2021
Landscape Master Plan
University of New Hampshire

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Section 1
Envisioning the Campus Landscape as a Sustainable and Resilient Asset

1.1 Updating the Landscape Master Plan
The 2019 Landscape Master Plan update establishes a framework for sustainable and resilient design, planning, landscape management and project management practices. Additionally, it sets specific standards for land use planning as well as best management practices within the universityuniversity's footprint in terms of storm water, plant material selection and paving strategies. This update is an opportunity to reconsider the relationship between the Landscape Master Plan and the Campus Master Plan, which depicts the overall organization and build-out of campus facilities, the organization of campus circulation and parking, and the preservation, restoration and enhancement of vital open spaces and natural systems. Historically, the Landscape Master Plan has been a reference document, but with the proper organization of experts and stakeholders dedicated to the goal of implementation, it has the potential to become a true-to-life and dynamic reflection of practice at the university.

The established character and identity of the Durham campus is understood to be an asset and will be well enhanced by reinforcing sustainable and resilient practices, reflecting the universityuniversity's already strong commitment to sustainability as demonstrated by the attainment of Platinum Status in the Sustainability Tracking & Assessment System (STARS) as granted by the Association for the Advancement of Sustainability in Higher Education (AASHE). The 2021 Landscape Master Plan functions both as a landscape planning standard for the university and as a complement to the Campus Master Plan in order to facilitate the university's goals to develop a vibrant, attractive and sustainable landscape.

1.2 Purpose of the Landscape Master Plan
The purpose of the Landscape Master Plan is to provide a frame of reference, as well as set the standard, for the planning, design and management practices of the campus landscape. Preserving the traditional character of the grounds while ensuring that it is developed and maintained according to current ecological standards and best management practices is a complex undertaking. The 2019 Landscape Master Plan update will aid in this effort by establishing design guidelines and landscape standards that foster sustainable planning, design and management practices.

1.3 Guiding Principles
Guiding Principles have been updated to incorporate both the expertise of respected professionals on campus as well as national and international standards for sustainable and resilient landscape planning, design, and management practices.

- ***Express the academic vision of the university*** – Landscape design and open space planning shall strive to improve both the appearance and ecological performance of the university grounds to facilitate the recruitment and retention of an exceptional and

diverse faculty, staff and student body. Campus planning and design shall recognize the landscape as an important educational resource and teaching tool fundamental to the successful fulfillment of the universityuniversity's Land Grant mission.

- ***Balance the needs of the built and natural environment*** – Biodiversity has always been an intrinsic characteristic of the campus landscape and should be fostered wherever possible.
  The universityuniversity has the opportunity to repair and prevent damage to the natural environment, while maintaining the collegiate image of its grounds.

  Through proper management of open spaces, UNH can mitigate the impact of previous and future changes to the built environment on storm water run-off, water quality, aquifer recharge, air quality, and landscape components. Open space planning shall respect the tenets of sustainability and recognize the crucial role that campus grounds serves in sustaining a healthy and resilient community.

- ***Support the daily life of the university*** – Campus open space shall be designed to foster social interaction and connect inhabitants more directly to the landscape. Accommodations shall be made for a variety of uses ranging from large gathering spaces to small niches that facilitate casual encounters and quiet contemplation as well as learning opportunities.

  Open space planning and landscape design will continue to foster the development of a "walking campus" by reinforcing existing circulation patterns and strengthening pedestrian connections. This should continue to be enhanced by a robust wayfinding system of signs and demarcated bollards, directing both pedestrian and vehicular traffic appropriately.

  Landscape design shall strive to gracefully accommodate all members of the campus community by adhering to the tenets of universal design.

  Selective open spaces should be maintained for a broad range of outdoor recreation, both spontaneous as well as scheduled activities.

  Parking lots shall be perceived and designed as integral components of the campus open space system. The layout and design of parking lots shall respect the inherent organization of the campus and shall relate in scale and character to the surrounding landscape.

  Pedestrian paths and gathering spaces require pedestrian-scale enhancements with amenities such as benches, lamps, trash receptacles and pedestrian scaled paving patterns.

  The campus landscape shall be enriched by the placement of appropriately scaled sculpture and public artwork that my also perform a function, such as the already

installed sculptural bicycle racks.

- ***Create a resilient New England aesthetic*** – Landscape design and management shall strive to reinforce the unique and authentic character of the regional landscape while updating it to address the current and predicted effects of climate change—which in New Hampshire include more extreme and variable precipitation patterns, a shift in the species of plants and animals that can thrive here, and more extreme heat in the summer. Campus planners and managers shall uphold the highest standards in sustainable landscape planning, design and management practices: utilizing organic management standards where possible and Integrated Pest Management (IPM) approaches at a minimum; implementing stormwater Best Management Practices and utilizing green infrastructure; incorporating the use of local building materials; and selecting native plant species whenever feasible, while recognizing the need for a novel ecosystem[1] approach to enhance ecological functions.

  Campus construction shall respect the integrity of healthy soils and plants and make adequate provisions to protect existing trees and shrubs. Provisions shall be made and strictly enforced during the construction process to minimize adverse site impacts including preventing tree root damage, limiting soil compaction, and avoiding contamination of the soil and groundwater.

  Open space planning and design shall strive to strengthen the campus's unique sense of place by enhancing the Great Lawn and transforming the perceived image of a traditional New England college to include novel ecosystems and green infrastructure.

  Landscape design and open space planning shall strive to preserve and promote the adaptive capacity of campus woodlands and groves; reconnect fragmented habitats and rehabilitate degraded ecosystems; prevent the spread and address the impact of invasive species; and utilize green infrastructure components where appropriate. The potential for rehabilitating degraded landscapes (*e.g.*, the Ravine, College Brook, Pettee Brook) should be prioritized in the planning process for new projects and design interventions.

- ***Maintain and strengthen the relationship with our communities*** – The quality and character of campus edges has been greatly enhanced by implementing complementary planting design, signage, lighting, and other site amenities since the 2004 Landscape Master Plan update. Campus gateways have been clearly defined and enhanced with landscape treatments that are inviting and announce arrival at points agreed upon with the town of Durham. Additional site amenities along the campus edges may be added when identified in collaboration with the town of Durham.

1 "A novel ecosystem, as defined by Richard Hobbs and his colleagues, is "a system of abiotic, biotic, and social components (and their interactions) that, by virtue of human influence, differs from those that prevailed historically, having a tendency to self-organize and manifest novel qualities without intensive human management." Trace source back from https://www.ser.org/news/311030/Whats-Wrong-with-Novel-Ecosystems-Really.htm

Open space planning shall strive for the development of outdoor spaces, such as walking trails, which serve all members of the Durham community, residents and students alike.

Downstream ecological effects of the universityuniversity's footprint on adjacent neighborhoods and the Oyster River watershed shall be considered in campus landscape design and open space planning in order to minimize adverse impacts. Grading plans, new plant installations, and built interventions shall be used as opportunities to improve stormwater runoff treatment, minimize sediment deposition, and provide habitat for local flora and fauna

Section 2
Landscape History and Design Principles

2.1 Section Introduction

Historically, the campus landscape has always been one of the university's greatest assets, drawing in students and faculty to its aesthetic qualities including the Great Lawn's broad trees and rugged outcrops, the Ravine's cooling natural streambed and the picturesque paddocks and pastures. Today, the campus landscape is all of these things, but also performs as an integral part of the campus infrastructure and stormwater management system, drawing to the university some of the most sought after experts in green infrastructure, ecology, and plant science both in terms of implementation and research.

As a result of a wide array of landscape planning, management, and design expertise within the university, the campus landscape aesthetic has evolved into one at the beginning stages of adaptation for resiliency and sustainability. While still reminiscent of its origin and celebratory of its New England character, the campus landscape is also incorporating new practices such as integrated pest management, permeable surfaces, green stormwater infrastrucure, and innovative plant systems. In this way, the universityuniversity can be adaptive to the effects of urbanization and climate change. As invasive species and changes in rainfall patterns increase exponentially, they must inform a continuously evolving toolkit including plant and material options.

These exciting developments have occurred as part of a change in the cultural landscape at the universityuniversity as well. The Sustainability Institute was founded in 1997, making it the oldest endowed sustainability program in higher education in the United States. Not long after came the founding of the New Hampshire Stormwater Center in 2002, whose mission includes dynamic research, testing, and educational programming that serves as a technical resource for municipalities all over the country. A few years later in 2007, university President Mark Huddleston made the university of New Hampshire the first land-grant university in New England to sign the American College & university Presidents' Climate Commitment (ACUP-CC). As a result of these and other important innovations and commitments, the Princeton Review Green Honor Roll listed UNH from 2008 all the way through to 2019.

The Ecosystem Task Force (EcoTF) was created to do justice to this legacy as it relates to the potential held in the campus landscape. Comprising experts and professionals within the university, the EcoTF is committed to developing and enforcing policies and practices that enable the UNH campus to become more resilient and sustainable, recognizing that a robust maintenance plan and schedule for landscape management—reinforced by the appropriate allocation of resources—are essential to the implementation of the aspirations laid out in this document.

Campus landscape management practices and the value associated with them have a profound impact on the capacity of the landscape to continue to be both beautiful and ecologically robust. The universityuniversity had been lucky to be able to use minimal resources for the purposes of

landscape management in its early years, but with increased construction footprints and increased use of outdoor spaces, aging landscape features, increased presence of invasive species and with climate change continuing to unfold at an accelerated pace, this will no longer be possible. On the whole, Grounds and Facilities have seen a decrease in allocated resources and the campus landscape has suffered the results.

