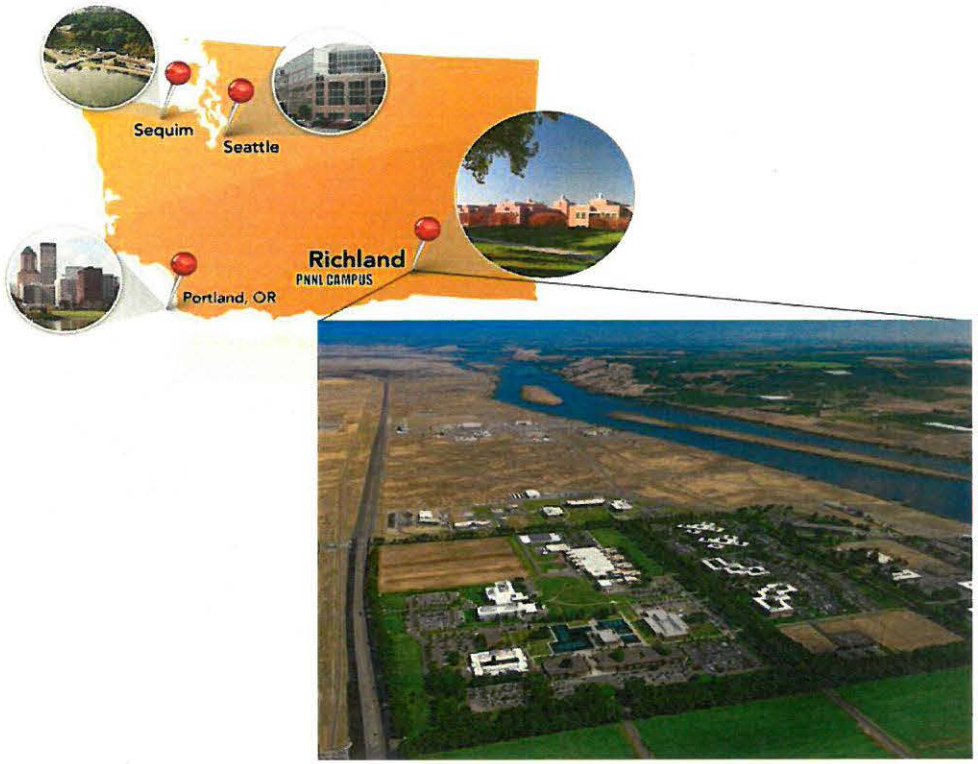


Figure 3.1. Washington State with an image of the Richland PNNL campus

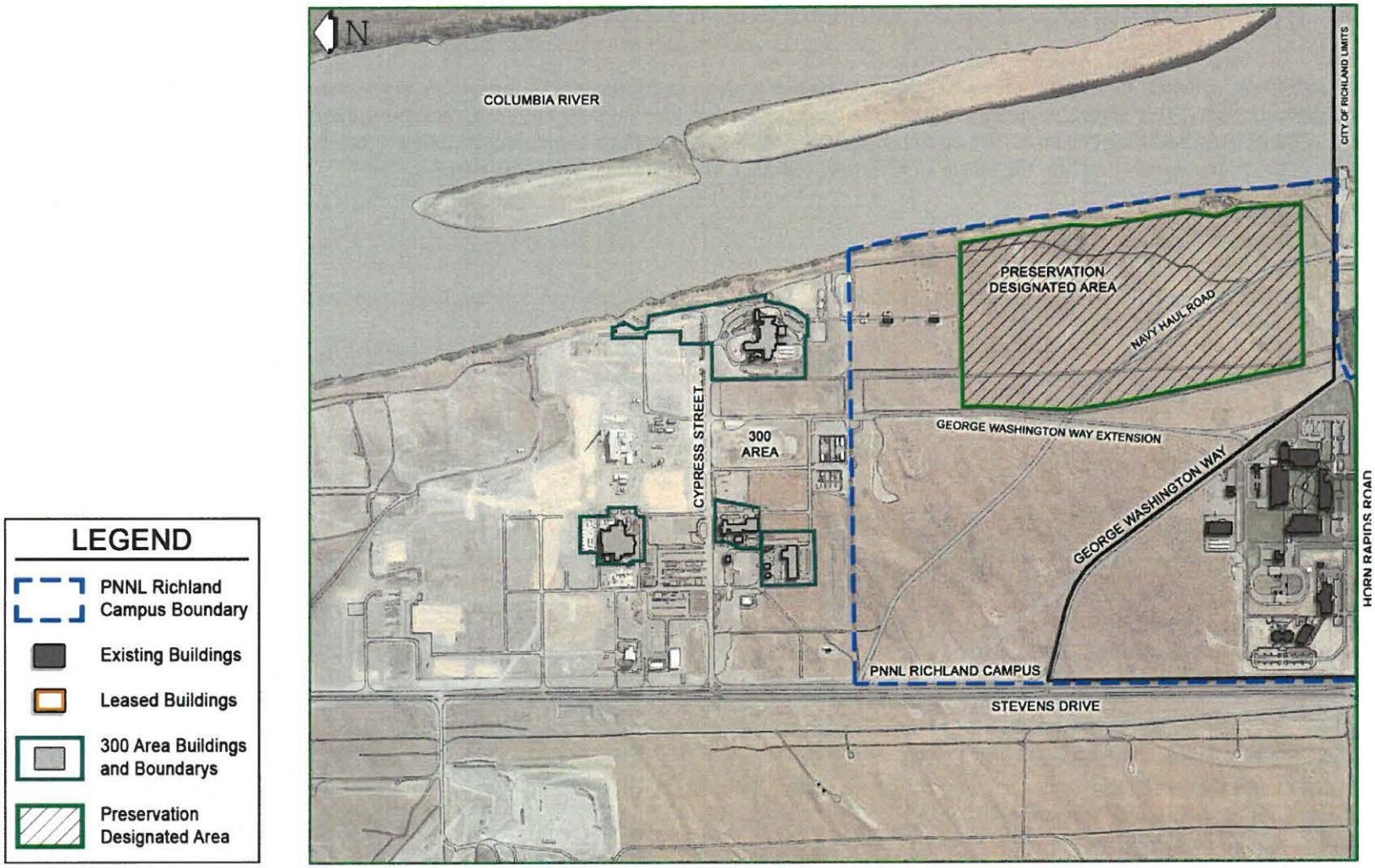
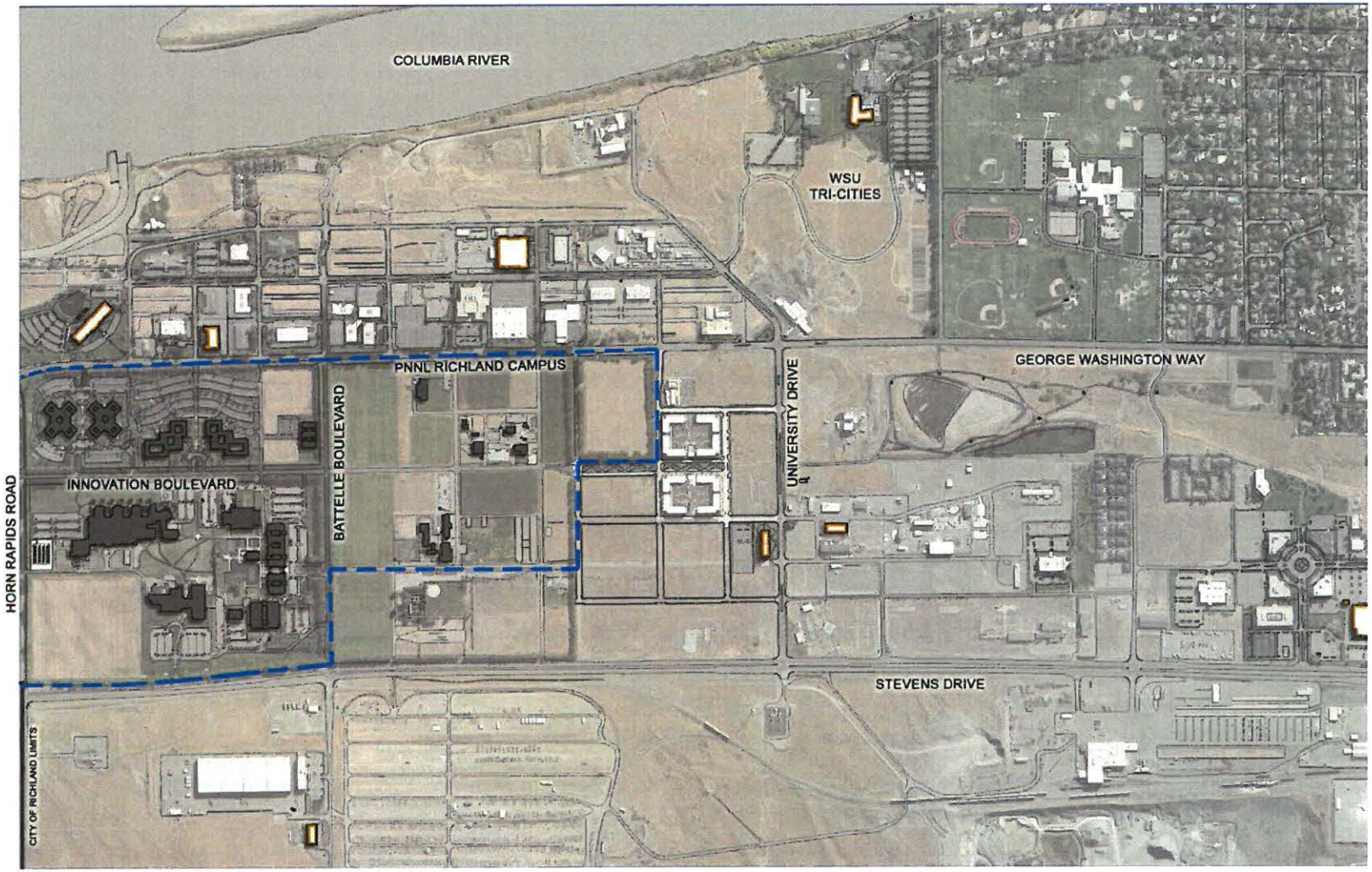


Figure 3.2. PNNL Richland Campus; Hanford 300 Area; and PNNL Other Areas located in Richland as of January 2017.


COLUMBIA RIVER
WSU
TRI-CITIES
PNNL RICHLAND CAMPUS
GEORGE WASHINGTON WAY
UNIVERSITY DRIVE
BATTELLE BOULEVARD
INNOVATION BOULEVARD
HORN RAPIDS ROAD
STEVENS DRIVE
CITY OF RICHLAND LIMITS

3.2 Planning Basis and Assumptions

3.2.1 Planning Basis

The planning basis for this CMP includes the following with regard to PNNL Richland Campus development:

- The preservation designated area within the PNNL Richland Campus is not available for development.
- Investments, to the extent necessary, in new development will consider all applicable funding sources in accordance with DOE requirements.
- Opportunities for direct programmatic investment will arise throughout campus development. Each opportunity will be evaluated against the Campus Strategy and this CMP. Opportunities realized will be incorporated into the Campus Strategy and this CMP.
- Development-driven changes to current land use and/or roads on the campus shall be worked through the appropriate stakeholders and applicable NEPA reviews.
- An approximate 31 m (100 ft) wide corridor along the southern and western boundary of the preservation designated area is reserved as a possible Navy Haul road route.
- The land at the north end of the EMSL building is reserved for a potential building expansion.
- On-going, high risk (see Section 4.1 for operational risk considerations that could impact building design and placement) research operations and non-research-related farming operations south of Horn Rapids Road will cease by the end of calendar year 2022.
- Beginning in FY2017, no new high risk research operations will be authorized south of Horn Rapids Road.
- New development will maximize the use of central utilities (heating and cooling) over stand-alone building-by-building systems, where economically feasible and reasonable.
- No new Category II or III Nuclear Facilities will be developed within the PNNL Richland Campus.
- Leased space outside the PNNL Richland Campus will continue to serve as flex space to enable research operations while optimizing functionality, reliability, utilization, and operating costs.
- Other opportunities for development, outside the campus, will be evaluated on a case-by-case basis using the campus development strategic objectives, as appropriate, in the analysis.
- Beginning in FY2017, new development south of Battelle Boulevard will be limited to facilities with a nexus to research activities conducted in the existing buildings south of Battelle Boulevard or collaboration with others (e.g., City of Richland, Washington State University – Tri Cities, etc.,.).

- Buildings that DOE determines no longer support mission needs will be decontaminated, demolished, and the site restored consistent with campus design concepts and/or to serve as a future development site.

3.2.2 Planning Assumptions

This CMP includes the following assumptions with regard to PNNL Richland Campus development:

- Actions by land-owners adjacent to the campus will be consistent with the reservations, terms, conditions, covenants, and restrictions set forth in their deed to said land.
- Required stakeholder and NEPA reviews driven by campus development activities will not identify significant impacts that cannot be mitigated.
- The areas described in Section 3.4 and illustrated in Figure 3.4, are consistent with the projected needs to deliver the mission and scientific vision over the planning horizon.
- Potential operational consequences that impact building design and/or placement can be mitigated by a combination of building design, placement within the appropriate area, and/or controls to restrict public access without significant change to planned utility infrastructure and distribution systems (roads, electricity, water, sewer, gas, storm drain, telephone, and telecommunications).

3.3 Future Development Capacity

Development capacity for the PNNL Richland Campus is approximately 2,000,000 gross square feet (GSF) and 3,200 parking spaces based on the notional campus development illustrated in Figure 3.3. The campus is also capable of accommodating general site development such as storm water management, traffic circulation, and an appropriate amount of amenities and open spaces.

3.4 Utility Infrastructure and Distribution System Corridors (Utility Corridors)

Currently developed areas of the PNNL Richland Campus are framed by utility corridors (roads, electricity, water, sewer, gas, storm drain, central heating and cooling, telephone, and telecommunications) to ensure adequate services are provided to the existing buildings. The currently developed areas are illustrated in Figure 3.4. There are two currently developed areas north of Horn Rapids Road; four currently developed areas between Horn Rapids Road and Battelle Boulevard; and a mix of seven currently developed and developable areas south of Battelle Boulevard. Future development of utility corridors will continue to be designed to create flexible, compact, clearly demarcated areas for efficient use of land and service delivery. Within each area, the design elements described in Section 4.1 of this CMP will be applied to guide development decisions and actions consistent with the processes and strategic objectives described in Section 2.0.