Snow removal comprises a large majority of the budget available to Grounds and Events Management due to the abundance of snow and ice in the New Hampshire climate. This limits the available funds for landscape maintenance and management, resulting in reduced ability to carry out best management practices, thus compromising green infrastructure components such as unvacuumed porous paving and invasive takeover of rain gardens. The universityuniversity has also been challenged in beign able to hire and retain employees who can develop adequate knowledge and skills in botanical management.

Additionally, tried-and-true snow removal practices have had adverse effects on water quality, plant health, and soil chemistry both on campus and in the greater Oyster River Basin as runoff contaminated with salt and sediment is directed into Pettee Brook, the Oyster River and College Brook. This leads to degraded edge conditions and biodiversity loss both on campus and within the larger watershed, of which UNH has a significant footprint.

2.2 Regional Influences and Relationships

The university campus spans an elevation change of over one hundred and fifty feet (150'). The campus highland is in the northwest quadrant on the Woodman Research Farm; the low point is diagonally across campus in the southeast quadrant along the Oyster River. Ridges and valleys, hilltops and knolls create a rolling topography and channel water into three major waterways; College Brook, Pettee Brook, and the Oyster River. Topography and geology also combine to create numerous wetlands across the campus landscape.

These water bodies and the campus at large sit within the Oyster River Watershed, which is also shared by the town of Durham. The core campus lies just adjacent to the Oyster River, while the contiguous campus encompasses a portion of it within its over 200 acres of forested land collectively known as the College Woods. This portion of the campus is used extensively for research and teaching in addition to providing the town of Durham and the university with a portion of its drinking water supply sourced from the Oyster River Reservoir. As a result, the universityuniversity has a shared responsibility with the town of Durham to protect and enhance the quality of the river's ecosystem. This responsibility is further shared with the communities upstream and affects the quality of life for those communities that reside downstream.

The university can also be thought of in terms of its vegetated ecosystems and its position on the edge of two major ecoregions, the Northern Forest and the Central Forest. The indigenous plant palette of these two forests, and of the university footprint, is rich in species diversity, including firs, pines, hemlocks and birches of the Northern Forest as well as oaks, maples ashes and other hardwoods common to the Central Forest. This variety has led to the formation of unique habitats and microclimates capable of supporting a diverse population of flora and fauna.

2.3 Landscape Evolution

In June of 1891 the Board of Trustees commissioned Charles Eliot, a distinguished landscape architect and "regarded as a good man in his profession," to layout the grounds for a new college on the old Thompson Farm in Durham, New Hampshire. Aside from an orchard and a few scattered woodlots the land was rolling and relatively open.

The bulk of the farm was in pasture and hay fields. Early photos indicate that portions of the farm had been out of cultivation for some time and were in the early stages of succession. Red cedar, birch, brambles and other early succession plants were scattered amid the fields, especially in the area of the present day Ravine. There appears to be no record of the plan Eliot developed but through his correspondence with Professor Pettee and other members of the Board, we know he looked to the topography for clues in organizing the campus and sited Thompson Hall on the knoll occupied by Ben Thompson's former home. Eliot sited other buildings along this ridge and entered into negotiations with the railroad to realign their tracks to the west to enhance his plan.

Vestiges of this landscape are evident today and contribute significantly to the character of the university campus and its sense of place. Perhaps the most evident feature is College Woods Natural Area, formerly the old Thompson woodlot. Other contemporary features such as the agricultural fields, barns, and paddocks recall this period, as does Thompson Hall. Consequently, preserving and enhancing the agrarian character of the campus landscape, especially along Concord Road is fundamental to the preservation of the campus's unique sense of place.

By the 1920's the university had grown, and the agrarian landscape was being transformed into the collegiate campus many hold dear today. In June of 1924, almost thirty-three years to the day that the Board hired Charles Eliot, the university secured the services of another landscape architect, Brenner Pond, also of Boston. Pond was a graduate of Dartmouth College, and later in his career became the head of the Department of Landscape Architecture at Harvard. Pond worked closely with Eric Huddleston, a professor in the architecture department and the future designer of twenty-two of the university's most distinguished buildings.[1] Together they created a plan that formalized the rural campus and introduced a new vocabulary of building and open spaces. Drawing upon 18th century Federal/Georgian style of architecture for inspiration, they organized the campus around a series of well-defined open spaces.

It was during this period that the campus infrastructure—roads, concrete walkways, dams, and buried utilities (sewer lines and drainage pipes—began to impact campus aesthetics. At the same time, new amenities such as terraced gardens, woodland trails, flowering shrubs and vase shaped street trees (elms) were introduced to the campus landscape. It was also during this period that the university introduced campus open spaces including the quadrangle, the athletic complex, and the amphitheater.

The landscape that evolved during the twenties and thirties typifies the landscape of the small New England college; large greenswards, well defined by red brick buildings and stately shade trees. This is the period that witnessed the transformation of the pastures along Main Street into the Great Lawn. It is important that the formal character of these spaces be preserved and that

thoughtful renewal plans ensure that the spatial and aesthetic integrity of this classic landscape be retained.

In the decades following WWII, the university experienced steady growth and, by the early sixties, the southern expansion of the campus had jumped the Ravine, including intrusions into the Ravine caused by construction of Spaulding and the MUB. No longer considered the back of the campus, the Ravine became an important central open space and counterpart to the open Great Lawn. While the early succession landscape of the agrarian period had matured into a shady glen dominated by white pine and mature hardwoods, the hardpiping of storm drainage and incidental building waste degraded the conditions of the College Brook. Recognized as an aesthetic amenity and serving as a network of pedestrians corridors, the Ravine continues to struggle to regain some of its ecological function.

The stately shade trees planted throughout the Great Lawn created a serene setting that, unfortunately, belied subtle, yet detrimental, changes occurring throughout the rest of the campus landscape. Many of the trees and shrubs planted earlier in the century had reached maturation and were beginning to experience decline. The arrival of Dutch Elm disease decimated the majority of street trees planted along Main Street, and the expansion of surface parking eroded campus open space. Years of economic strains and tightened operating budgets led to deferred and reactive maintenance practices.

Campus expansion also had a detrimental impact on the campus's natural systems, especially with regard to a lack of stormwater management. In the 1960s and 1970s, lax regulatory policies allowed for, and indeed encouraged, the burial of stream segments and the deposition of runoff into campus waterways. The proliferation of surface parking, roads, and impervious roof surfaces intensified runoff and strained the campus's capacity to control the discharge of stormwater. As a result, flooding became a perennial problem in College Brook. Contiguous woodlands and open space systems were fractured, and the proliferation of invasive plant species radically altered the vegetative character of the Ravine.

These setbacks informed a heightened environmental awareness while the 2004 Landscape Master Plan was being created, and facilitated a shift in attitudes and design practices that encouraged stewardship while allowing for development and further expansion of the campus. The Landscape Design Guidelines were created in order to facilitate innovative design and sound management of the landscape to ensure that the unique character and sense of place on campus is not only preserved but enhanced with the passage of time.

This 2019 update seeks to update these design guidelines to reflect current best management practices in addition to expanding the scope of the original philosophy to include planning and maintenance practices as well as design.

2.4 Landscape Systems and Open Space Design

The university's open space system seeks to create a harmonious environment in which the aesthetic and ecological quality of campus life is enhanced and has an enduring effect on the collegiate experience. This. in turn, enhances faculty, staff and student recruitment and retention

as well as alumni loyalty. In the early campus planning days, there was great consideration of both topography and waterway footprints when selecting placement for building sites. While this fell to the wayside during 1950s–80s, campus planning efforts have begun to embrace this approach once more.

Topography and water are two landscape systems among many which serve distinct roles ecologically, socially, and functionally. In order for these systems to continue to serve such a vital role in campus life, the university must take action to preserve and promote their adaptive capacities. It is vital to develop and maintain an ecologically robust, resilient, and sustainable landscape if the campus is to continue to be a compelling draw for the university. The renewal and enhancement of built systems is a part of this endeavor and must take into consideration these systems to bridge the gap between the university's established character and the character of resilient and sustainable practices in the campus landscape.

2.5 Landscape Typologies

Campus woodlands include the College Woods Natural Area[2], residual forests in the southwest quadrant, the Northwest Woods and forest lands on the southern edge of the campus between the Oyster River and Mill Road. They constitute a major portion of the campus open space system and are characterized by native trees, shrubs, and groundcovers, serving an essential environmental, social, and recreational role on campus. They provide essential habitat for native flora and fauna, absorb carbon dioxide and release oxygen, trap dust particles, filter air pollution, prevent soil erosion, and reduce runoff into campus streams and the Oyster River (thereby protecting and enhancing water quality in the community water supply).

Woodlands also enrich the quality of campus life for students, faculty and staff as a valuable educational resource, formal teaching laboratory and outdoor classroom. It is important that they are protected from undue encroachment as deforestation is not easily mitigated. Re-establishing canopy is very difficult once a portion is removed. Additionally, the campus has historic trees that should be valued and protected as natural *and* cultural treasures of the university.

To facilitate an increase in use and appreciation, it is important that pedestrian connections between the academic core of the campus and the woodlands be clearly articulated and that woodland trails be incorporated into the larger wayfinding system. Trails are an important recreational resource, offering ample opportunity for active and passive recreation. They need to be well-maintained and clearly marked with interpretive markers and orientation maps. Interpretive signage should be used to describe the woodland's unique heritage and the important role they serve in creating a resilient New England campus aesthetic.