Figure 3.4 also illustrates projected development of utility corridors, resulting in eight developable areas north of Horn Rapids Road in a notional full campus build out. The developable areas can be used to host a variety of large- and smaller-scale buildings or to integrate a grouping of smaller-scale buildings as required to meet mission need while maintaining overall campus density and design characteristics. The existing utility corridor that begins at the intersection of Horn Rapids Road and George Washington Way and continues north to the Hanford 300 Area will be relocated to one or more of these notional utility corridors should DOE mission requirements result in the depicted buildout. Major utility systems, with the possible exception of heating and cooling delivery, will continue to be decentralized. Stand-alone mechanical systems and utilities services will be provided on an individual building basis and connected to a City of Richland utility corridor. Major utility trunks are located in easements aside roadways or within pedestrian corridors. Heating and cooling delivery may transition from stand-alone, building-by-building systems to centralized utility plants where economically feasible and reasonable.

In Figure 3.4, the section of George Washington Way north of Horn Rapids Road that connects to Stevens Drive is removed and the George Washington Way Extension going north from Horn Rapids Road to the Hanford 300 Area is moved east, adjacent to the preservation designated area. The George Washington Way – Horn Rapids Road intersection and the Stevens Drive – George Washington Way intersection may be reconfigured to facilitate traffic flow.

3.5 Navy Haul Road

As shown in Figure 3.2, a gravel road currently traverses the campus from southeast to northwest, crossing the undeveloped preservation designated area, and then merging into Stevens Drive. At that point, Hanford Site roads are used to reach the 200 East Area Burial Grounds, Trench 94. This route has been used since the 1980s to haul decommissioned Naval reactor compartments from barge transport to the disposal site. The Navy will continue to use this haul road as needed into the foreseeable future.

Pending a decision to proceed with the notional buildout depicted in Figure 3.3, other DOE decision criteria, and future Navy mission requirements, there may be a need to relocate the Navy haul road within the boundaries of the PNNL Richland Campus. Because such a relocation decision would need to be based on factors such as final building layout designs, safety considerations, and other operation factors which are not available at this time, no specific route or alternatives for a new haul route are currently proposed. To preserve options for relocating the Navy haul road in the future, DOE would reserve an approximate 31 m (100 ft) wide corridor along the southern and western boundary of the preservation designated area as a possible relocated route (Figure 3.4). Other routes on undeveloped areas outside of the preservation designated area may be chosen depending on future Navy mission requirements, safety considerations, and the configuration of DOE facilities and roads at the time of relocation. Future relocation, expansion, or upgrade of the Navy haul road would be subject to DOE approval and would be assessed in a separate future NEPA review.

Intentionally Blank

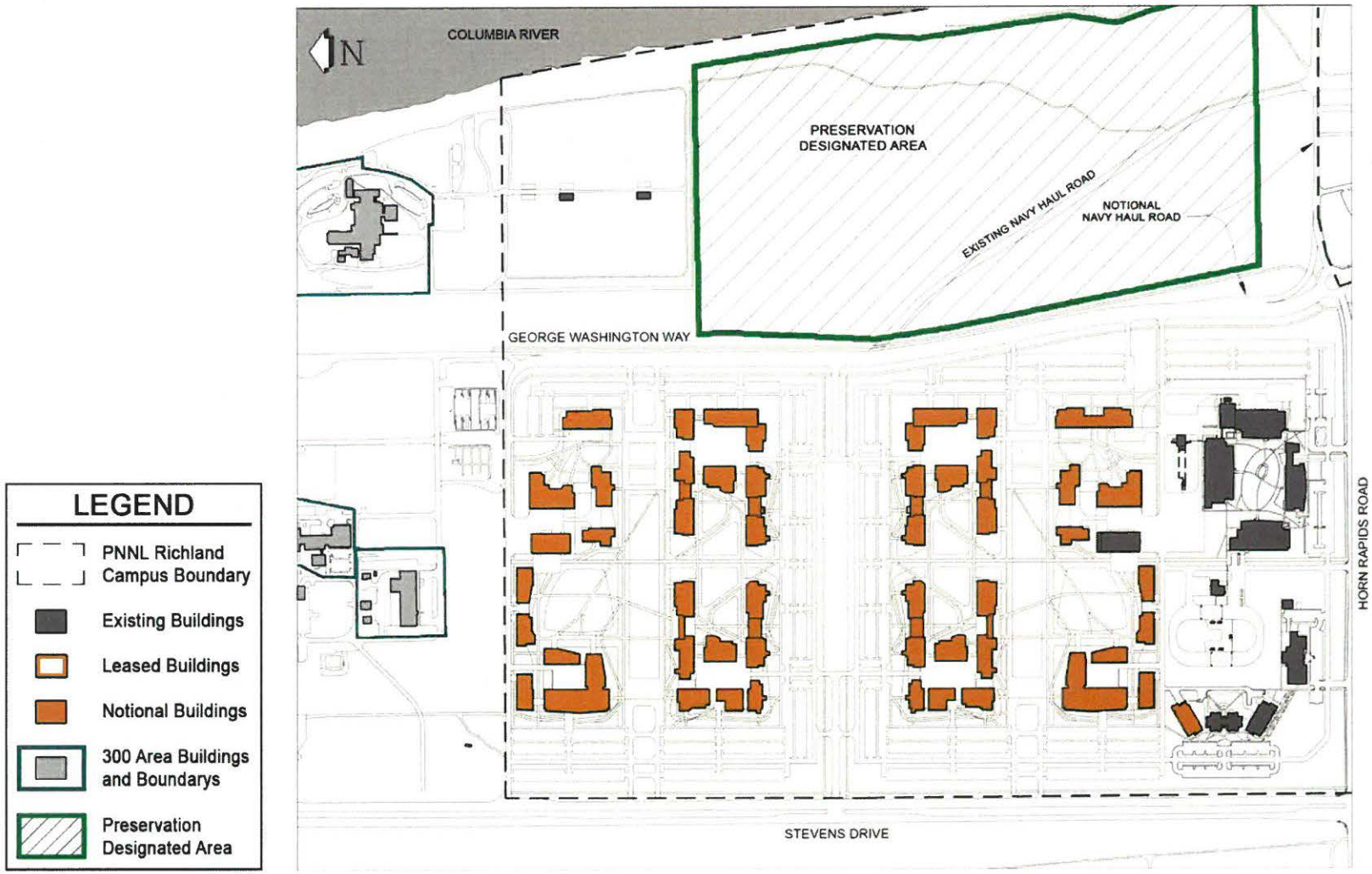
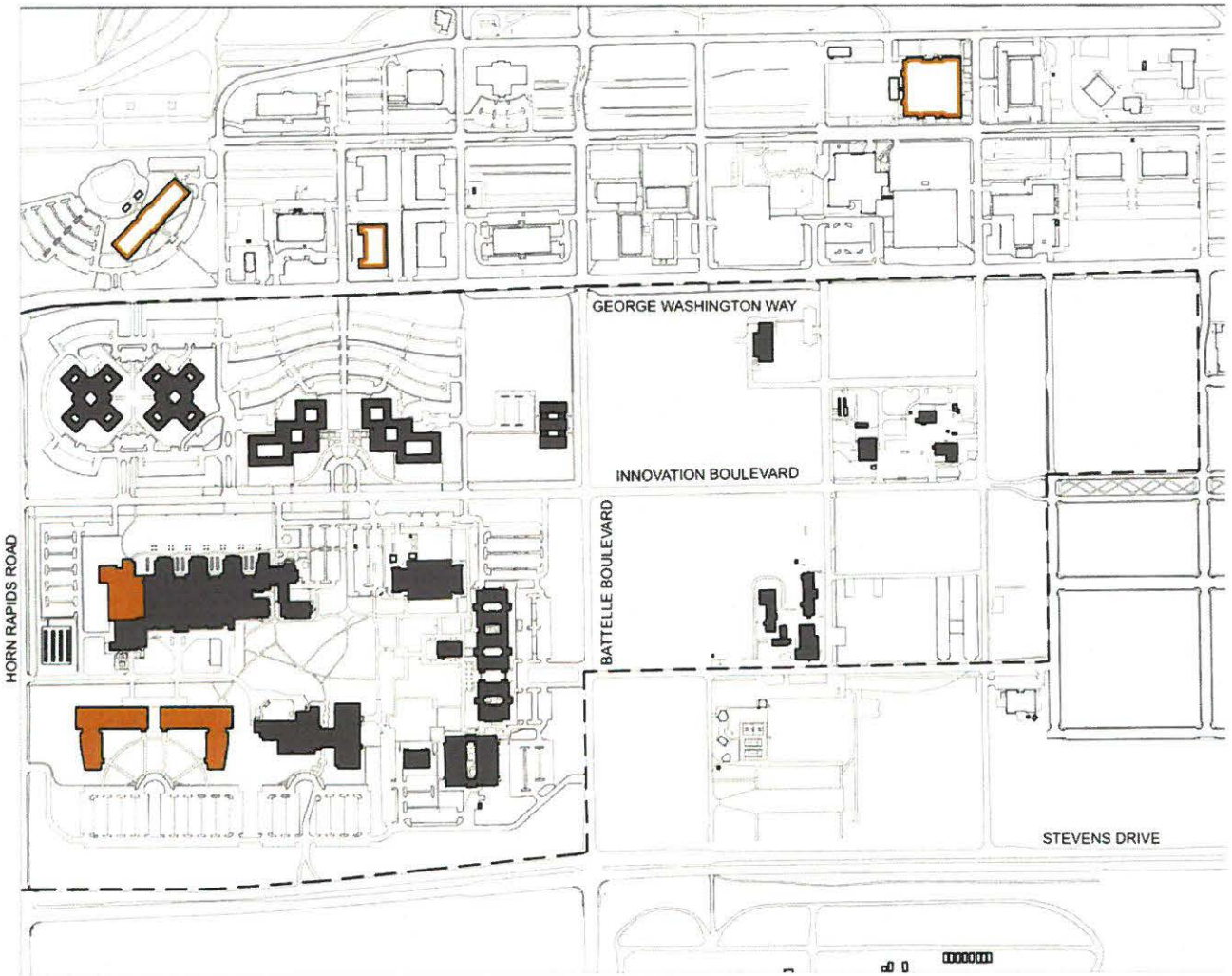
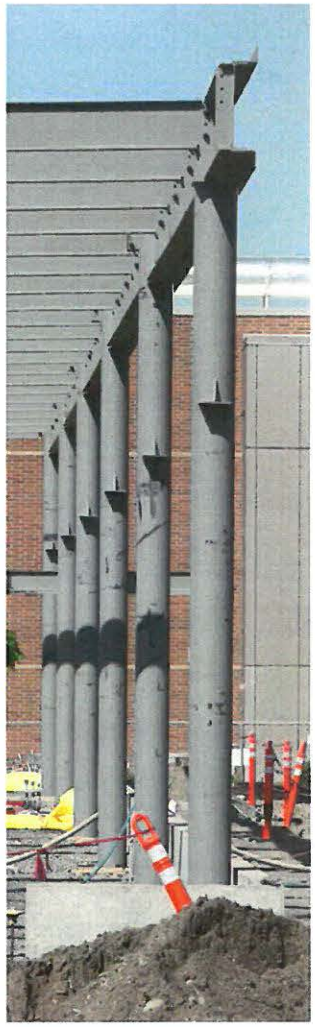