2 "This designation places these stands in a preservation status. This area was designated in 1961. Since this time nothing has been done to alter natural process within the Natural Area. Dead or dying trees have only been removed when they pose a hazard to trail traffic and safety." From the Office of Woodlands and Natural Areas website, accessed August 5 2021, https://colsa.unh.edu/collegeWoods

Gateways to the campus woodlands should be clearly marked and delineated with appropriate landscape treatments. Pedestrian amenities such as directional signage, lighting, benches, and trash receptacles should be incorporated into gateway designs. To ensure that the rustic character of the woodlands is preserved, site furnishing should be restricted to major gateways. However, consideration should be given to the strategic placement of a few granite "pedestals" along the trails to offer hikers an opportunity for rest or enjoy quiet contemplation.

Campus Groves are isolated swaths of forested area comprised of mostly native trees, shrubs, and groundcovers that are predominantly remnants of woodlands that evolved on site after farming operations ceased in the 19th century. These include the woodlands around the McLaughlin/Lord/Jessie Doe dorms, the area around the New England Center, the area surrounding the Alumni Center, the Ravine and the wooded area around the Christensen/ Williamson/Hubbard dorms, and the Philbrook Dining Hall. There are also smaller groves along Main Street adjacent to the athletic fields.

Campus groves serve the same ecological functions as larger woodlands but are also important in providing pockets of habitat in the central portions of the campus while reducing the heat island effect. As a result, future expansion near or adjacent to campus groves should be thoughtfully designed and carefully executed to ensure that the spatial integrity and ecological vitality of these areas is protected.

Management of these portions of campus must address issues of resilience within these areas, including a phased plant list that is responsive to the effects of an already-changing climate as well as those changes that are projected to occur by 2050. This acknowledges those species that are currently in decline on campus due to an increase in disease and pest problems, an increasingly irregular rainfall pattern and periodic drought.

Additionally, the university seeks to facilitate a more ecologically robust treatment for edge conditions surrounding isolated woodlands within the academic core of the campus as well as on the edge of the woodlands west of the railroad tracks. This can be achieved with minimal impact to campus aesthetics by thoughtful reduction of maintenance operations (mowing, weeding, and tree removal), creation of a feathered woodland edge environment, and the strategic placement of low-maintenance plant systems such as wildflower meadows (comprising native perennial forbs and grasses), which will enhance biodiversity and the capacity for climate adaptation and resilience. Aggressive invasive plant species should be eradicated where feasible. The removal of organic matter such as fallen leaves and fallen trees (unless obstructing circulation) or the cutting of snags (unless posing a safety hazard) in the interior of these areas should be avoided.

Wetlands and Waterways, together, constitute the lifeblood of the campus ecosystem. Wetland is the collective term for marshes, bogs, and other areas where water covers the soil, or is *at* or *near* its surface at various times throughout the year. Waterways are rivers, streams, brooks, gullies, and swales.

Wetlands play an integral role in sustaining a diverse campus ecosystem as indispensable habitats, harboring a multitude of soil microbes, plants and wildlife in all forms. In addition,

wetlands help regulate water levels and reduce seasonal flooding, reduce soil erosion, enhance water quality and provide opportunities for recreation while at the same time contributing to the natural beauty of the campus and its sense of place.

The majority of existing campus wetlands are found in the southwest and northwest portions of the campus, west of the railroad tracks. it is also important to note that much of the campus development was built on and continues to occupy filled wetlands. As such, the university has continuing maintenace issues that stem from past development decisions. To avoid adding similar issues in the future, it is important that all wetlands on campus be clearly identified and delineated and valued as the university considers the implications of proposed future build-out of the campus. To that end, a robust description of many of the existing campus waterways and wetlands found west of the railroad tracks is provided in the 2012 *Assessment of College Woods Part I: Inventory of Natural Resources and Uses.*[3]

Pettee Brook, College Brook, and the Oyster River are the principal waterways and flow west to east channeling the majority of water through campus and eventually into Great Bay. In addition to Pettee and College Brook there are a number of smaller streams on campus, some of which are seasonal but nonetheless serve an important role in watershed management.

Channel modification, reservoir construction, and land use changes have had an adverse impact on the vitality of campus waterways and wetlands, leading to problems downstream. The construction of the railroad line impeded the flow of water through campus and the subsequent construction of dams on Pettee Brook and the Oyster River impounded water for community reservoirs. Segments of Pettee and College Brook have been buried or channelized. The development of impervious surfaces such as streets, parking lots, and rooftops has significantly increased the amount and rate of runoff at the campus edge. This has resulted in periodic flooding and the degradation of the watershed downstream. It is important that future development compensates for these actions and includes remedial treatments that revitalize these systems and restore their ecological integrity.

Meadows, paddocks and open fields constitute a significant portion of the campus open space system. Located primarily west of the railroad tracks along Concord Road, these spaces are important to fulfilling the university's Land Grant mission. For the most part they are working landscapes and their management is influenced by cultural practices related to raising crops and livestock. Contemporary management practices such as integrated pest management and the careful monitoring of soil conditions has mitigated the adverse impact that traditional agricultural practices once had on the campus environment. In fact, the meadows and open fields serve an important environmental role by providing habitat for pollinators, birds, and small mammals. They are also effective in reducing overland flow rates and absorbing toxic substances from site runoff, which diminishes the build-up of noxious substances downstream where high concentrations can have an adverse effect on fisheries and other fragile ecosystems.

[3] See https://unh.app.box.com/file/843440336064

Aesthetically, the meadows, farm fields, and paddocks along Concord Road contribute to the university's image and unique sense of place. It is important that the rural character along this corridor be preserved and enhanced and the haphazard placement of structures and utilities should be avoided whenever possible. Wide visual sweeps that amplify the meadow image should be preserved and the open space integrity of meadows should be strengthened by the selective introduction of hedgerows, tree groupings and fence line treatments that enhance important edges and the organization of the agricultural complex. Four board equestrian fences should be used to delineate paddocks and pastures. These fences should be stained white and be kept in good repair and grass and noxious weeds should be kept in check so as to present a neat and orderly image of the campus. Large shade trees should be planted to enhance the quality of "farm lanes" connecting meadows and open fields with agricultural buildings.

2.6 Semi-Built Environment

Campus Quadrangles are spatially well-defined areas enclosed on three or more sides by academic or residential buildings. They represent one of the basic building blocks for defining campus open space, especially in the dense academic core. Quite often referred to as open quads (bordered on three sides) or closed quads (bordered on all four sides) they are usually formal in character, i.e. restrained planting and simple geometric forms and walkway alignments.

The landscape treatment within a typical quad, such as the area at Hitchcock/Randell/Devine, consists of level lawn, shade trees, and occasionally groups of shrubs at the corners or adjacent to the main entrances to buildings. Sidewalks tend to be axially aligned with building entrances, often crisscrossing the lawn or forming a perimeter around its edges. In addition to formal quads, there are a number of modified open quads on campus such as the area surrounding Christensen and Williamson Halls. These spaces are usually informal in character and may be defined on only two sides. In such cases the larger landscape flows into these spaces in a manner that blurs the edge of the space making it difficult to discern where the quad ends and the larger landscape begins.

The well-defined character of a quadrangle strengthens its perception as an outdoor room. Consequently, quadrangles are expected to accommodate a multitude of active and passive uses. Quadrangles often host social functions such as weekly BBQs and annual alumni receptions. This places extraordinary demands on the turf. It is therefore important that turf areas within quadrangles be designed and maintained in ways that can accommodate high levels of use.

Formal building arrangements engender formal landscape treatments; loose and open arrangements, typified by the modified quad, call for more casual, contemporary landscape treatments. In all cases, landscape treatments within quadrangles should complement the architectural character of the buildings that define the space. Landscape treatments within quadrangles should be conducive to active recreation while allowing for smaller niches along the edges that can accommodate more passive and solitary experiences. Quadrangles should be well furnished with comfortable benches, pedestrian scaled lamps, trash receptacles, and bicycle racks. When spatially feasible and aesthetically appropriate, recreation facilities such as volleyball courts and horseshoe pits should be incorporated into quadrangle designs.

Tree and shrub plantings within quadrangles should be durable consisting mostly of strategically placed trees and open lawn. Avoid trees that are shallow rooted and cast dense shade (sugar maples, beech); consider trees that have open canopies to encourage dappled shade, allowing underlying grass or groundcovers to receive sufficient levels of light. Grass mixes should be selected for high wear tolerance and shade tolerance where needed. Careful consideration should also be given to the placement of shrub masses and evergreen trees. Avoid creating places of concealment, especially adjacent to walkways, first floor windows and building entrances. Resources must be allocated to allow for the pruning of trees, hedges, and shrub masses regularly as well as for the immediate removal of graffiti and repair of damaged site furnishings to maintain site character and "pride of ownership."

Campus Courtyards serve as social hubs and "urban stages" for university life. They are areas where social gathering and interaction occur and should be spatially well-defined and flexible to accommodate for a variety of events ranging in scale from political rallies and protests to solitary retreats.

Courtyards tend to be most successful when they are located at the intersection of major pedestrian corridors with multiple entry points and with the exclusion of vehicles. Visual connections should allow for unobstructed views of adjacent spaces and pathways. Courtyards should be predominately paved, preferably with attractive porous unit pavers or combinations of pavers and bands of concrete. These materials create a more welcoming and humane affect, while allowing for stormwater to infiltrate. Landscape treatment (shrubs, flowers, and lawn) within courtyards should occur primarily on the periphery although large shade trees should be strategically placed within the courtyard to provide shade and spatial definition. South-southwest exposures are ideal for courtyards and if thoughtfully designed they can create "sun pockets" that can extend the outdoor season in early spring and later autumn.