Figure 3.3. Notional development for the PNNL Richland Campus


GEORGE WASHINGTON WAY
INNOVATION BOULEVARD
BATTELLE BOULEVARD
HORN RAPIDS ROAD
STEVENS DRIVE



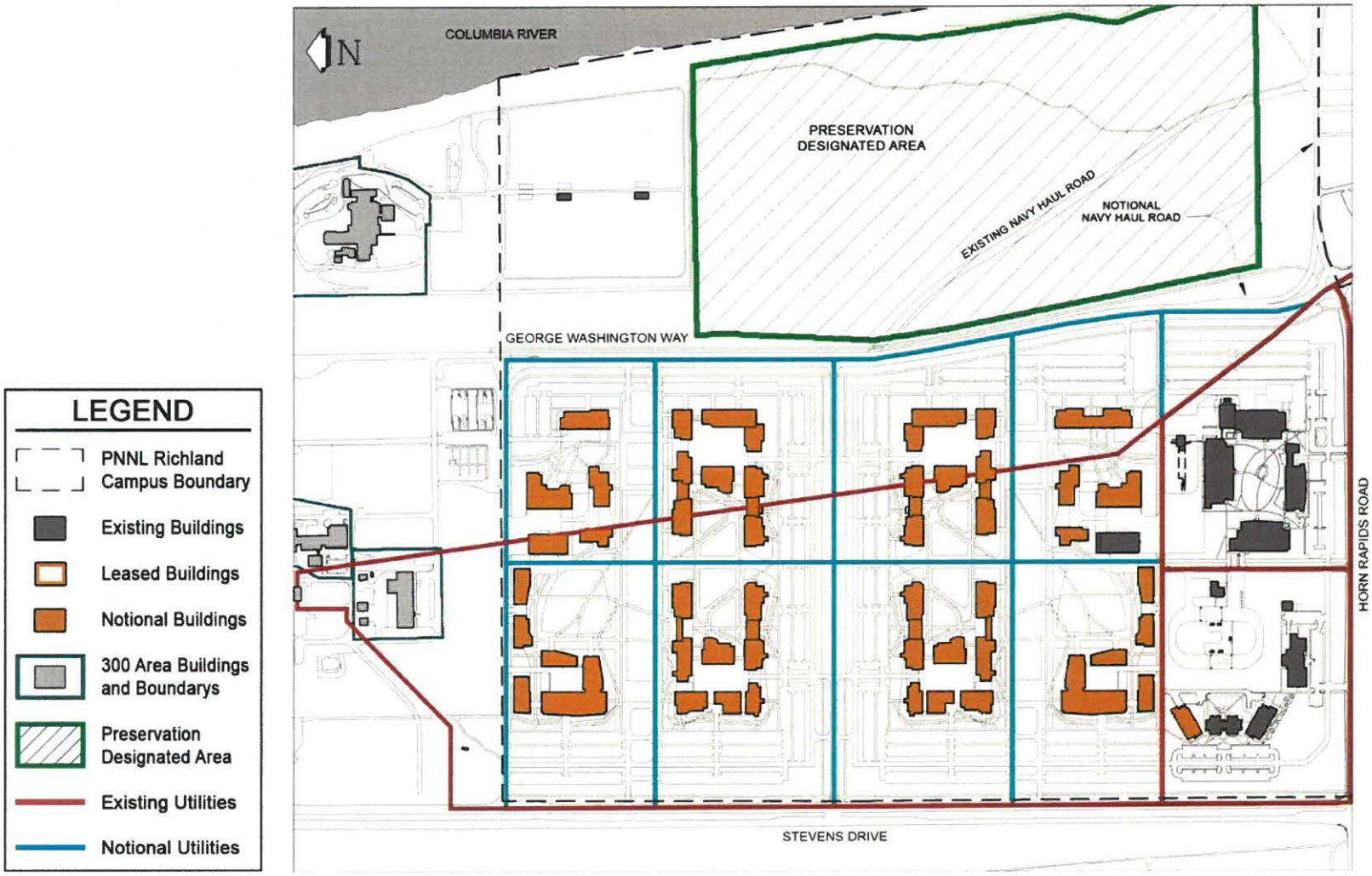
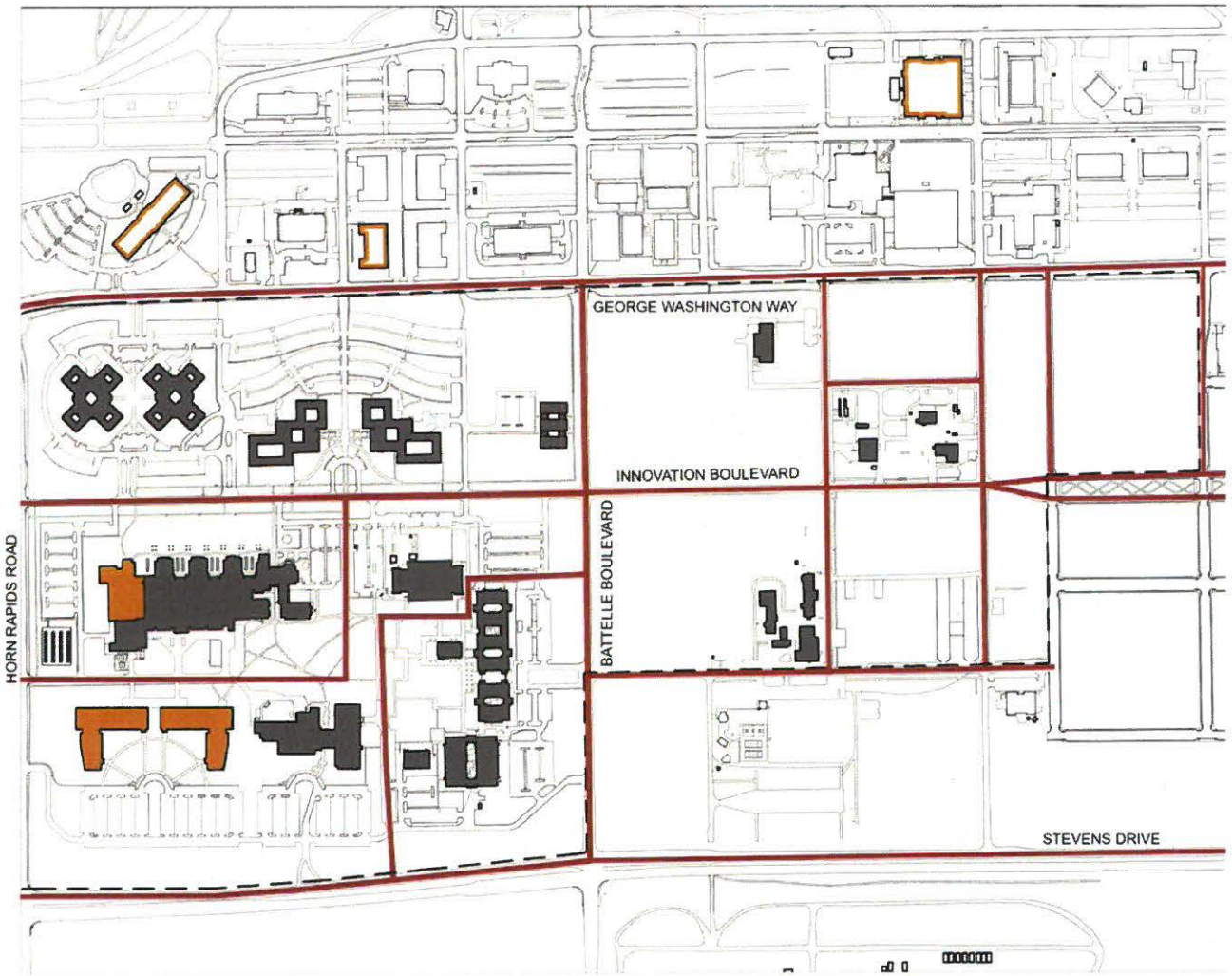


Figure 3.4. Utilities infrastructure and distribution systems corridors


GEORGE WASHINGTON WAY
INNOVATION BOULEVARD
BATTELLE BOULEVARD
HORN RAPIDS ROAD
STEVENS DRIVE

4.0 Design Considerations

Figure 4.1 is a series of images depicting the current PNNL Richland Campus character: arrangements of building clusters, distribution and use of open spaces, modern facilities with circulation patterns and parking zones, and landscape aesthetics, which are all important elements of the existing campus atmosphere and overall visual appeal. Future development will maintain a site density and architectural character similar to the EMSL, BSF/CSF, and 3410, 3420, and 3430 Buildings. Section 4.1 describes the design concept for the campus. Section 4.2 provides the existing state and proposed changes to the design elements that form the campus' organizational framework (update to new structure).

Figure 4.1. Current campus character, landscape, and common use space

4.1 Design Concept

Today, the PNNL Richland Campus is arranged as a series of land parcels divided by a system of major public and private roadways. Within each parcel, there are open space areas that act as visual relief, pedestrian routes, and outdoor common use areas. Open spaces provide a physical organizational structure of linked landscape areas around which buildings are clustered and through which pedestrian corridors flow. Open spaces create the overall campus character, look, and density. Common-use spaces are activity areas for gathering, eating, having informal meetings, etc. Whereas open spaces typically flow throughout the campus, common-use spaces are usually associated with specific building functions such as dining areas, meeting spaces, building or site entries, and the like.

New development on the campus will continue the desirable characteristics of the existing campus (Figure 4.2 and Figure 4.3) while introducing new ideas for campus renewal through investments to acquire new and/or renew PNNL's existing facility and infrastructure assets. These investments will deliver long-term value and adaptability in a mission-aligned, functional, reliable, modern, and sustainable campus; while balancing costs, time, and resources.

Expanding on the existing spatial layout of the campus area and its open space, through building placement and sustainable site development, reinforces the campus-like environment and highlights existing amenities. Maintaining current building setbacks and open space relationships conveys a consistent aesthetic, defines the campus edges, and informs circulation networks.

Design and building placement considerations will include:

- Building orientation to promote energy efficiency by allowing easy access to daylight and solar control.
- Clustering buildings to encourage pedestrian movement and help create large open spaces for animal and plant species habitats that enhance environmental quality in and around the building and can potentially provide natural pest control.
- Reducing impervious surfaces by implementing pervious materials or paving designs to encourage stormwater infiltration.
- Minimizing heat-absorbing site surfaces by using light-colored materials for roofs and hard-paved areas.
- Reducing the amount of water used for landscape irrigation by introducing drought-tolerant native plant species and reducing irrigated lawn areas.
- Reviewing potential operational consequences:
    - Pilot-scale processes that involve hazardous chemicals and/or higher risks than bench-scale operations
    - Hazardous materials that involve public safety considerations or that could be of concern to the public
    - Potential for hazardous material contamination
    - Attractive assets and/or operations that may draw the public into close proximity with hazards or result in property loss

  - Potential controls to restrict public access
- Reviewing potential "Quiet" space requirements for imaging tools planned to be used in the space.
- Consistency with planned utility infrastructure and distribution systems (roads, electricity, water, sewer, gas, storm drain, telephone, and telecommunications).

Figure 4.2. PNNL campus open spaces and architectural character

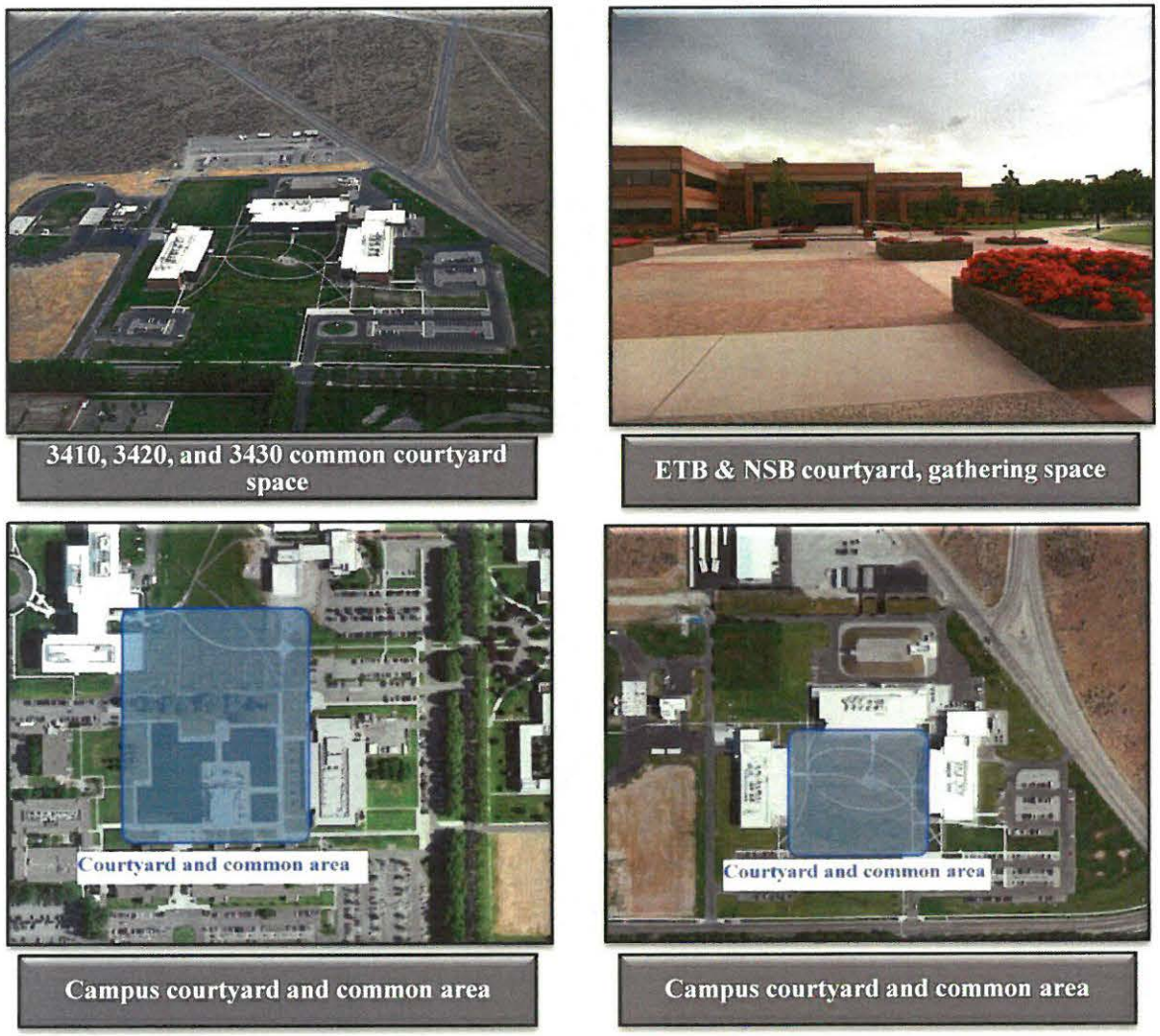


Figure 4.3. Existing open courtyard and common space design across the PNNL campus

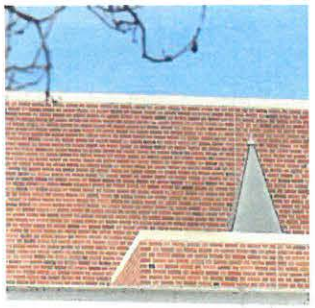
4.2 Design Elements

Each of the following subsections presents a design element that contributes to overall campus development.

4.2.1 Gateway and Staff Core Areas

Development of the Collaboration Center creates a gateway to PNNL along Horn Rapids Road via the intersections at George Washington Way to the east and Stevens Drive to the west. This gateway divides the campus into roughly equal halves at full notional development (Figure 3.3). Facilities north and south of Horn Rapids Road as well as the surrounding road system, will be readily accessible, creating the ideal location to promote interaction and develop a larger sense of community within the overall campus (Figure 4.4).

While the Collaboration Center is envisioned as the central public services and arrival point on campus, execution of this CMP also results in core areas that provide staff with amenities and support services in interior and exterior environments. These areas will be linked to the open space networks. Buildings in the area will be populated with scientific research programs and support functions necessary for mission alignment. Being at or near a campus population center, these centralized locations are planned to promote synergy and interaction, building a sense of community.