Ample seating is essential to the successful development of a courtyard. Provide choice in the arrangement of benches and chairs. Seating should also be built into the design, capitalizing on the inherent sitting opportunities available, such as ledges, steps, and low walls. Combine sitting areas with trees; establish groves to create a sense of enclosure. Allow for one linear foot of seating area for every thirty square feet of courtyard space. Courtyards should also be amply lit to avoid dark corners or poorly lit niches and nodes. All courtyards and seating areas should be designed to universal accessibility design standards.

Courtyards are ideal locations for food vendors. Food animates campus spaces and attracts faculty, students, and staff facilitating casual encounters and enhanced opportunities for learning. While there is a recognized need for them, there are relatively few courtyards on the university campus. Campus courtyards that do exist include Murkland Courtyard, Conant Courtyard, Whittemore Plaza, and several smaller quasi-courtyards such as the entrance court in front of Morse Hall and the drop off area at the MUB. As the campus expands, consideration should be given to the development of more appropriately scaled and adequately landscaped outdoor spaces and courtyards.

Campus Lawns create a sense of balance and harmony among diverse campus spaces. The Great Lawn, with its broad expanse of turf, defined by prestigious buildings and large shade trees, projects a powerful and memorable image. It typifies the traditional character of a collegiate landscape. Creating a resilient approach to lawn design and management is fundamental to ensuring that the character and identity of the UNH campus can continue to thrive in a changing climate while accomodating ecologically based design.

For many, a lush, green carpeting of grass is a highly desirable element in a campus landscape, affording students, staff and faculty social and recreational opportunities. Properly selected and maintained grass offers excellent wear tolerance, enabling it to be used for active as well as passive recreation. The lawn in front of Scott Hall, for example, with its southern exposure is a popular gathering area for students in the late spring and early fall. Sunbathing, studying, Frisbee throwing, and picnicking are featured activities.

However, lawns are also are inherently high-maintenance, with little ecological value. Cultivating large expanses of turf is labor intensive, consumes significant amounts of energy, and requires inputs of fertilizers, along with vigilant pest monitoring and management. Runoff water carrying fertilizers and pesticides may contaminate surface and groundwater when left to its own devices. Stormwater Best Management Practices (BMPs),[4] Integrated Pest Management (IPM)[5] and careful nutrient management plans should be utilized in the design and management of lawns in order to minimize these consequences.

Careful consideration should be given to the layout and configuration of lawn areas to ensure that they can be efficiently mowed and maintained. Consideration should also be given to circulation patterns around and across proposed lawn areas. Designers should strive to accurately predict pedestrian flow and provide functional walkways in the initial design. To discourage the development of "cow paths," the installation of post and chain details, low plant beds and the strategic placement of site furnishings such as benches, trash receptacles, and bike racks should be considered in locations prone to shortcutting.

When designed, installed and maintained properly, lawns can minimize soil erosion, trap dust particles, bind and store carbon dioxide, furnish oxygen, filter and purify water, and moderate surface temperature and humidity. Avoid the indiscriminate use of lawn drains and other devices that quickly channel water into the storm water system. When designing lawns, create relatively flat areas (2% - 5% pitch) that comfortably allow for individual to large group activities; avoid lawn areas with slopes greater than 4:1 (25% grade). However, more robust plantings tend to do a

[4] These are practices recognized by the Environmental Protection Agency and other regulatory and permitting agencies that facilities implement to reduce contaminated runoff and protect water quality. See https://www.epa.gov/npdes/national-menu-best-management-practices-bmps-stormwater

[5] From UNH Extension website: "an approach that uses chemical pesticides as a last resort, combining a variety of approaches to prevent and control pests and diseases. IPM doesn't preclude the use of chemicals, nor does it require the use of organic products, but rather it's an approach that results in less chemical use and successful management of pest challenges." *Accesed August 5th 2021,* https://extension.unh.edu/blog/garden-IPM

better job at these tasks and interstitial spaces in which lawns are not heavily used should be considered for pollinator meadows or alternative ground covers.

Campus Gardens are an opportunity to increase biodiversity using plant materials that are adaptive to climate change, while enriching the quality of campus life, accommodating a range of experiences. At times, gardens foster gatherings and social interaction and, at other times, provide solitude and opportunity for quiet contemplation and renewal. Campus gardens range from spatially well-defined areas intended to serve as outdoor rooms to thematic collections of individual plants thoughtfully arranged in the landscape. The new garden on the west side of Murdough Hall is an example of the former; the landscape planting in front of Hood House is an example of the latter. In either case, they are dynamic spaces and even the most carefully planned "maintenance free" garden demands periodic attention. Therefore, campus gardens should be developed in conjunction with a long-term maintenance plan that ensures their vitality and functionality.

While they may serve many missions and assume many styles of expression, it is important that gardens be perceived as more than a mere collection of plants artistically arranged. Gardens are built spaces that reinforce the overall organization and structure of the campus landscape. They should relate to the greater landscape in scale, proportion and use and be conceived as extensions of a balanced open space system. They should also relate aesthetically, contextually, and spatially to the adjacent buildings and landscapes they are intended to serve. The garden can help restore the fragmented landscape, and in such cases, preference should be given to a mix of resilient native plants and adaptive novel species to insure success as climate and site conditions continue to change.

Gardens should reinforce the intellectual mission of the university as a leader in sustainability and resiliency, serving as outdoor classrooms and living laboratories. The amphitheater on the east side of Rudman is such an example. Opportunities exist to create similar spaces adjacent to the Paul Creative Arts Center and within the enclosed area adjacent to Parson/Iddles. Future opportunities will present themselves such as the potential to reestablish the landscape between Rudman and Hewitt. When designed to support the academic mission of adjacent buildings, it is important that gardens relate in scale and architectural character.

The Ravine is a campus open space used for teaching and research. Improvements to the Ravine, such as defining its boundaries with a stonewall and creating portals that delineate entrances could strengthen the perception of this area as an important campus open space. Opportunity exists to further enhance and extend this natural area by reclaiming the landscape currently occupied by the Campus Crossing Lot and complimenting the natural character of the Ravine northward into the area of the Dell with pollinator meadows. Landscape concepts for the Ravine must respect College Brook and its floodplain, which means prioritizing natural ecosystem features and functions when designing, constructing, and/or maintaining access for people.

2.7 Built Environment

Gateways are thresholds and are meant to convey a sense of arrival or signal transition from one campus area to another. Some vehicular gateways, such as the intersections of Mast Road and

Concord Road or the intersection of Main Street and College Road require bold statements in order to clearly announce arrival and entry onto the campus. On the other hand, the intersections of Edgewood Avenue and Strafford Road or Main Street and Pettee Brook Lane are potential vehicular gateways but need not be elaborate in scale or design and may only require a subtle recognition that the visitor has arrived on campus.

Throughout the rest of the campus there are opportunities to create a series of pedestrian gateways to accentuate the transition from one area of the campus to the next. Entrance points into the Ravine, the Great Lawn, College Woods Natural Area and the Northwest Woods as well as various locations along College Way, Demeritt Way and Library Way are logical opportunities for gateways and offer excellent opportunities to enrich the pedestrian experience on campus.

Gateways within the interior of the campus should be designed to a pedestrian scale. It is important they be spatially oriented and clearly articulated with paving changes, site furnishings, signage, and vertical elements such as gate posts, trees or shrub massings. Pedestrian gateways are also points of orientation. Wayfinding should be prioritized in the development of gateway designs, noting building locations and other destination points. Lighting should be adequate to illuminate writing and associated artwork. Gateways are appropriate locations for bus stops and elements such as bus shelters and bicycle storage.

Campus Streetscapes facilitate circulation through or around the campus. Approximately a dozen streets make up the campus streetscape system. The historic lack of attention to stormwater management on streets presents a great opportunity—and indeed, need—for robust stormwater green infrastructure practices. Streetscapes interior to the campus (College Road, McDaniel Drive, Forest Park, Williamson Drive, Demeritt Circle and Gables Way) help organize and connect disparate areas of the campus and have the capacity to do the same in terms of stormwater runoff. These streetscapes should be unified through attractive green infrastructure enhancements in order to reflect university commitments and project an overall sense of harmony and balance as they relate to the campus' unique character and identity.

Many of these streets also serve as important pedestrian corridors and vital components of the campus open space system. While campus streets should be designed to safely accommodate vehicles, they should be detailed to a human scale to create a more pedestrian ambience. This can be accomplished through the use of street trees, pedestrian lighting, and street furnishings such as benches and trash receptacles. Pedestrian crosswalks should continue to be clearly delineated and traffic calming devices such as speed tables or textured pavements within pedestrian crossings should be used to reinforce a pedestrian-oriented condition within the academic core of the campus.

In addition to enriching the pedestrian experience, streetscape enhancements improve the overall image of the university and help project a positive first impression of the campus. From the east, the UNH campus begins with a turn onto Main Street; from the west, this is the case along Concord Road; from the north this is true for the intersection of Edgewood Avenue and Strafford Road. Vehicular gateways should be developed in these areas in order to help convey a sense of arrival and entry onto campus. Garrison Avenue, Pettee Brook Lane and Mast Road Extension

are important streets shared by the university and community. These streets should be viewed as shared open space that forms a common edge between the university and the Town of Durham. Streetscape improvements in these areas should be done in cooperation with local authorities and neighborhoods.

Campus Walkways, along with campus streets, provide structure and organization to the campus landscape. Walkways link buildings and open space and unify disparate areas into a cohesive whole. The hierarchy of campus walks should be conveyed through their organization, alignment, width, and the use of materials. Primary walks (College Walk, Library Way, and Demeritt Way) should be direct and wide enough to comfortably accommodate anticipated levels of use. Secondary (the majority of campus walks) and tertiary walks should be developed in a manner that links destination points with primary walks. New walkways should serve as an opportunity to introduce stormwater best management practices utilizing unifying elements in harmony with the surrounding area while respecting the hierarchy established for campus walkways.