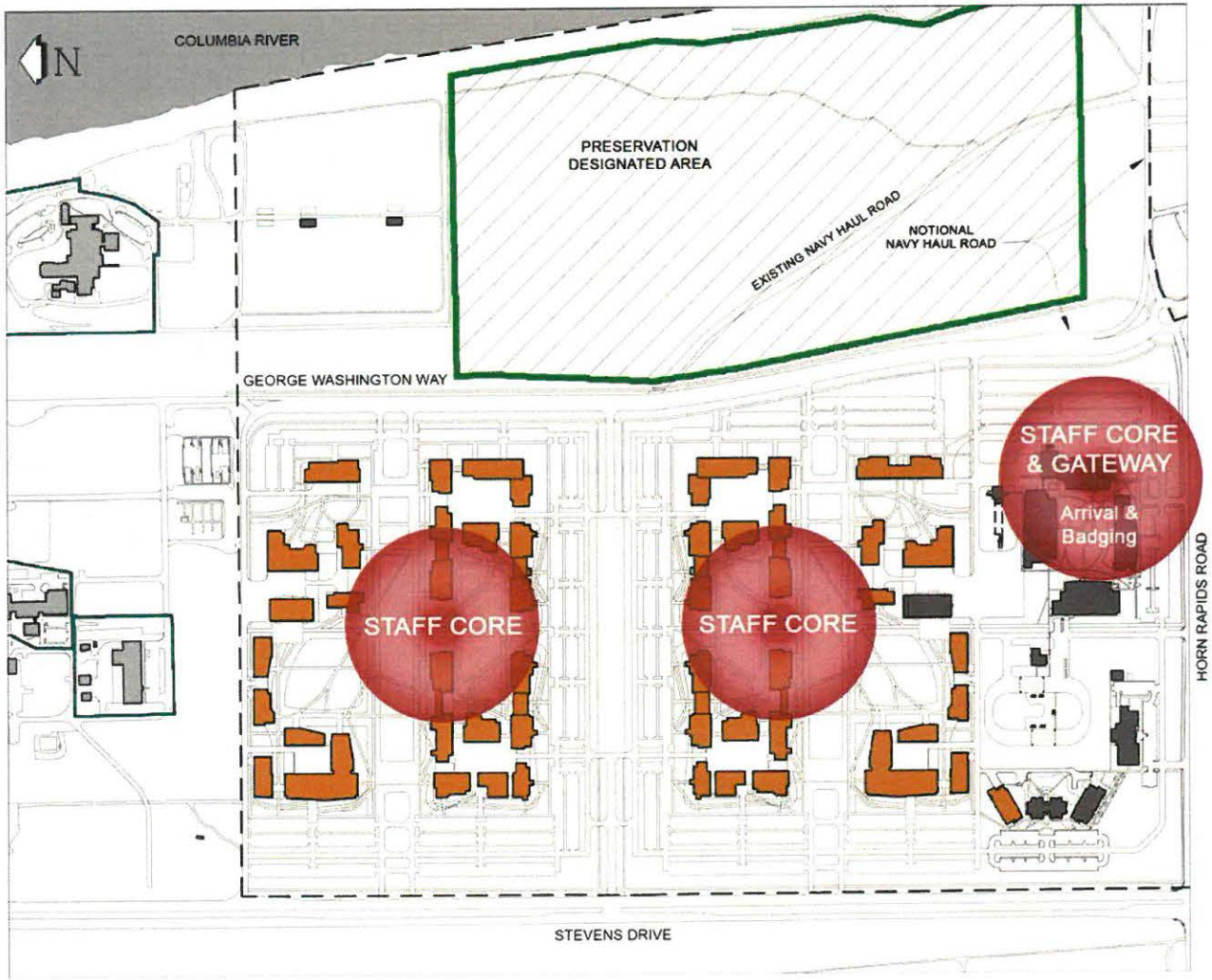
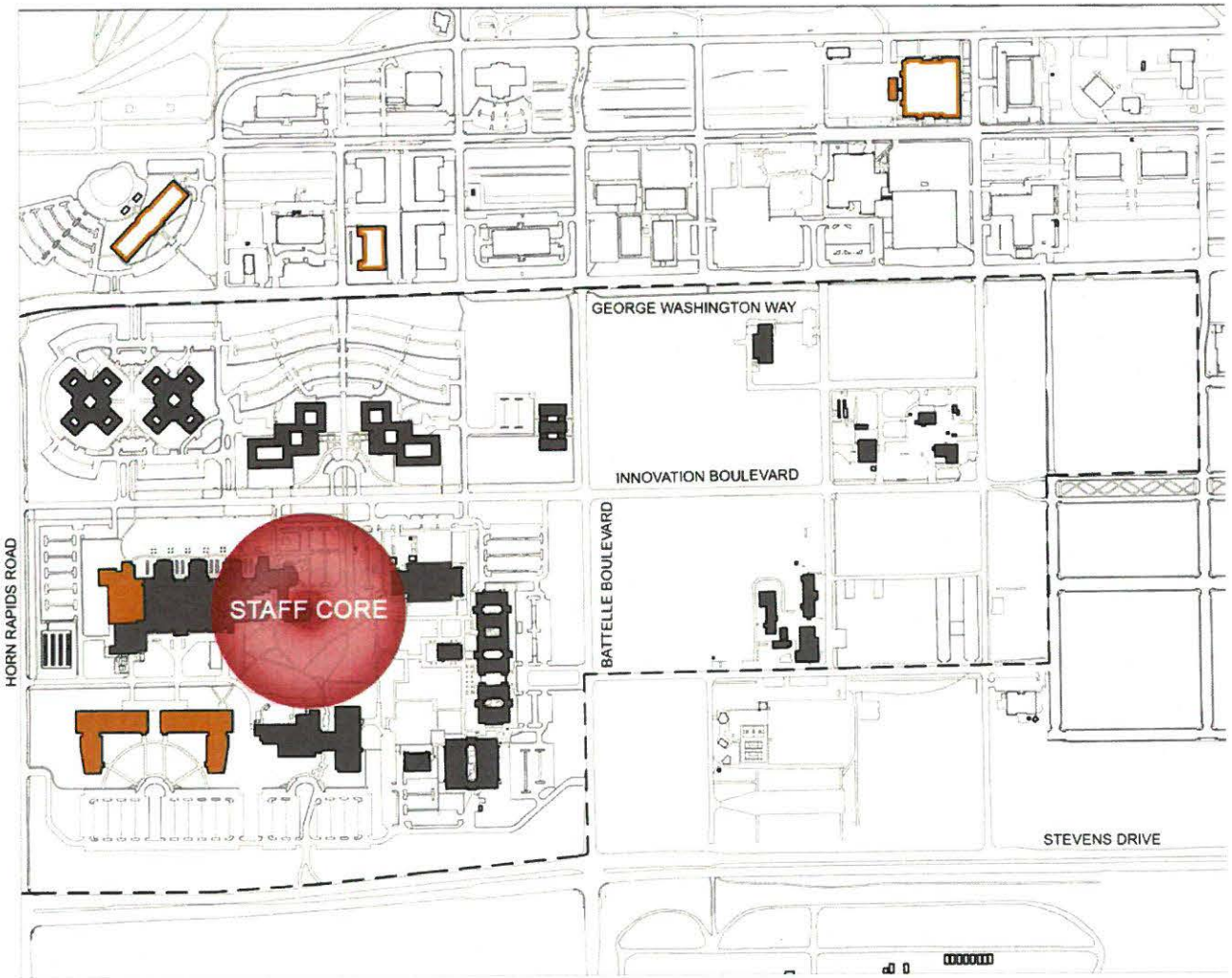


Figure 4.4. "Heart" of campus and "staff cores"


GEORGE WASHINGTON WAY
INNOVATION BOULEVARD
BATTELLE BOULEVARD
HORN RAPIDS ROAD
STAFF CORE
STEVENS DRIVE

4.2.2 Circulation and Parking

4.2.2.1 Vehicular Circulation

The campus is located adjacent to/within a mid-sized metropolitan area. According to the U.S. Census Bureau 2013 5-year American Community Survey (USCB 2015a) population data, the population with an 80 km (50 mi) radius of the campus is estimated to be approximately 480,000. Access is primarily by private vehicle and secondarily by public transit (bus service). George Washington Way and Stevens Drive are the main vehicular routes connecting the campus to central Richland and both are actively used (see Pacific Northwest National Laboratory Transportation Operations Analysis, September 2011, Prepared by Transportation Solutions, Inc.). From these corridors, the cross streets of University Drive, Battelle Boulevard, and Horn Rapids Road provide access to the campus. Innovation Boulevard is an internal campus street running north-south from Horn Rapids Road, intersecting with Battelle Boulevard, and continuing south. Service traffic is limited to the main perimeter streets and to specific areas, generally well separated from pedestrian routes, public areas, and open spaces.

As the campus develops, vehicle traffic (service, public, or private vehicles) would be limited to periphery roads, parking, and dedicated service accesses without significant change to the circulation routes south of Horn Rapids Road (Figure 4.5). Entry locations would be reinforced by logically connecting public thoroughfares with parking and service access roads, and implementing way-finding and signage strategies. Modifications to George Washington Way will be implemented, and new east/west vehicular connections to parking lots north of Horn Rapids Road will be introduced from Stevens Drive and George Washington Way. Where possible, a primary pedestrian, secondary vehicle hierarchy for traffic should be established to keep pedestrian and vehicle traffic separate.

Service buildings would be grouped to limit the number of access drives (Figure 4.5). Service traffic will be limited to service zones, which will be strategically located for facility operations and maintenance and away from common pedestrian routes to provide the least disruption to the research community. Consider screen walls, planting, and grading to augment any natural screening to minimize views into the service zones. Figure 4.5 depicts the service routes, service zones, and traffic routes to serve a fully-developed campus. Neighborhood Electric Vehicles will also use these designated service routes for typical day-to-day deliveries and building service access.

4.2.2.2 Parking

The majority of existing campus parking areas for employees and visitors are located in perimeter lots accessible from Battelle Boulevard, Stevens Drive, Horn Rapids Road, and George Washington Way. This parking design offers a desirable stand-off between public circulation ways and buildings and enables the ability to maintain open spaces and pedestrian-only areas internal to the campus (Figure 4.6). ISB1, ISB2, ETB, and NSB, residents, users, and visitors have adjacent parking areas to the west that are accessible from George Washington Way and Innovation Boulevard. EMSL, ROB and LSL2 residents, users, and visitors have adjacent parking areas to the east that are accessible from Innovation Boulevard and Battelle Boulevard. Guest House users have an adjacent parking area to the north that is accessible from Innovation Boulevard and George Washington Way.

As the campus develops, the majority of staff parking will be located primarily at the perimeter of the campus areas, minimizing parking in the interior and enabling "clean-fuel" shuttle options for transportation within the campus. Parking areas should be compartmentalized, reduced in scale, and designed to minimize potential conflicts between pedestrian and vehicular traffic. Landscaped islands within the lots will provide for reduced visual impact of paved areas, improved storm water runoff control and treatments, and shading of vehicles. Parking areas will include parking stalls for the handicapped, reserved electric vehicle stalls and charging areas, van-pool stalls, and other specialized spaces.

Parking areas for fleet or service vehicles as may be required for specific buildings, would be limited in number, and screened from public view and major pedestrian areas. Parking areas would be lighted at appropriate levels to allow for 24/7 safe access and use.

Figure 4.6 shows the location and physical attributes of parking and traffic flows to create a pedestrian-oriented campus. This will further strengthen the collegial atmosphere while maintaining the campus' open character and minimizing potential conflicts with pedestrian and vehicular traffic. These strategies are aided by the use of landscape buffers (e.g., trees) and by manipulating topography (e.g., berms) to screen vehicles.