A visitor's first impression of the campus is influenced by the condition of campus walkways. Well-designed and maintained walkways enhance the pedestrian experience and project a positive image of the campus landscape. Haphazard "patch jobs" and the inconsistent use of paving materials throughout the campus compromises aesthetics, diminishes the public's perception of the landscape, and creates potential safety hazzards.

Walkways are also social spaces. They are the places for casual conversations and chance encounters; they are places where students, faculty, and staff meet. Small nodes or courtyards at the intersections of walkways facilitate human interaction. Tertiary walks and trails facilitate contemplative strolls. The addition of amenities such as benches, trash receptacles, kiosks, and shade trees at these locations further enhance the users' experience.

Bicycle Facilities become increasingly important as bicycles become a preferred method of transportation. The university must take appropriate measure to insure safety and access. Protected, contiguous bicycle lanes should be considered as the preferred route design method, with shared use pedestrian/cyclist connectors from the main campus to peripheral parking lots, outlying parcels and future housing developments as a secondary option. In the meantime, cycling should not be encouraged or allowed on campus walkways. Separate bike routes should be clearly delineated and marked with appropriate signage.

In addition to accommodating cross-campus circulation, the safe storage of bicycles should be a primary consideration when developing campus site designs. In the west lot, provision should be made for the secure, overnight storage of bicycles. Similar accommodations should be considered in A-Lot. Bike racks should be employed in sufficient numbers to minimize the prevalence of locking bicycles to handrails, lampposts, signposts, and trees. Racks should be strategically located along primary walkways and within reasonable proximity to building entrances. They should be sensitively sited in well-lit areas with high visibility and well integrated with the architecture and surrounding landscape. Bike racks should not obstruct the regular flow of pedestrian traffic or snow removal, and other maintenance issues should be taken into

consideration when siting the racks. Consideration should also be given to incorporating bike storage into the design of transit stops and bus shelters.

Parking Lots are essential for providing campus access. Efforts must be taken to mitigate the adverse impact surface parking has on the landscape by reducing surface parking where feasible and thoughtfully designing parking lots that treat and infiltrate stormwater runoff while respecting the character of primary campus open spaces. The configuration of parking lots should reflect the inherent organization of the campus and should relate to the scale and character of the surrounding landscape. Parking islands should be no smaller than 12' feet wide and planted with salt- and drought-tolerant species. Adequate depth of soil should be ensured if planting trees. Islands can be designed to enhance the aesthetics of parking areas, treat and infiltrate stormwater, and reduce the impact of heat build-up associated with large expanses of paved areas. Rather than creating mounded islands, the islands can be slightly depressed infiltration areas with curb cuts to accommodate surface water runoff collection.

While screening is important, it is more important that design solutions reinforce visual and physical connections between adjacent open spaces and preserve the sense of free flowing open space. Pedestrian connections between parking lots and primary destination points should be designed as integral components of the campus pedestrian system and should be spatially well-defined and nicely landscaped.

Equally important are programming considerations for parking lots, especially surface lots interior to the campus where parking demand is high in the daytime but lower in evening. Parking lots can be designed to accommodate social and active recreational uses as well as parking uses. Fences, seat walls and landscape plantings should be incorporated into landscape plans adjacent to parking areas to provide spatial definition, screening, and to enhance the pedestrian character and scale of the facility. Amenities such as bluelight phones, benches and seating areas, bus stops, trash receptacles, adequate lighting, plantings, bike racks and bicycle storage lockers should be incorporated into design solutions to lend a human scale to parking areas and enhance their aesthetic appeal.

Building Plates encompasses the portions of the campus landscape that are disrupted due to the construction of new buildings or the restoration of existing facilities. This includes project staging areas and all other portions of the landscape disturbed or altered during the construction process. Policies for reducing the environmental harm that results from construction activity are laid in the Landscape Management for Project Managers document,[6] which requires consistent enforcement.

Tree and shrub placements should correlate to the architectural massing of the building and frame and enhance building entrances. Entryways should be safe and well lit. Avoid creating places of concealment, such as large shrub masses near first floor windows or building entrances. Deciduous trees should be sited along the south-west sides of buildings to provide cooling shade.

[6] 2005 manual prepared by Saucier + Flyn LtD. Landscape Architects, for UNH. See https://unh.app.box.com/file/311356472472

Evergreen trees should be strategically located to screen buildings and outdoor areas from the prevailing northwest winter winds.

Landscape designs should allow for reasonable service access to buildings to facilitate the maintenance of building systems or the delivery of goods and services. Dumpsters and utility locations should be thoughtfully incorporated into the overall site design and should not be located near primary building entrances or along primary walkways.

Utility infrastructure should be sited to ensure preservation of existing landscapes, wetlands, and waterways and allow for opportunities to rejuvenate degraded ecosystems. Align utilities under the streets, walks, and paved courtyards to minimize conflict with natural areas and to ensure maximum landscaping longevity. Consolidate new underground utilities in multiple, parallel installations. Locate surface hatches, utility covers, ventilation, and access elements within paved areas to the greatest degree possible. If planted areas are the only option, coordinate with existing tree locations and integrate into plantings to conceal appearance while avoiding root zones.

The additional cost in materials and labor to route utilities around the root protection zone is quickly offset by reduced costs associated with the long-term maintenance and often replacement of damaged or weakened plants. Where it is not practical or feasible to avoid encroachment of the root protection zone, alternative steps should be taken to minimize damage to plant roots.

Most above-grade utilities require maintenance access and clearances. These utilities include backflow preventors, emergency generators, and other large industrial elements. Integrate above-grade elements into the site or building design to minimize visual impact on landscape, and ensure protection of trees. Consolidate utilities with adjacent facilities where possible when landscape is part of new building construction. Locate air intake units for buildings away from outdoor sitting areas to minimize the intake of smoke and exhaust fumes. If utilities occur in the landscape, locate away from primary entries and walks and screen with enclosures or plant materials. Integrate external enclosures into the surrounding environment by using appropriate scale, materials, and finishes. Avoid installation of visible utilities in view corridors or similar locations where the utilities would have a negative visual impa

Section 3
Priority Strategies for Moving Toward the University's Vision

3.1 Section Introduction
The Landscape Design Guidelines establish a framework to build upon the campus' rich design heritage by emphasizing simplicity, balance and ecological sensitivity. Guidelines are principle based, founded on the tenets of sustainability and the belief that landscapes should be managed not simply maintained. They are dynamic such that planning, design and management practices should be setting the stage for climate adaptation. Long-term management considerations must take into account climate adaptation challenges while honoring the aesthetic tradition on campus, making updates where necessary. These guidelines are divided into 3 parts: Promoting the Adaptive Capacity of the Landscape, Landscape Preservation and Landscape Enhancement.

3.2 Strategy 1 - Promote the Adaptive Capacity of the Landscape
An examination of the campus's evolution reveals that the degradation of the landscape began long before the university was founded. Eighteenth and nineteenth century farm practices took a tremendous toll on the landscape. The extensive clearing of native forests resulted in an irreplaceable loss of indigenous soil, flora and fauna. The subsequent construction of the railroad and the building of three dams further compromised the already altered natural systems.

As climate related changes accelerate at an exponential rate, it is vital that the university build a depth of understanding regarding campus vulnerability and the adaptive capacity of the landscape. According to a report by the US Forest Service entitled, "Climate change vulnerability and adaptive capacity: Evaluating collaborative landscape decision making," climate models show that landscapes will be facing unprecedented changes due to the effects of climate change. The report suggests that institutional dynamics and governance arrangements can interact to facilitate socially and ecologically sustainable futures for communities if done collaboratively and with intention.

Many urbanized areas similar to the university have found that approaching degraded ecosystems by using a traditional restoration model is not only expensive but often fails over time due to existing conditions outside of the project extents that inevitably affect the project footprint (e.g., toxic dumping upstream). Instead, universities and municipalities are pushing forward projects that encompass designed adaptations to bridge the gap between what existed before human-related degradation and a healthy future that takes into account current conditions. The goal of this work is to slow degradation, adapt to current conditions, and manage ecologically robust and adaptable landscapes now in order to create an ecologically robust future landscape and prevent an even greater expenditure of labor, energy, time, and money on larger rehabilitation projects. The sooner the university takes a proactive position with respect to the adaptive restoration of degraded landscapes, streams, and wildlife habitats, the more successful it is likely to be. This entails the following:

Re-envisioning the Landscape as Connected and Dynamic

Within the academic core of the campus there are a number of opportunities to strengthen connections between disjointed landscape elements. In *Planting in a Post-Wild World*, Thomas Rainer and Claudia West suggest that communities approach lawns, utility easements, parking lots, road right of ways, and municipal drainage channels as "territories of vast potential ." There are many of these opportunities on the university campus just waiting to be utilized.

At the same time, managing campus flora to accommodate changing climate conditions will require mindful planning and flexibility. Species that have previously been well-suited may, in some cases, cease to thrive, requiring more or different maintenance practices. Species selection for new plantings should consider likely changes in temperature, precipitation, growing seasons, pest pressures, and the like. Eradicating existing invasive species, and avoiding the introduction of new ones, will be a continued and important challenge as well.