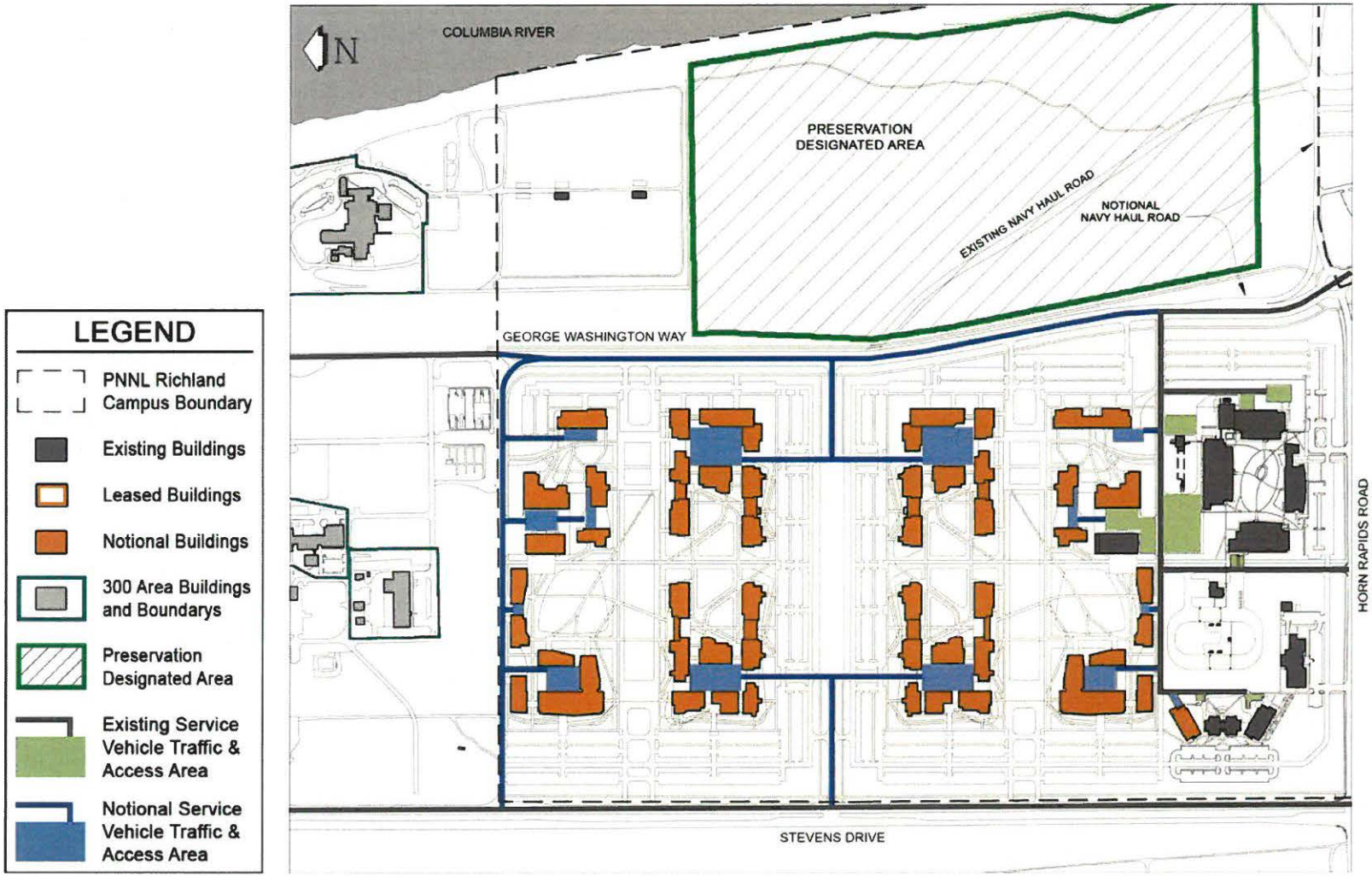


Figure 4.5. Existing and future service zones and service routes

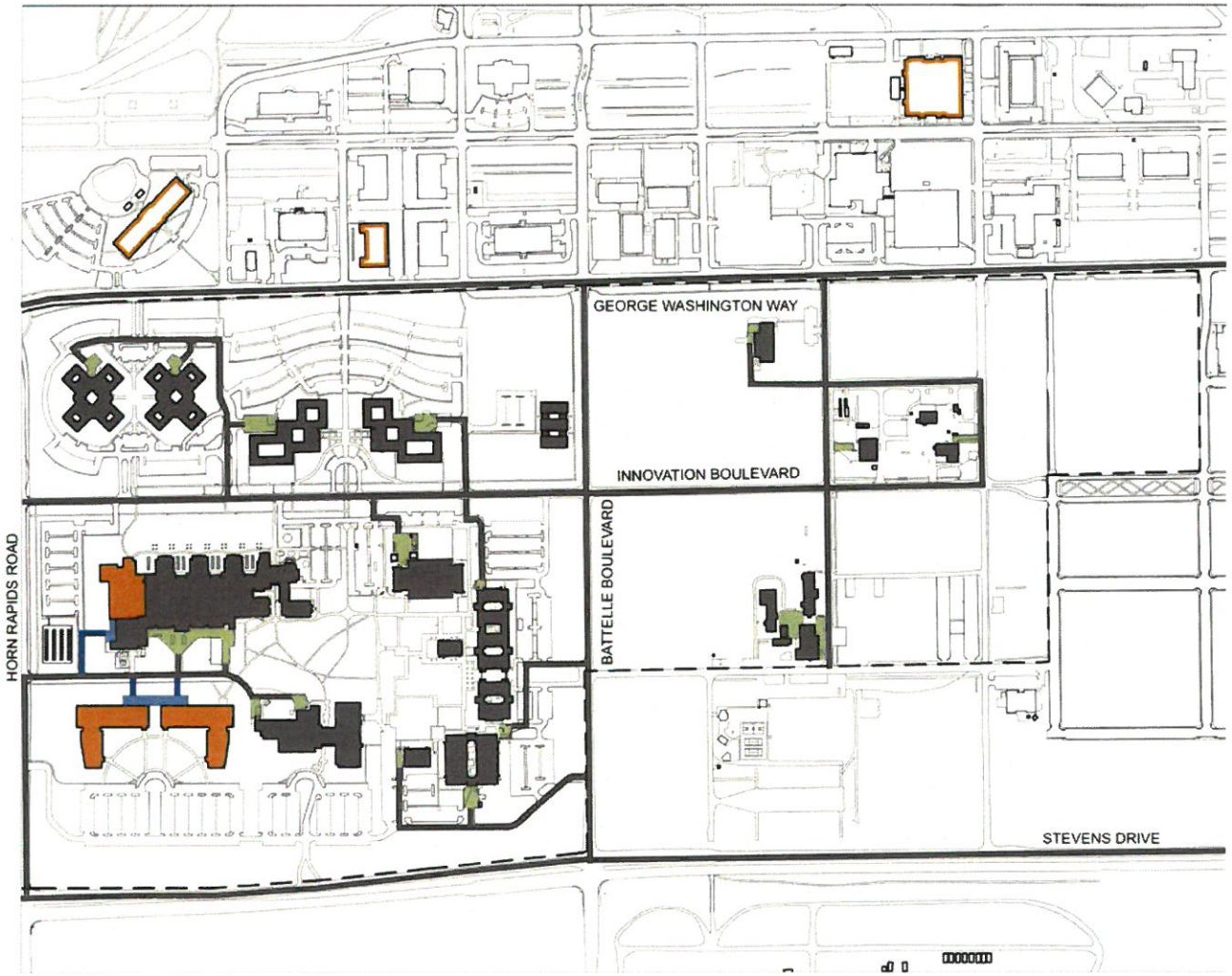
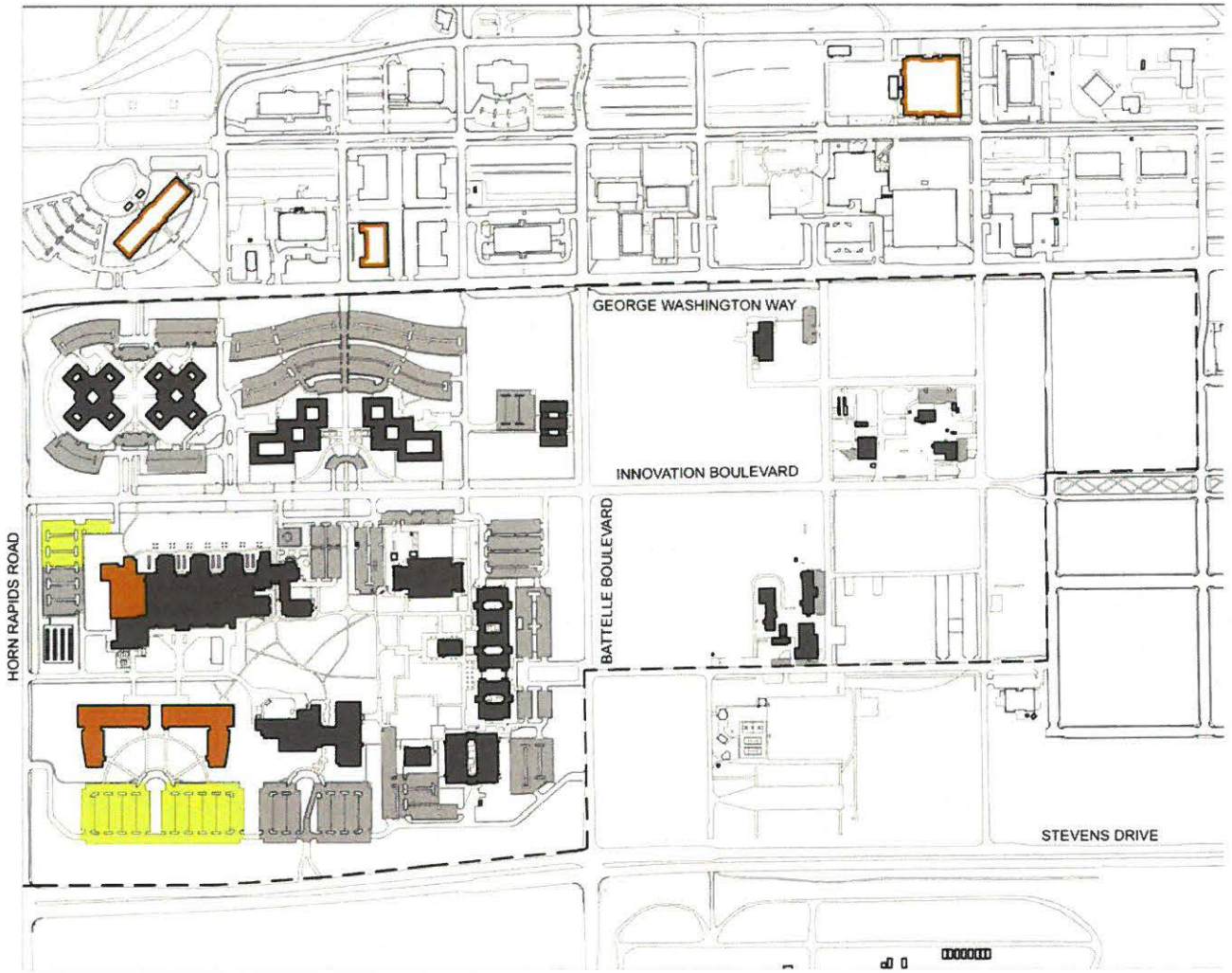

GEORGE WASHINGTON WAY
INNOVATION BOULEVARD
BATTELLE BOULEVARD
HORN RAPIDS ROAD
STEVENS DRIVE

Figure 4.6. Existing and future parking areas


GEORGE WASHINGTON WAY
INNOVATION BOULEVARD
BATTELLE BOULEVARD
HORN RAPIDS ROAD
STEVENS DRIVE


Pacific Northwest

4.2.2.3 Bicycle Circulation

Existing bicycle circulation is currently provided at campus edges with striped bike lanes on Battelle Boulevard, George Washington Way, Horn Rapids Road, University Drive, portions of Stevens Drive, and internal to the campus on Innovation Boulevard.

Campus development includes an improved bicycle and pedestrian circulation plan to provide opportunities to move within the campus, between the PNNL geographical entities surrounding the campus, and to connect to the broader Richland community (Figure 4.7). The pedestrian transportation system will consist of a combination of marked on-road bicycle lanes and shared walking-bicycle-exercise paths of sufficient width to accommodate the mixed use in a safe manner. Parking, storage, and showering facilities would be incorporated to deliver amenities that encourage the use of bicycles.

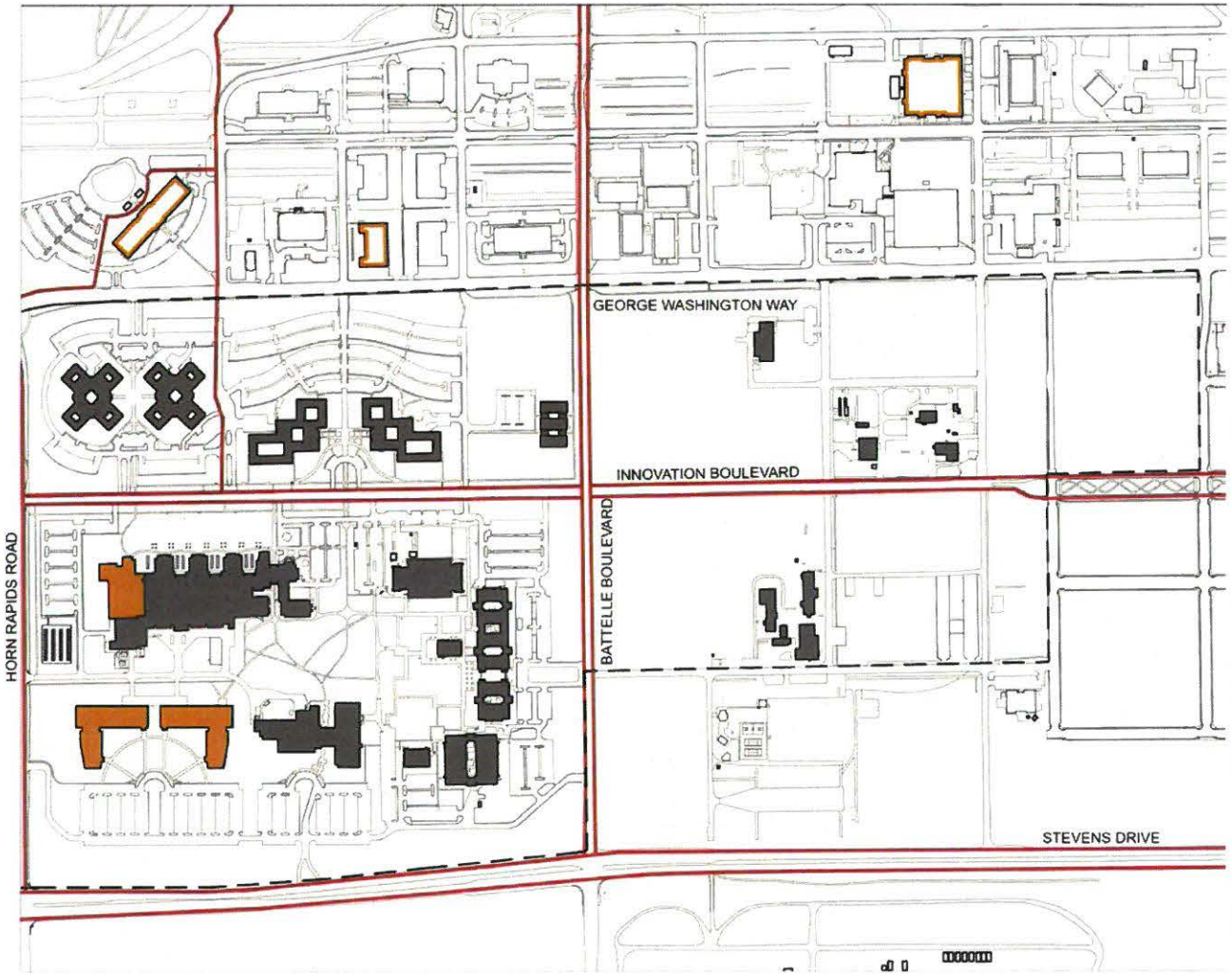
4.2.2.4 Pedestrian Circulation

Currently, pedestrian circulation is generally internal to the campus buildings and open space, offering separation from major vehicular traffic areas, which improves pedestrian safety and comfort. These pedestrian circulation routes act as linkages between open spaces, common-use areas, building clusters, and parking areas. Speed bumps, crosswalks, signage, and landscape development have been implemented at pedestrian crossings along Innovation Boulevard. These strategies and others should be identified as a model for future campus development where primary pedestrian routes intersect with vehicular circulation.

As the campus develops a pedestrian route that separates pedestrian traffic from vehicular traffic as much as possible shall be developed (Figure 4.8). The route would effectively connect the campus and encourage pedestrian movement between buildings rather than using private vehicles, and would allow for increased opportunity for collaboration. Pedestrian paths would connect to the public transportation stops and to the Richland Riverfront Trail to increase connectivity to the community. Pedestrian traffic would be supported by adequate walkways, lighting, and additional on-campus security and safety measures, where needed.

Intentionally Blank

Figure 4.7. Existing and future bicycle route plan


GEORGE WASHINGTON WAY
INNOVATION BOULEVARD
BATTELLE BOULEVARD
HORN RAPIDS ROAD
STEVENS DRIVE

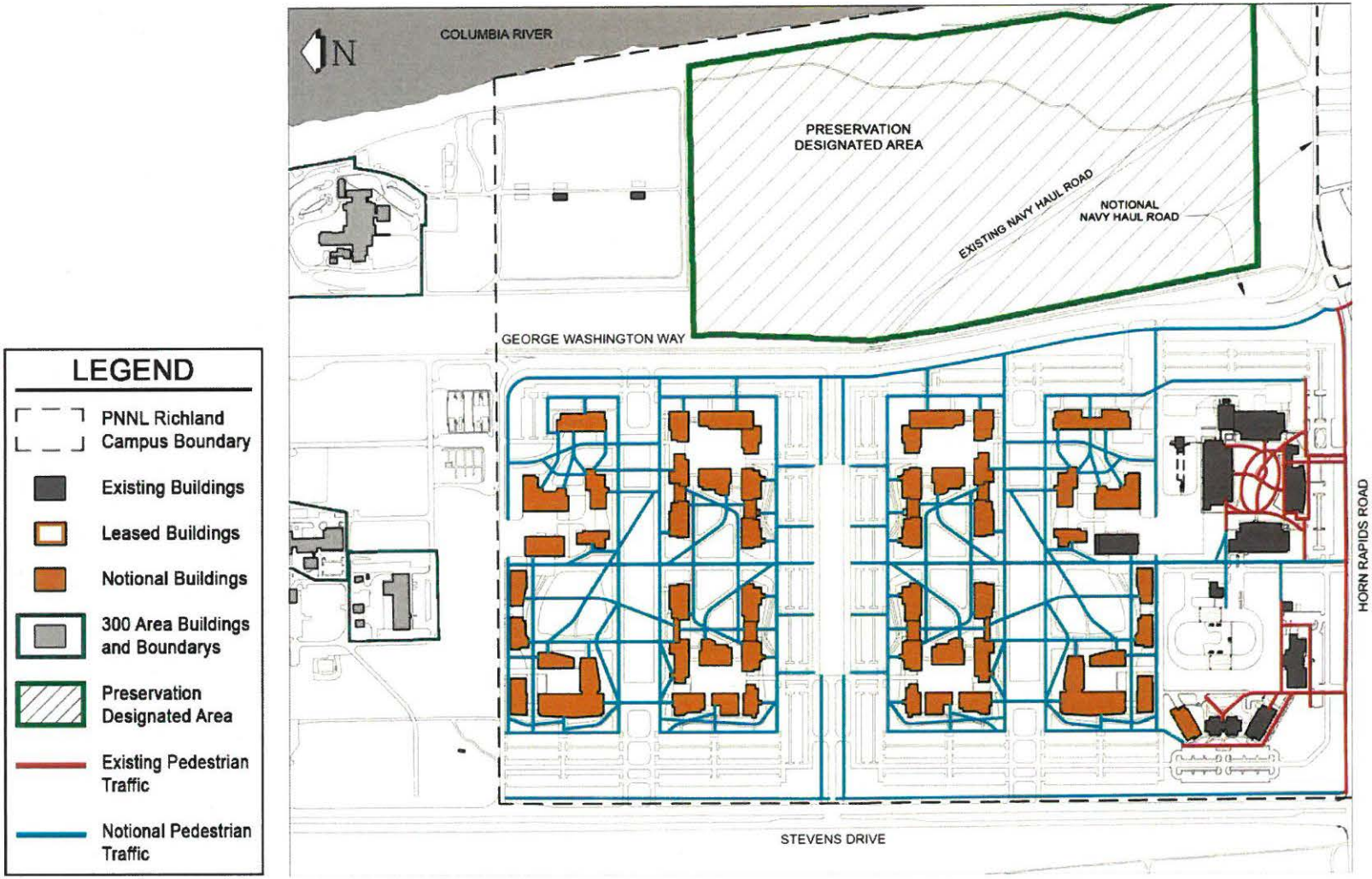
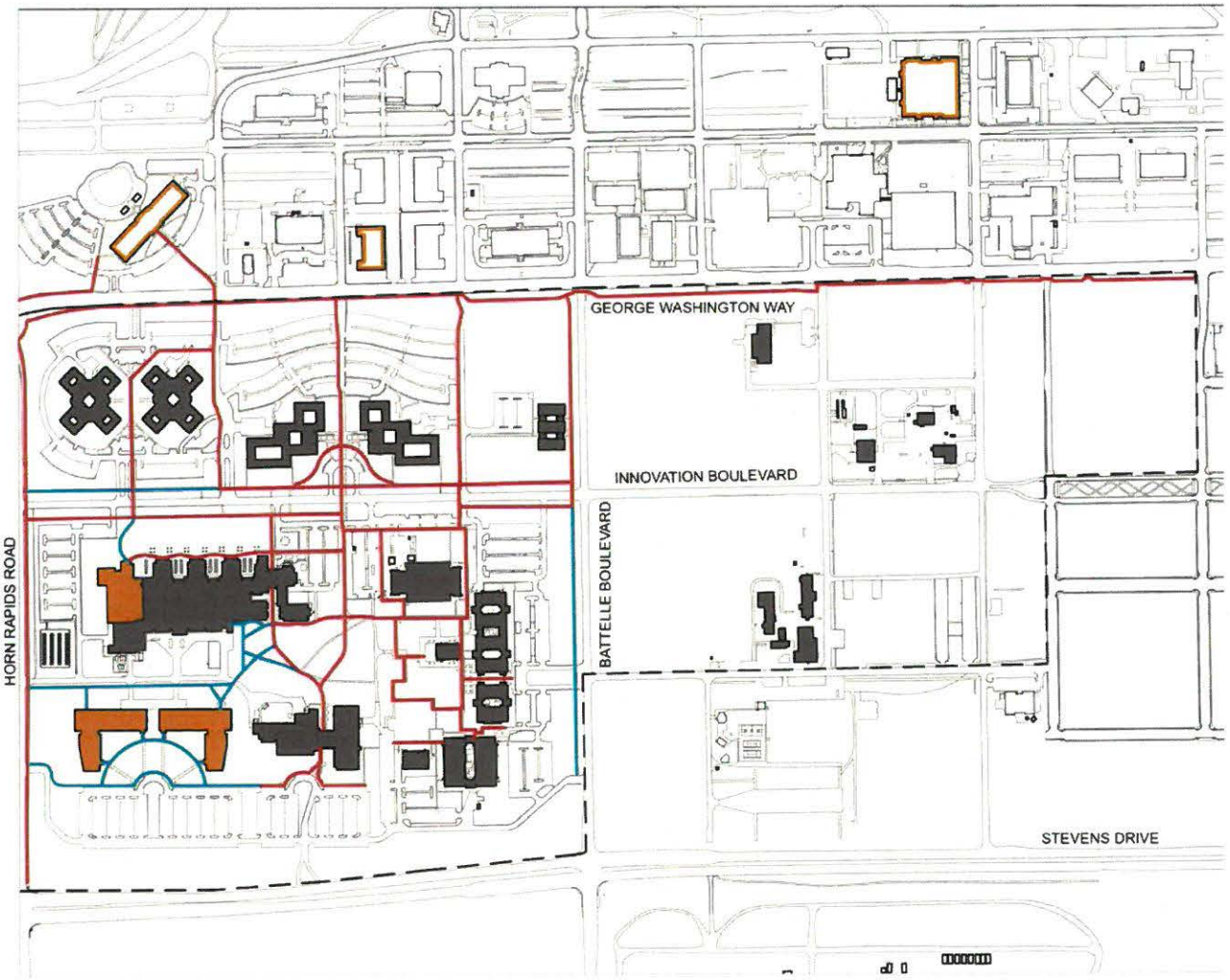


Figure 4.8. Existing and future pedestrian pathways


GEORGE WASHINGTON WAY
INNOVATION BOULEVARD
BATTELLE BOULEVARD
HORN RAPIDS ROAD
STEVENS DRIVE

4.2.3 Open Space

Open spaces provide a physical organizational structure of linked landscape areas around which buildings are clustered and through which pedestrian corridors flow. They create the overall campus character, look, and density. Open spaces typically flow throughout the campus.

The existing Innovation Boulevard corridor provides an excellent example that should be seen as the standard for the development of future open space. Existing open space is illustrated in Figure 4.9. Other existing qualities considered appropriate for future development include a high percentage of landscape to pavement area; a wide landscape zone dominated by mature, large-scale shade trees that provide windbreaks, and align with and reinforce pedestrian and vehicular routes; and a relatively consistent building setback (Figure 4.10).

Open space will continue to be an important design element as the campus develops. Building groupings will be developed around well-designed and appropriately scaled open spaces in combination with potential research adjacencies and effectively placed amenities and support services to help create high-quality work environments. Figure 4.9 conveys the importance of the geographical layout and locations of open space (e.g., grounds) as a design element for the systematic placement and ordering of buildings and other physical structures.

Future development will maintain a minimum 500-foot building setback from the eastern edge of Stevens Drive. The minimum setbacks for the balance of the campus borders will be the lesser of 200 feet or currently existing buildings along that border.

Campus art and interpretive features could be strategically located within building groupings to encourage informal interaction and connectivity to the region, and to reinforce the culture and scientific research at PNNL. Campus art and interpretive features can aid in the development of the campus character. Art and interpretive features should be strategically located to accent amenity spaces and highlight campus circulation routes. To the maximum extent practicable, selected art and interpretive features should be the result of collaboration with the artist and community and reflect the cultural, intellectual, and historical interests and values of the surrounding community.

Intentionally Blank

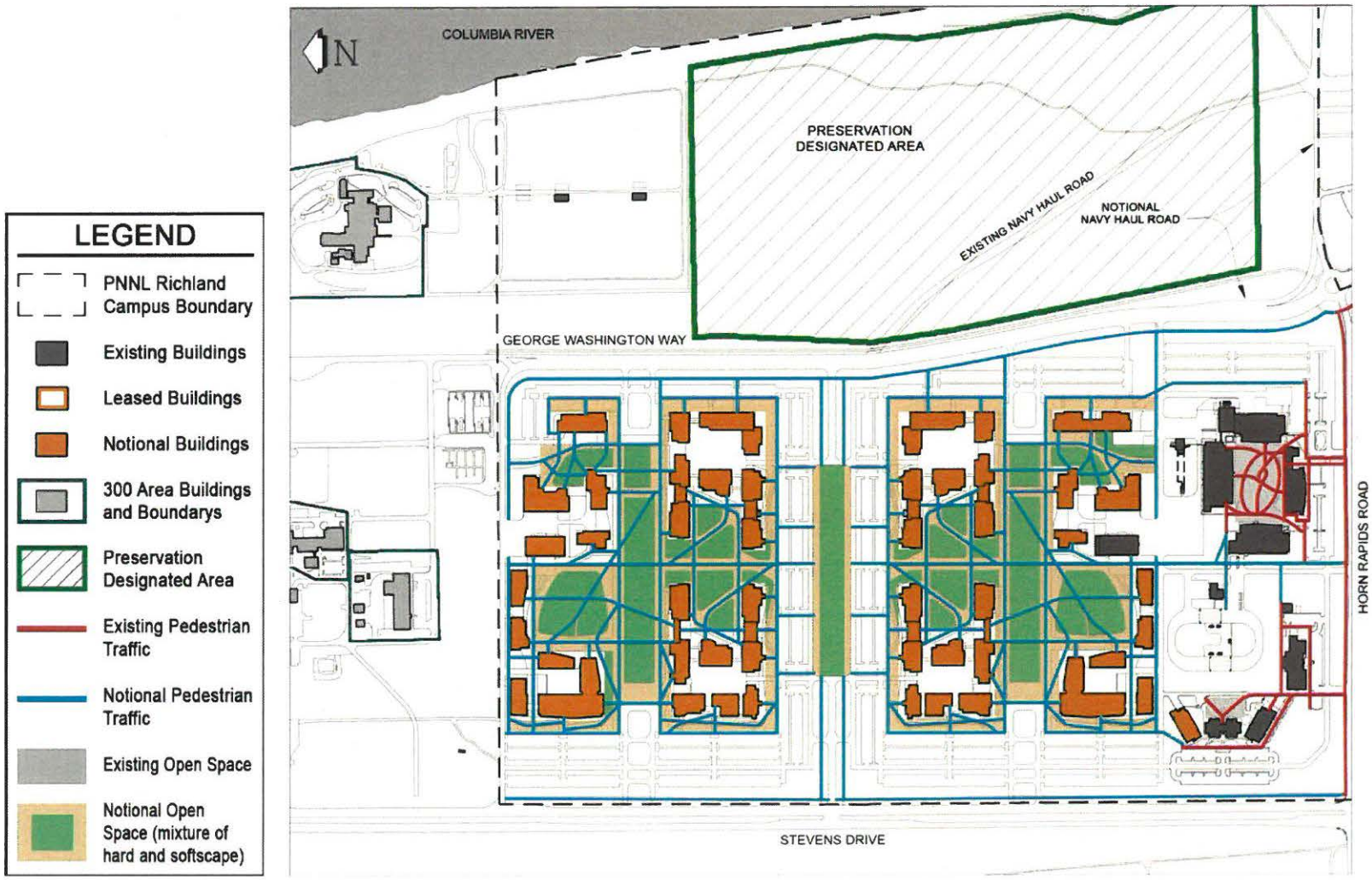
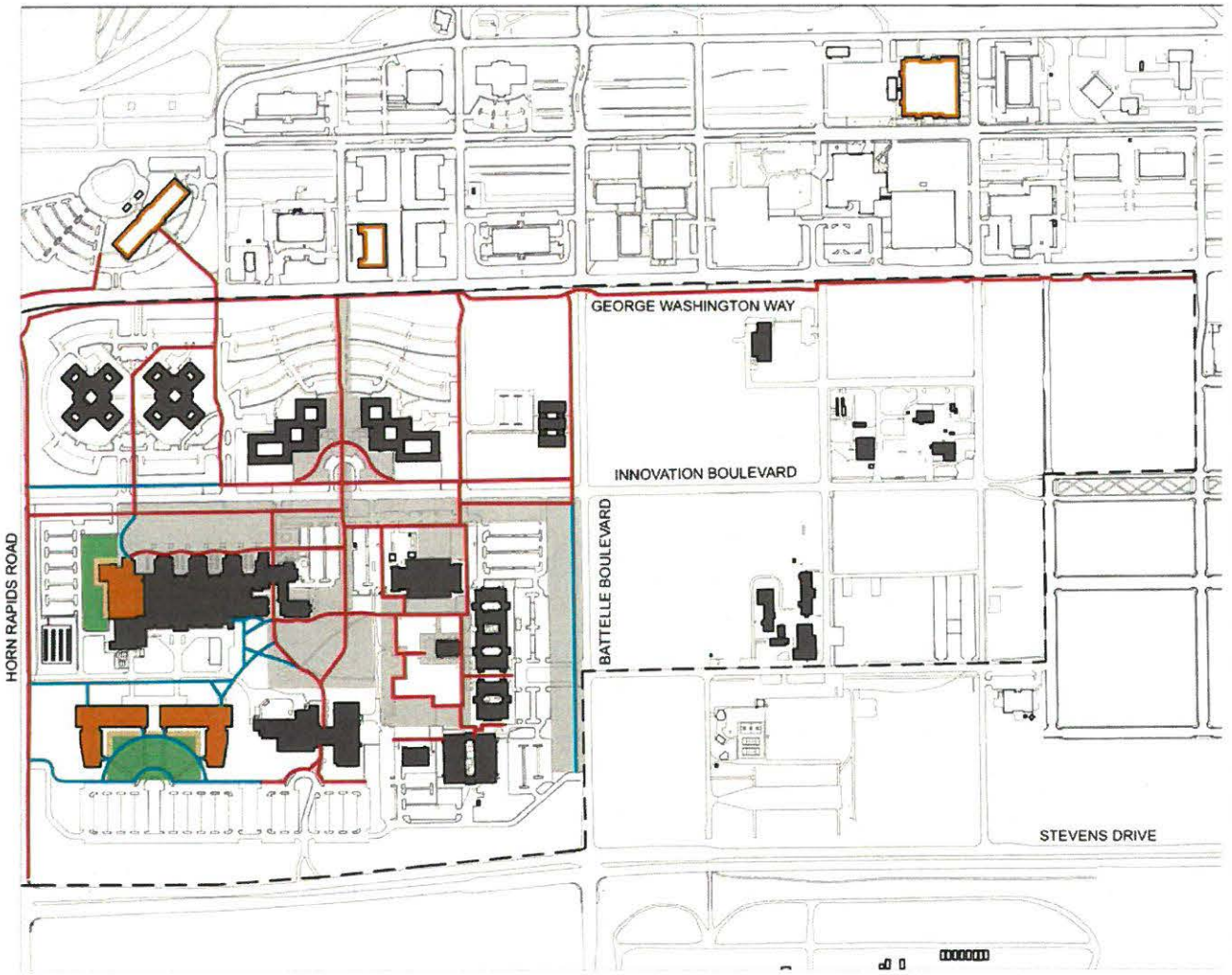