Rehabilitation of the Ravine offers an exciting opportunity to start tackling all of these opportunities and challenges in an integrated and complementary fashion. It is a central campus landscape element that is widely used as part of the pedestrian circulation system and has great potential to bring in biodiversity. Invasive species such as Norway maple, barberry and honeysuckle have compromised the aesthetic character and beauty of the Ravine as well as its performative quality as a waterway. It currently requires regular removal of especially aggressive invasive species; however, a novel plant community can be designed to reduce maintenance requirements and accommodate for the decline of native species that no longer thrive in this changing environment—keeping aggressive invasives at bay by default. Using this deliberate approach to the Ravine will strengthen its identity and begin to celebrate procession through it. As passage-through becomes part of the university trail system, students, faculty and staff will begin to appreciate its exciting and resilient aesthetic.

Opportunities to expand and compliment the perceived limits of the Ravine should also be explored with contemporary planting strategies that include wildflower ribbons and indigenous shrubs and trees suitable for riparian zones, in addition to adaptive novel species. UNH Extension has designed an adaptable plant community of forbs and warm season grasses that, once established, requires no irrigation or pest management, mowing only once per year, and minimal periodic invasive removal, while providing valuable habitat for pollinators, birds, and other wildlife.

Similar opportunities for these and other plant communities should be explored in the area between the Campus Crossing Lot and Engelhardt Hall, as well as between fragmented stands of woodlands and campus groves such as the woodlands south of McDaniel Drive, between Evergreen Drive and Forest Park. The university's novel plant community design can be used repeatedly on campus to rejoin these woodlands with the woodlands in the central portion of the campus, creating a uniform and aesthetically pleasing adaptation.

Undertake Comprehensive Stormwater Management and Stream Rehabilitation

To prevent the further degradation of waterways and wetlands, a comprehensive Pollution Prevention Plan, developed using the expertise of the UNH Stormwater Center, will integrate

projects that have already been installed in numerous portions of the campus and evaluate other sites around campus in order to create a proactive plan for stormwater management. It is important that the entire watershed be considered when developing the plan's goals and objectives; opportunities to support or promote interventions upstream that will have significant beneficial impacts may be as, or more, important than campus-specific interventions. The comprehensive stormwater plan in itself reflects the desire for a healthy aquatic ecosystem endpoint. Fundamental to this plan must be the paradigm shift towards making stormwater management and stream health first priorities when considering any landscape modifications, rather than leaving these concerns as afterthoughts.

The built environment of the campus should be managed in coordination with waterways and wetlands in such a way that controls non-point source pollution and runoff in order to lessen downstream flooding and reduce toxic load. Likewise, shoreline protection setbacks and reference lines should be respected when it comes to siting structures, maintaining existing natural woodland buffers, and applying chemicals or fertilizers.

Parking lots should be developed and managed using best practices for successful stormwater management. Identify locations of point source pollution and develop appropriate mitigation plans. Landscape plans must look for opportunities to daylight buried streams and prioritize restoring streams and stream corridors; specifically, careful consideration should be given to restoring the riparian buffer along the entire length of College and Pettee brooks.

Create Habitat by Design

A comprehensive approach to planting design, installation and maintenance is key to successfully creating habitat. Plant communities should be designed specifically to address critical habitat needs for small animals, pollinators, and songbirds, especially within the academic core of the campus. In woodland areas, the preservation of dead or dying trees that provide dens and nesting places for wildlife should be considered while accounting for public safety in the way of clear trails and walkways. In the core campus, trees that pose a potential hazard or detract from the general aesthetics of the campus should be removed and mulched if disease free. These efforts would be greatly enhanced by developing an interpretive signage program to foster greater awareness about the benefits of habitat creation and management practices on campus. Fragile and otherwise valuable ecosystems should be identified and protected from future construction, and campus trails should be routed to avoid these areas.

3.3. Landscape Preservation

Preserving the cultural heritage and ecological integrity of an expanding campus landscape is a collaborative process between the client, the designer, the builder, and those responsible for its long-term upkeep. UNH personnel and contractors should all be accountable for protecting existing trees, preserving healthy topsoil, and ensuring water quality. The university will strive to improve its enforcement and adherence to policies designed to protect the campus landscape before, during, and after construction, with special attention to the following:

Construction Envelopes

Prior to the initiation of design, it is important that the project site be thoroughly inventoried to ascertain the location of valuable site features and fragile areas that will need protection during the construction process. By consensus it is important that the design team establish a construction envelope that includes the footprint of any new structure as well as a carefully delineated work zone.

Once a construction envelope is established, all areas outside the construction envelope shall be regarded as a protected area and shielded by construction fencing prior to the initiation of any site disturbance. The limits of the building zone should be recorded on all design and construction documents. Protected areas should be completely off limits to any construction activity including equipment and vehicle parking, cleaning stations, and materials storage.

Within the construction envelope, a staging area should be clearly delineated. Cases in which the construction envelope is not of sufficient size to support all construction activities require a designated staging and storage area off-site. Contractors should not be allowed to park any construction equipment and private transportation outside of the construction staging area or designated contractor parking lots. If site conditions limit the parking area within the staging area, construction workers should be expected to carpool from remote parking lots.

All chemical mixing and disposal should occur within the construction staging area. The cutting or drilling of inorganic materials such as metal, plastic, concrete, or treated wood should occur within the construction staging area, be contained to the greatest degree possible, and be properly disposed of. All stockpiling of materials should occur within the construction staging area. Strict controls must be placed to protect any trees and their root systems within the construction envelope. Whenever possible, institute "just-in-time delivery" practices.

Topsoil Preservation

When not protected, soils are easily damaged. Soil restoration is an expensive and time-consuming process. Protecting the soil during construction is a fundamental sustainable practice. Carefully remove topsoil from all areas to be disturbed and store all topsoil on site or at a nearby location protected from sheet drainage that may contaminate and degrade the soil's condition. If it's a multiyear construction project, top soil should be distributed in other parts of the campus, or if redistribution isn't possible, inert soil should be mixed with compost to bring it back to life. Avoid soil compaction and incorporate a soil compaction analysis at the end of construction projects. Restore all compacted areas by tilling and adding soil amendments based on the recommendations by the Landscape Architect, Grounds Superintendent, or consulting Soils Specialist.

Preserving Existing Plants Suitable for Protection

Preserving the vitality of campus trees is paramount to preserving the character and integrity of the campus landscape and ensuring a resilient future. It is the goal of every construction project to protect as many trees as possible during construction to prevent unnecessary costs associated with tree replacement and remediation. Successful tree preservation must be planned for early in

the design process. Trees that are landmarks, significant in form, or serve a vital ecological role shall be given special consideration in the evaluation process.

Trees that are structurally unsound or are in the final stages of decline should not be considered as candidates for tree preservation. It is also important that trees selected for preservation be evaluated using a life-cycle cost model. Attempting to avoid up-front costs can lead to higher costs in the long term, and create unreasonable demands on future maintenance.

Respecting Root Protection Zones

Protecting the root system of a plant is fundamental to preserving it during the construction process. The root protection zone extends to a tree's drip line, but we must recognize that tree roots extend far beyond this measure. A construction fence should be employed to keep people and vehicles out of the protected zone. Where this is not possible, install a minimum of a 3" bark mulch layer to minimize soil compaction where vehicles and foot traffic are apt to occur. An arborist should evaluate the specific plans for the impacted trees to determine what more will be needed.

Avoid disturbance within the root protection zone and limit removal of the root system from any one side as root removal can eventually lead to unsafe tree fall conditions. Minimize site disturbance near plants and carefully monitor trees disturbed during construction. Continue to evaluate trees post construction for a period of two years to detect general decline that may result from construction impacts.

In the design process, plants may be strategically grouped in such a way that prevents future grading or construction activity from interfering.

Site Grading

Site grading can be used to responsibly manage stormwater, screen objectionable views, enhance desirable views, provide sound control, direct circulation, and reinforce the spatial definition of outdoor spaces. Site grading should result in a setting that is ecologically responsible, visually pleasant and in harmony with the existing scale and character of the campus. Grading plans should respect local and federal design guidelines relevant to the Americans with Disabilities Act and seek to make areas accessible to the greatest extent possible. When developing grading plans the following criteria should be considered:

- Avoid the reliance on salt or sand during snowy conditions
- Ensure safe and efficient pedestrian and vehicular movement
- Minimize impacts on existing vegetation, especially established trees
- Strive to achieve a balance between cut and fill requirements
- Limit slopes in lawn areas to less than 10%. Slopes mowed by vehicles should be 25% or less but in no case exceed 33%. Grass slopes in excess of 33% will necessitate hand mowing.
- Planted slopes, requiring periodic maintenance such as weeding, pruning, and litter control should not exceed 3:1 (33%); slopes in excess of 3:1 shall be considered not maintainable on a routine basis

- Unpaved slopes should not exceed 2:1 (50%) or soil angle of repose, whichever is less.

Site Drainage
Designers should strive to incorporate Best Management Practices (BMP) in the development of drainage solutions. The goal of a BMP is to control, store, and treat storm runoff on-site. A BMP for a specific site should integrate with the natural and built landscape while considering maintenance requirements, costs, and responsibilities.

Site designers should strive to include appropriate landscape treatments as integral components of a site drainage plan. Landscape practices such as vegetated swales, filter strips, basin landscaping, and urban forestry practices preserve and/or enhance the aesthetic character of a site while contributing to an effective stormwater management plan. UNH should have Facilities and the Stormwater Center oversee the siting, planning, designing, and maintaining on campus stormwater systems. This is not only a cost-effective approach, but also preserves institutional commitment to the campus waterways and wetlands.

Erosion and sedimentation control are critical issues in the development of a stormwater management plan. The use of appropriate erosion control practices can significantly reduce soil loss. This is particularly important during the construction phases of projects.