Figure 4.9. Open space and connections


GEORGE WASHINGTON WAY
INNOVATION BOULEVARD
BATTELLE BOULEVARD
HORN RAPIDS ROAD
STEVENS DRIVE

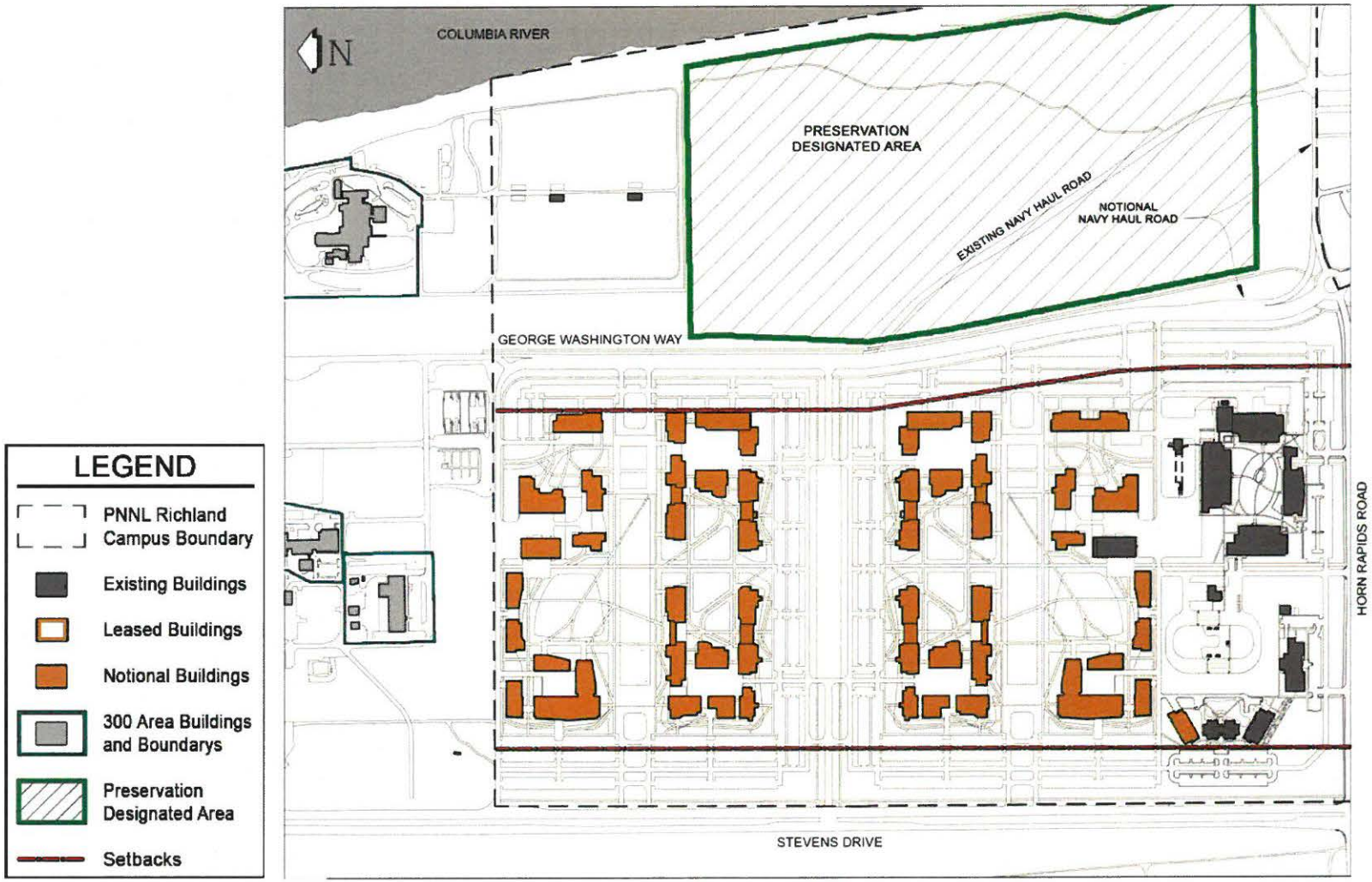
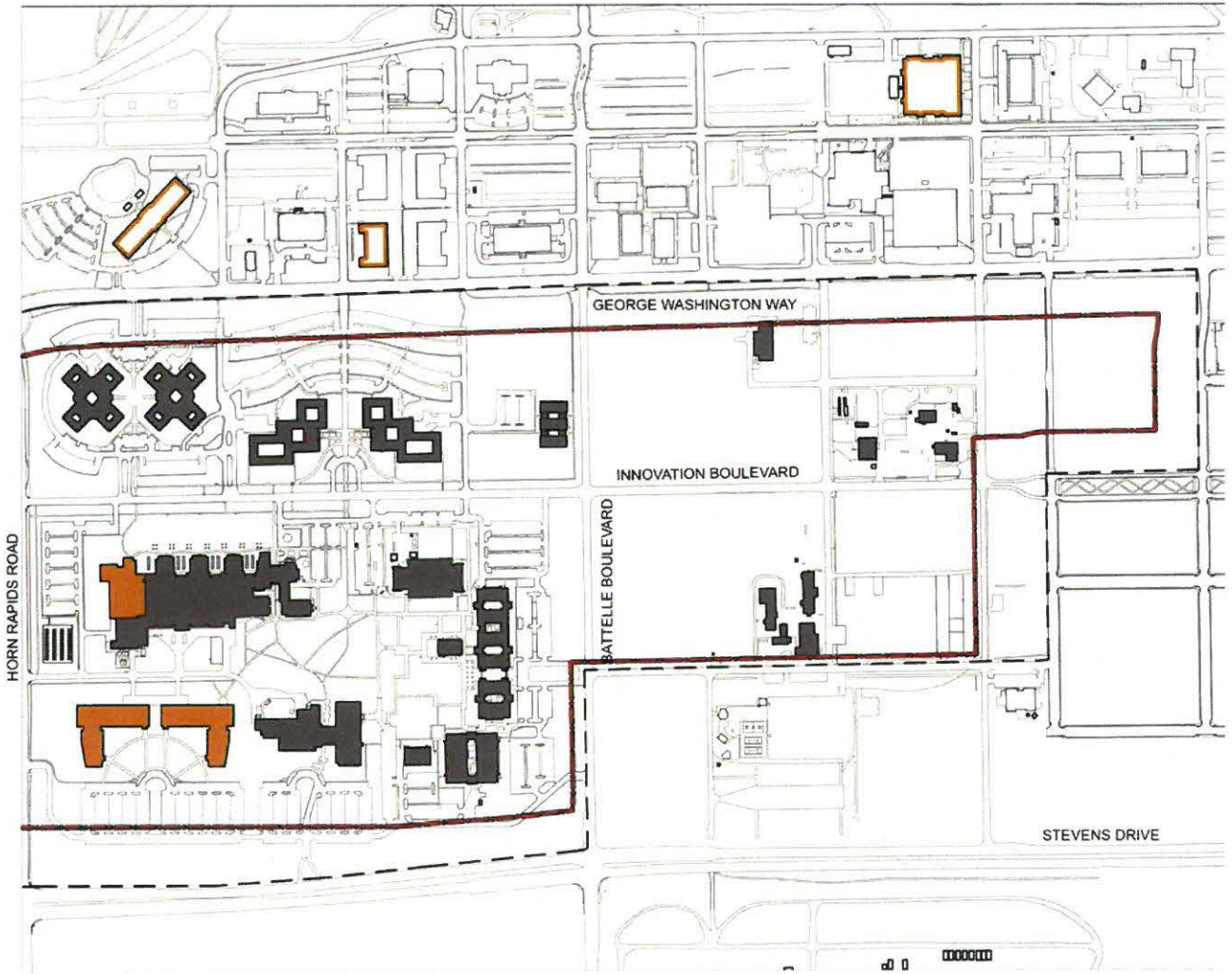
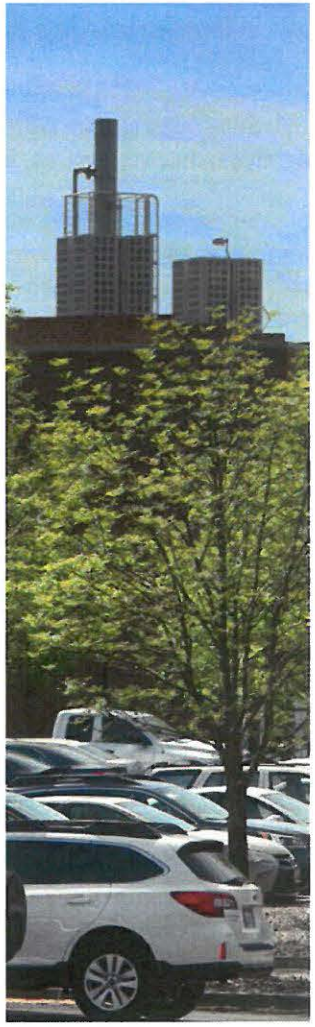


Figure 4.10. Building setbacks


GEORGE WASHINGTON WAY
INNOVATION BOULEVARD
BATTELLE BOULEVARD
HORN RAPIDS ROAD
STEVENS DRIVE



4.2.4 Common-Use Space

Common-use spaces are activity areas for gathering, eating, having informal meetings, participating in outdoor/wellness activities, etc. Whereas open spaces typically flow throughout the campus, common-use spaces are usually associated with specific building functions - dining areas, meeting spaces, building or site entries, and the like. They influence the specific use of individual areas within the campus.

Today, the campus includes multiple common-use spaces. The exterior common spaces, food service, and main Auditorium Building are shown in Figure 4.11. The exterior commons are a major pedestrian connection between surrounding buildings, and offer opportunities for casual and formal interaction and collaboration. North of Horn Rapids Road, the existing facilities are arranged around a landscaped quadrangular commons. These commons are also the terminus to the Innovation Boulevard corridor, which is positioned in the center of the existing buildings and occasionally closed to traffic for special staff events.

As development moves northward, common use-spaces such as a cafeteria and training/meeting facilities will be located to serve multiple facilities, and function in both an interior and exterior environment with linked pedestrian corridors and open spaces. Amenity buildings have been proposed as the center and gateway to campus to house food service, badging, and visitor-center provisions. The dedicated interior and exterior spaces for gathering and interaction are illustrated in Figure 4.11. These spaces facilitate increased communication and interaction among visitors and staff, add character to the campus, and reinforce the unique identity of the campus. Development of the common-use space south of Horn Rapids Road through installation of attractive and inviting activity areas, and the encouragement of outdoor use and activity could strengthen the collaborative nature of PNNL.

Intentionally Blank

Figure 4.11. Common use space/building amenities


GEORGE WASHINGTON WAY
INNOVATION BOULEVARD
BATTELLE BOULEVARD
HORN RAPIDS ROAD
STEVENS DRIVE

4.2.5 Landscape

PNNL's campus is a visually appealing green oasis within a semi-arid shrub steppe ecosystem. The landscape in the developed area south of Horn Rapids Road is largely an expanse of well-manicured lawns. Rows of mature sycamore trees (i.e., London Plane) line Innovation Boulevard, Battelle Boulevard, Stevens Drive, Horn Rapids Road, and George Washington Way. Planted at the time of the Laboratory's inception in 1965, the sycamore trees are a well-known landmark (Figure 4.12). The trees provide shade, windbreak, and spatial structure – defining campus edges and pedestrian and vehicular corridors, with the framing of views – a basic component of the existing landscape composition. Landscaping in the area north of Horn Rapids Road transitions from the manicured and ornamental characteristics found in the developed area south of Horn Rapids Road to drought-tolerant native landscaping (use of low maintenance, low water requirement, and indigenous plant materials).

While it is important to maintain some of the existing landscape character, future development on the campus will be consistent with PNNL's Engineering Design Standards (ADM-057-PG-01) and incorporate more drought-tolerant native landscape practices to improve campus sustainability; including consideration for replacing some of lawn area surrounding existing buildings. Additional considerations include the following:

Weather Protection – Landscape development on the campus should consider and mitigate environmental conditions in order to enhance human comfort and safety. Campus-scale trees (medium to large, 40 feet or taller at maturity) can be utilized to provide protection from the sun and wind and to emphasize circulation patterns. Site walls, landscaped berms, and building orientation can be planned to provide protection from prevalent wind patterns on campus.

Visual Openness –The existing scale of development provides a consistent spatial relationship between buildings and open space. Plant materials will be selected to promote clear site lines to building entries and primary circulation patterns. Consider screen walls, planting, and grading to augment any natural screening to minimize views into the service zones.

Drought-Tolerant Native Landscape – As the area north of Horn Rapids Road develops, the landscape paradigm will

Figure 4.12. Corridor of sycamore trees along Battelle Boulevard

shift from irrigated lawn and tree-lined streets to that of a shrub steppe ecosystem native to the Columbia River Valley. Native and adaptive vegetation will be used for landscaping to reduce additional water consumption beyond the initial three-year establishment period. Use of native landscaping is a commitment in the PNSO Cultural and Biological Resources Management Plan and PNNL's environmental assessment, "PNNL Richland Campus Future Development." Low-water irrigation systems may be installed for the establishment period only. The preference is for campus vegetation in the form of native species with evapotranspiration that would lower micro-climate temperatures. This shift will help enhance PNNL's identity as well as drastically reduce irrigation water consumption. Irrigated lawn areas would be limited to high-traffic areas that develop the spatial character of the campus and can double as amenity spaces for observing nature and large events (Figure 4.13 and Figure 4.14).

The concept and example images below depict a landscape with limited lawn areas, a restrained use of tree-lined walkways, shade trees in parking areas, and developed native planting areas that highlight building entries and pedestrian circulation. Larger open space areas are shown as drought-tolerant native seed mixes, while irrigated lawn areas are limited to campus quadrangles that can serve as organizing elements for buildings and circulation while providing useable space for large events and observing nature. Figure 4.15 indicates reduced irrigation zones that can be developed through changes in vegetation and maintenance.

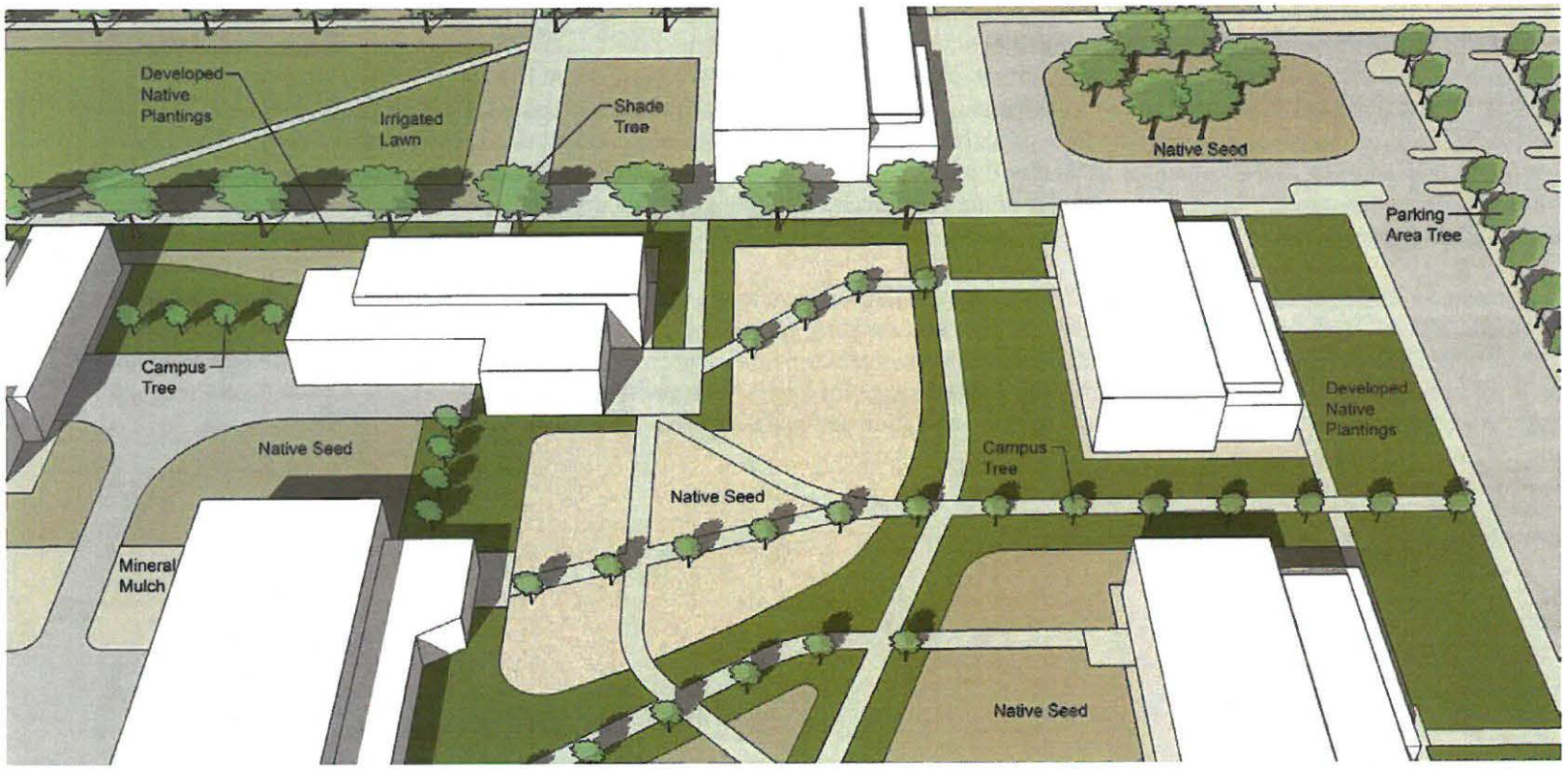


Figure 4.13. Landscape concepts

Figure 4.14. Example landscape images

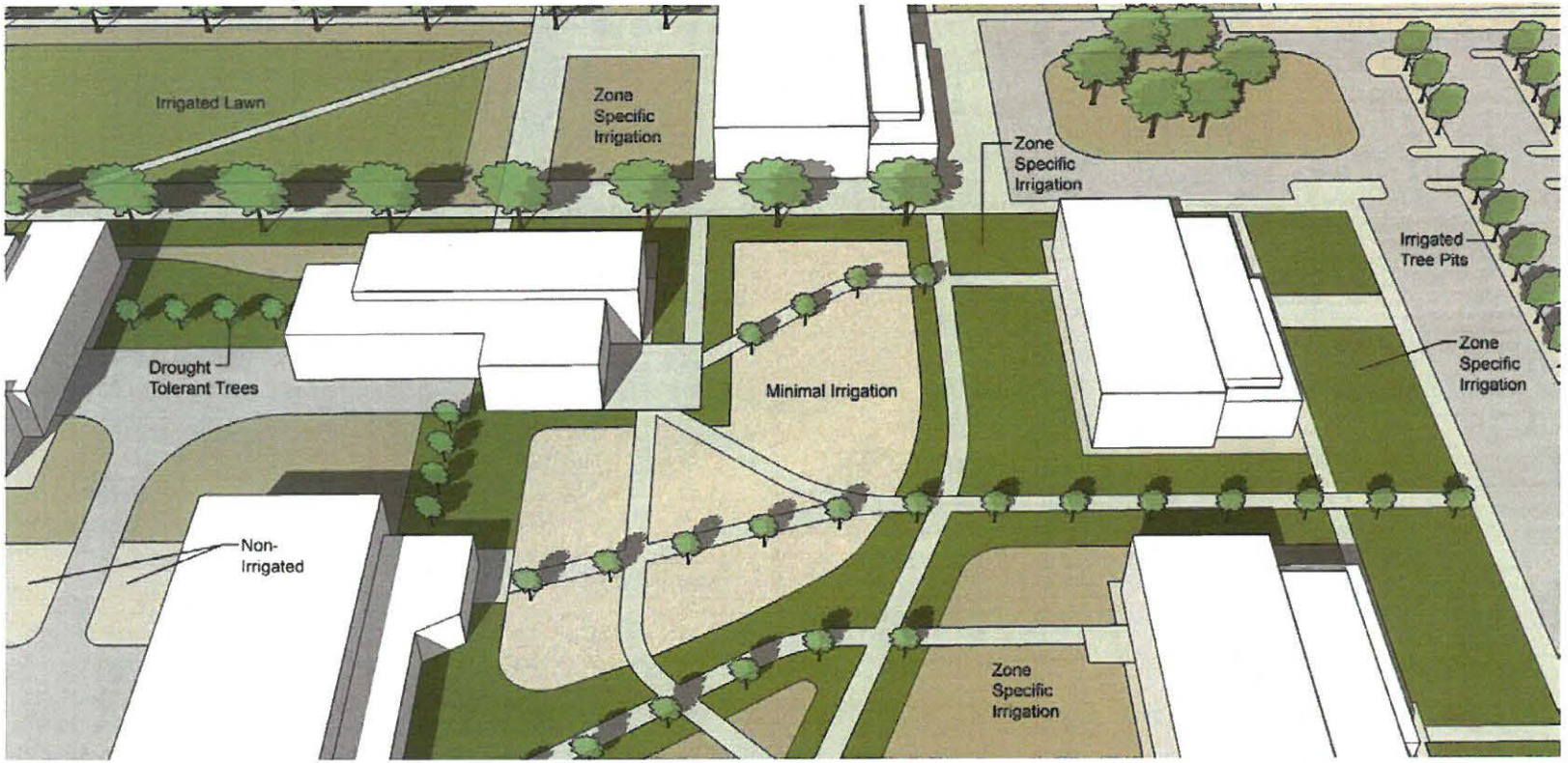


Figure 4.15. Irrigation zoning

4.2.6 Storage Space

Storage space on the campus includes: in lab; in building; adjacent to building; warehouse; transportainer yard; and lay down yard (not related to a specific building). Centralized storage facilities are located south of Battelle Boulevard and on the northern edge of existing buildings north of Horn Rapids Road. A storage working group routinely evaluates storage space use and recommends actions to improve use and minimize operating costs related to storage.

As support functions outside the PNNL Richland Campus are vacated and additional development occurs on the campus, new distributed and centralized storage facilities will be required to support the science mission. Distributed storage will be provided in individual buildings or clusters within the service zones. Transportainers will be discouraged around facilities. Centralized storage facilities will continue to be provided in existing warehouses. New storage facility development will be considered as further development north of Horn Rapids Road warrants; likely near the northern border of the PNNL Richland Campus.

4.2.7 Safety and Security

Today, the campus is open access and pedestrian-oriented without the physical presence of armed guards, security fences or gates. While such a campus is desired to support the scientific culture of open information exchange, it does present issues of personnel, physical asset, and information protection. Additionally, knowing that the public has access to the campus (right up to the exterior walls of most buildings), there is a need to protect the public, personnel, and assets from various research operations. Current safety and security measures include placing parking at the campus perimeter, the exception being access to parking lots from Innovation Boulevard for buildings along that roadway. Pedestrian-scale lighting is provided and access to the campus center is limited to the noted exception. Service facilities requiring some level of public access are grouped together.

Future development will continue to protect and secure personnel and assets using the current measures. Recognizing the security posture could change, this CMP provides the flexibility to place more stringent measures on a localized, function-specific basis using architectural "soft" barriers such as site walls, landscape buffers, topographic changes, and building orientation. PNNL's Security Design Criteria recommends an 80-foot (25-meter) standoff distance from buildings and parking areas (Figure 4.6); this is an example of a "soft" barrier approach. A vehicle barrier or gate mechanism by loading docks would serve a dual purpose: protecting government/fleet vehicles parked behind it and enable security contact for large delivery and service trucks to access the loading dock area.

The emphasis for campus protection will remain on the effective utilization of the Campus Camera System and Emergency Call Box System similar to those employed at large colleges and universities. Additionally, PNNL will maintain a cadre of Security Officers (SOs) to routinely patrol campus, respond to events, and coordinate with local law enforcement. Since all of the existing campus and some of the potential development sites are located in the City of Richland's jurisdiction, a memorandum of understating (MOU) will be maintained with the Richland Police Department that outlines police services on campus to include physical presence of police officers and vehicles on a random

basis. If development on the campus occurs outside city limits, coordination with the Benton County Sheriff's office or other applicable law enforcement agencies will be performed in order to provide appropriate support. In addition, Principles of Crime Prevention through Environmental Design (see U.S. DOE - Securing Buildings and Saving Energy: Opportunities in the Federal Sector, Jeffrey Harris, William Tschudi, and Beverly Dyer) will be considered in proposed development scenarios. The positive security culture along with proper utilization of crime prevention through environmental design techniques allows staff and visitors engaged in normal activity to observe the space around them by the placement of site and building elements. Territoriality suggests providing clear designation between public, private, and semi-private areas to create a sense of ownership and clearly demonstrate the transition between intended uses. Access control includes signage and highly visible site and building elements that discourage access into prohibited areas. Landscape designs for trees and other plantings will be coordinated with campus camera placement and other security measures so as not to detract from campus protection.

Appendix A

PNNL Geographical Entities

Entity	Definition/Description
PNNL Richland Campus	One of four PNNL geographic areas, the PNNL Richland Campus refers to the collection of real property reserved and approved for PNNL use (Figure 3.2). PNNL Richland Campus is located partly in Richland, WA, wholly in Benton County, WA, and in proximity to the Hanford 300 Area. PNNL Richland Campus does not include the PNNL Marine Sciences Laboratory, Hanford 300 Area, or PNNL Other Areas.
PNNL Marine Sciences Laboratory (MSL)	One of four PNNL geographic areas, PNNL Marine Sciences Laboratory refers to the collection of real property reserved and approved for PNNL use in Sequim, WA. PNNL Marine Sciences Laboratory does not include the PNNL Richland Campus, Hanford 300 Area, or PNNL Other Areas.

Entity	Definition/Description
Hanford 300 Area	One of four PNNL geographic areas, Hanford 300 Area refers to the facilities approved for use by PNNL in the 300 Area of the Hanford Site, located wholly in Benton County, WA. These facilities support PNNL missions anticipated to extend beyond 2045 as documented in the Operational Agreement between PNSO and DOE-RL. Hanford 300 Area does not include the PNNL Richland Campus, PNNL Marine Sciences Laboratory, or PNNL Other Areas.
PNNL Other Areas	One of four PNNL geographic areas, PNNL Other Areas refers to facilities/spaces approved for PNNL use and located outside the PNNL Richland Campus, Hanford 300 Area, or PNNL Marine Sciences Laboratory. These locations are typically contractor leased facilities/spaces. Examples include LSB and APEL (located in Richland, WA), Port of Pasco (located in Pasco, WA), and facilities/spaces located in other states such as Albuquerque, NM, and Portland, OR.