3.4 Landscape Enhancement

Campus Accessibility
The following recommendations are based on design principles and guidelines developed by the Architectural and Transportation Barriers Compliance Board (a Federal agency) and the Public Right-of-Way Access Advisory Committee (PROWAAC) as a minimum standard for access across the campus. However, a sustainable UNH should strive for equity in all areas to prevent costs associated with life cycle assessments, such as having to demolish and repave sidewalk corners to include curb cuts down the line. Universal design should be used to facilitate access and be incorporated into all capital projects to the greatest degree possible. In general accessibility should:

- Provide for equal opportunity and maximize accessibility for all users
- Be reasonable in cost
- Be clear, simple and understandable
- Be enforceable and measurable
- Be constructible and maintainable
- Address safety for both pedestrians and motor vehicle operators
- Provide implementation guidance for other municipalities and institutions looking to follow suit
- Be flexible enough in design to include future technologies
- Be consistent with ADAAG
- Support independent use by persons with disabilities.

A continuous unobstructed path connecting all accessible elements, places and spaces of the campus should be provided. Accessible routes should coincide with the route planned for the general public to the maximum extent feasible, surpassing the minimum requirement for accessible features and dimensions by design by incorporating looped routes and avoiding dead ends. Design considerations shall also address how accessible routes are affected by rain, snow, or ice.

Sidewalks, trails, and shared-use paths leading to outdoor developed areas shall conform to the guidelines presented in the Accessibility Guidelines For Outdoor Developed Areas. Campus sidewalks shall have a clear width of not less than 72." Nowhere may the cross section of an accessible sidewalk exceed 1:48 (2%). Placement of street fixtures, utility covers, gratings and other covers should be outside the entire public sidewalk to the maximum extent feasible. If drainage gratings are located within accessible sidewalks, the gratings shouldl have no spaces greater than ½" wide in one direction.

Safety and Security

Maintaining a safe and secure campus is a proactive process that encompasses a range of issues, some of which are related to landscape design. With an understanding of basic design principles, a thoughtful designer can develop a landscape plan that is aesthetically pleasing, functional, and an important component of a campus wide crime prevention program. Crime Prevention Through Environmental Design (CPTED) is an important component of any crime prevention program and asserts that the potential for criminal activity to occur on campus can be reduced through thoughtful design and consistent maintenance. A CPTED plan is built on four principles:

- ***Territoriality*** indicates that a well-defined space promotes a sense of ownership, making it easier to identify intruders. Site plans should be developed so that public, semi-private and private zones can be clearly discerned. Physical and symbolic barriers should be used to separate and differentiate various zones. To the extent possible, interior and adjacent exterior spaces should relate physically and programmatically. The character and spatial organization of semi-private and private zones should imply a sense of ownership by designated users.
- ***Surveillance*** can happen naturally using open design, free of obstacles and places of concealment. Coordinate the layout and installation of emergency "blue lights" with Campus Safety & Security to insure adequate coverage throughout the campus. Minimize the use of objects that may limit visibility into and/or through a site. Avoid creating places of concealment, such as shrub masses near first floor windows or building entrances. Strategically place lighting fixtures to illuminate entrance and exit points and provide a uniform wash of light throughout the site using down-facing fixtures to avoid light pollution. Visual corridors should be maintained in open park-like settings as well as in densely planted areas.
- ***Maintenance*** is essential to ensure the quality of a space and engender pride of ownership. It is important that trees and shrubs are pruned as needed to keep them neat and orderly and to prevent overgrowth that may reduce visibility. It is also important to repair or remove damaged furnishings and keep the area free of graffiti.

Campus Seating

Seating affords opportunity for a wide range of social interaction, ranging from formal gatherings, to chance encounters and quiet retreats. Create intimate seating niches throughout the campus to encourage informal encounters among students, faculty, and staff. Seating walls are important design components and their use should be encouraged to define the edges of spaces and to provide informal seating. Locating seating opportunities at important gateways, building entries, and intersections of walkways encourages social interaction. Seating furniture should be placed on hardscape to avoid the creation of compacted cow paths. Seating should also be protected from winter winds and uncomfortable drafts, preferably in suntraps that enable the use of the outdoor areas in the fall and spring.

Locate campus seating near areas where food is served. Make provision in seating areas for food carts and other vendors. Seating within plazas and other open spaces should afford a variety of exposures, orientations, and views. Seating opportunities should be developed within the Ravine and campus groves to offer opportunities for quiet reflection and enjoyment of the natural surroundings.

Stairs and Steps

Stairs and steps not only facilitate pedestrian circulation but also add character and can serve as seats, stages, and even focal points in a site design. However, stairs do pose maintenance concerns and limit accessibility for some users, especially in the winter when snow removal and ice control may significantly increase maintenance demands. Consequently, stairs should be developed with restraint and should not be the sole landscape design for grade changes.

Campus Walls

Stonewalls enrich campus character and reinforce its sense of place, making them the best choice for freestanding walls throughout campus. Stonewalls within the academic core should have a split face and be secured from a local source unless otherwise specified in project drawings and/or specifications. Stone walls designated for use in other areas of the campus can be constructed of local fieldstone unless their role calls for a more formal appearance.

Concrete retaining walls, when called for, should be enriched with subtle scoring patterns and capstones. Capstones should extend the full width of the top of the wall, and be sloped 2% in the downhill direction. Weep holes should be carefully integrated into the design of solid walls. Care must be taken to insure that seepage does not stain the walls surface or the pavement at the base of the wall. Surface drainage behind and above the wall should be intercepted with a diversion swale to prevent surface water from flowing over the top of the wall.

Architectural walls (walls integral to the building) should be used to extend the architecture into the landscape and unify the building and its site. They should be compatible with the proposed building but respectful of site context and used to provide seating in plazas and near building entries where appropriate. Architectural walls should also be used to screen dumpsters and utilities whenever possible.

Wall materials such as landscape timbers and Versa-loc are aesthetically inappropriate for use within the academic core. A structural engineer should review drawings for retaining walls higher than 4 feet.

Campus Fences

Fences should be used to delineate the edges of campus spaces or serve as protective barriers. Many fence types are common to New England and can be effectively used to reinforce the regional character of the landscape and its unique sense of place. The following fence types are recommended for campus use:

Academic Core – White Two-Rail Fencing

Fencing should be used with restraint within the academic core. When used it should consist of white two rail fences with the 4-inch square rails rotated 45˚ to form a diamond pattern. The height of fencing should vary according to the specific design intent and site conditions. The proportional relationship between rails and posts should be carefully considered. Fences should "run" level; avoid the use of fences in situations where the land slopes in such a fashion as to necessitate the fence stepping down across the landscape.

Posts should be native granite with a thermal finish. Interior posts should be a minimum of 5-inches square. End posts should be 8-inches square. Fence posts should be set back a minimum of 18 inches from a paved surface to ensure adequate room for snow removal and storage.

Agricultural Areas – White Rail Fencing

Within the agricultural areas of the campus, white four-rail HDPE fencing should be used to define paddock space and the edges of meadows and fields. Over the long-term, HDPE fencing is cost effective, requires low maintenance, maintains its aesthetic appeal, and is animal friendly. Fence posts should be a minimum of 5-inches square with a simple cap. Rails should be 2 inches x 6 inches. Fences should be kept in good repair. Post and rail fences within the agrarian portions of the campus should follow the contours of the land, rising and dipping with changes in grade. Avoid situations that require the stepping of the fence to compensate for sudden changes in grade. Set fencing far enough back from the edge of the road to allow adequate snow storage and so as not to obscure a view of meadowlands.

Chain Link Fencing

In certain locations and for certain utilitarian functions chain link fencing is the logical choice because of its durability and effectiveness as a barrier. Where chain link is required, black vinyl covered wire with black posts and rails should be used. Chain link fencing is appropriate to locations where crowd control is required, such as adjacent to the athletic fields. When used as a protective barrier a landscape plan should be prepared that will obscure portions of the fence with landscape treatments or divert sightlines to lessen the fence's visual impact. Black vinyl fencing should be considered for construction fencing, especially within the academic core where extended construction will detract from the overall character and appearance of the landscape.

Screening Fence

Within the academic core and in other areas where screening is required to shield an offensive view and vegetation will not suffice, a white stained board fence should be used. Posts should be five-and-a-half inches square bevel at the top with square edges. Smooth five-and-five-eights wide "V" groove boards with shiplap joinery should be vertically mounted. Board fences should run level with the grade, but in those instances where changes in grade preclude this, board fences should be stepped.

Landscape plans should be developed as a foreground to the fencing to reduce its scale and visual impact. Architectural walls can be used as an alternative to board fencing as a screen for utilities or objectionable views using materials that compliment nearby architectural detailing.

Gifts and Memorials

Campus memorials commemorate the lives of former students, faculty, staff, and other persons who have had a lasting impact on the university. Memorials and gifts often serve as the catalyst for the development of new campus open spaces and landscape projects. Memorial landscapes often include seating, artwork, planting, and other landscape amenities. Memorials serve to remind us that our time at the university is fleeting and whether we are students, faculty, staff, or stewards our obligations are not only to address the concerns of the present but also to honor the obligations of the past and preserve opportunities for the future. Stewardship programs that endow existing landscapes such as the Ravine should be encouraged as a desirable alternative to the installation of gifts or memorials.

Memorials should be carefully sited in the landscape, and consider the long-term development of the campus.

Living memorials such as trees, gardens, and woodland groves should have a maintenance endowment assigned them. The assignment of an endowment shall be at the discretion of the university and may be required as part of the gift. It is the policy of the university to avoid the placement of memorial plaques. A book containing a list of campus memorials is available for public viewing at the Diamond Library.

The placement of memorials should consider routine maintenance concerns such as mowing and snow removal.

Section 4
Implementation Strategies: Mobilizing the Sustainable Learning Community

The processes outlined in this section are intended to do two things: take the principles and practices embodied in the preceding three chapters from the realm of the theoretical or aspirational to the applied; and to create stronger structural connections between faculty, students and staff in considering how to successfully do so. This is the pragmatic and smart thing to do, as well as the right thing.

Despite maintaining much visual continuity of the landscape, deferred maintenance and construction activity practices have contributed to an overall decline in landscape quality and ecological performance, which undermines UNH's resilience. Climate reports indicate that landscape management requirements will exponentially increase and become more expensive as a result of climate-induced, extreme weather events, pests, disease, and changing USDA Plant Hardiness zones.

Working now to get ahead of the curve by adopting, operationalizing, and institutionalizing the principles and goals outlined in this Landscape Master Plan will be essential to ameliorating this growing economic and environmental risk and to ensuring UNH's physical campus and landscape remains a highly valuable asset in attracting and retaining students and staff.

4.1 LMP Stewardship

In order for the LMP to be effectively implemented, it needs to be stewarded by a dedicated interdisciplinary group of in-house experts and stakeholders. To that end, the Ecosystem Task Force (EcoTF)[7] shall function as the primary steward for the Landscape Master Plan. This stewardship will encompass a wide variety of responsibilities, including provision of expertise and input from the campus community; research and assessment to support continued awareness and implementation of best landscape stewardship practices; and advocacy for policies (e.g., protected status of valuable ecosystems like College Woods) and resources (e.g., staff or funding) that align with the principles and goals outlined in this plan.

4.2 Campus Projects Review for a Sustainable and Resilient Future

The Ecosystem Task Force (EcoTF) will undertake a regular Campus Projects Review in order to support the continual and consistent implementation of the standards and principles outlined in this Plan and to assess the potential for the inclusion of resilient and sustainable landscape planning and management and design standards in upcoming projects. Many of the aspirations

7 The EcoSystem Task Force is an advisory body to the President and Executive Council, comprised UNH of staff, faculty and students, that examines sustainability issues related to land use, development, and ecosystem management and makes recommendations regarding land use, landscaping, ecosystem health, biodiversity and development. See https://www.unh.edu/sustainability/sustainability-institute/task-forces

of the LMP, such as responsible storm water management and biodiverse planting design, can be realized by incorporating them into upcoming campus projects, large and small, that occur each year. This review by EcoTF will include all upcoming projects across campus, and will require close collaboration with the Facilities Project Management team. At least twice annually, EcoTF meetings will feature an overview of current and upcoming projects, providing Task Force members with opportunity to learn about what improvements are happening around campus, provide input for those projects by reinforcing the principles and the strategies of the Landscape Master Plan, and offer specific considerations for individual projects.

4.3 Active Management Plans and Processes

Specific guidelines, standards and policies must be established in a fashion that will allow them to evolve appropriately over time and to be informed continuously by those whose work involves relevant landscape management decisions or tasks, such as Facilities Project Managers, contractors, Grounds and Events staff, and others. To facilitate the creation and evolution of such "living plans," the Ecosystem Task Force shall work with three Working Groups/Committees who can bring to bear the expertise of staff, faculty and others in the UNH community:

- A Botanical Management Working Group
- A Watershed Protection Working Group
- The Committee on Woodlands and Natural Areas

The first two shall be efforts of the Ecosystem Task Force, the latter is a well-established body. All three will be consulted to help provide the following:

- Updates to the campus Planning Design and Construction Guidelines, which are the reference document used by all design professional and construction teams working for the university.
- Updates to the Landscape Management for Project Managers workbook, used by the Campus Stewardship groups, that codify best management practices (i.e., "good housekeeping") that are consistent with the principles and guidelines outlined in this Landscape Master Plan.
- The development and stewardship of project priorities and implementation plans that incorporate relevant inventories, maps and analyses of campus landscapes, areas of opportunity and/or concern, resource usage and needs. By assessing current conditions and defining precise landscape management needs and practices, the university will benefit from having reference documents for the purposes of needs assessment, accountability, and advocacy when appropriate.
- Specific strategies and interventions that could be applied to priority landscape improvement areas (see section 4.4) to meet the goals and realize the vision outlined in this Master Plan.

4.3A Botanical Management/Maintenance

The Botanical Management Working Group shall be tasked with the following:

Planning for Campus Tree and Shrub Health and Maintenance

Planning will involve stewardship of an updated Campus Tree Inventory that includes the presence, type, location and health of trees (prioritize key areas if needed), alongside a current Annual Tree Report noting any trees requiring remedial treatment, including but not limited to pruning, fertilization, pest/disease management, guying, and bracing. Ideally, this inventory will be conducted in collaboration with faculty and students as part of curricular or co-curricular efforts.

Based on the updated inventory and annual report, recommendations should be developed, with a categorization such as:

Removal – No replacement
Removal – Replacement in kind or similar species
Watch List – Trees showing signs of decline
Maintenance – pest/disease management
New Planting Recommendations

Developing these recommendations must involve consultation with a certified arborist to identify trees listed as in poor condition that will need removal within the next two years. The recommendations should prioritize trees that pose a threat to public safety or harbor noxious pest or pathogens,which should be slated for immediate removal. Trees that do not pose a safety hazard and serve as wildlife habitat can be slated for removal at a future date or left if they do not detract from campus aesthetics.

This should be followed by a Campus Tree and Shrub Master Plan, noting trees in poor to fair condition that can be rehabilitated with remedial treatment as well as anticipated removal dates and replacement planting dates for trees on the removal list. The plan should note the proposed location, botanical name, common name and size of suggested replacement trees and shrubs, as well as anticipated removal dates and planting dates. It should also include a detailed replacement budget to be developed that indicates a reputable supplier, includes the duration of warranty, and projects removal costs, plant material costs, and other costs associated with the installation of replacement plants, i.e., based on a lifecycle cost model.

Regulat Assessment and Planning for Turf Management and Reclamation

Lawn quality varies across campus, with different sites requiring different maintenance strategies. The Great Lawn is an asset that presents an attractive and positive image of the university. However, edge conditions within 18 inches of pavement tend to be degraded with a lack of vegetation, allowing for sediment to erode and lessening the aesthetic quality of the space.

The development of a Turf Management and Reclamation Plan is recommended to address these and other turf related challenges, beginning with an analysis of existing turf conditions, categorizing turf on campus into one of four levels. These levels should indicate priority, management practice, and opportunity for conversion to more ecologically robust planting schemes. Levels should be defined by a zone-based categorization methodology to include:

- ***Level 1 Lawns*:** high profile lawns, such as the Great Lawn require intensive maintenance that should adhere to an Integrated Pest Management (IPM) Plan
- ***Level 2 Lawns*:** lawns in the core campus require slightly less maintenance and can benefit from reduced mowing, fertilization, and pest control. These areas may benefit from alternatives to Bluegrass, i.e. Hard Fescues
- ***Level 3 Lawns***: peripheral lawns are good options for reclamation and replacement by native grasses and/or wildflower meadows
- ***Level 4 Lawns*:** lawns in transitional zones, such as alongside the Ravine, are ideal for ecological rehabilitation and should be replanted and regraded according to the requirements of adjacent ecosystems. They might feature tall/native grasses, wildflower meadows, lower maintenance regimes, etc.

In, addition, regular assessment of the lawns shall be undertaken to proactively prevent or treat problems as they arise (e.g., pests and diseases, weed incursion).

Training and Reference Materials to Support Botanical Management
Landscape management recommendations and references that support organic and/or IPM care standards as relevant to guide appropriate selection and care for campus trees, shrubs, turf, and plants shall be curated by this group and provided as references for campus staff and contractors who undertake outdoor campus maintenance activities and/or incorporated as updates to the Planning, Design and Construction Guidelines. These materials may include lists, training materials, and/or best management practice guides to appropriate plant selection, planting, feeding, pest management, mowing/pruning, as well as to the conduct of practices that indirectly affect plant and animal life (e.g., application of salt or sand on roads and walkways).

Efforts should be made to provide opportunities for maintenance staff to attend training sessions (e.g., workshops, conferences); training may be provided by expertise on campus.

4.3B Watershed Protection and Stormwater Management
As illustrated in the UNH Utilities Master Plan, the "existing stormwater sewer system owned by UNH includes approximately 141,000 linear feet of storm sewer mains and service connections, 24,000 linear feet of ditches and swales, 260 manholes, and 910 catch basins. The system also features installations of "Best Management Practices" (BMPs), including tree box structures, rain gardens, subsurface infiltration systems, wet wells, and bioremediation areas".

The Watershed Protection working group, co-chaired by the campus utilities manager and the director of the UNH Stormwater Center, shall be responsible for the following:

Comprehensive Watershed Protection Planning and Reporting
The plans and reports should maintain UNH's commitment to watershed health both within the campus footprint and downstream and offer a cohesive, functional, campus wide approach to stormwater management and watershed health. In addition to a thorough analysis of current conditions and integration of existing installations, this plan will identify priority projects and maintenance needs to be addressed accordingly. It will incorporate recommendations regarding

the stormwater treatment practices, in accordance with UNH's MS4 permit and wastewater practices in accordance with the Town of Durham's National Pollutant Discharge Elimination System (NPDES) and the Great Bay General Nitrogen permit. These may include:

- Paving and hardscape management strategies that consider life-cycle maintenance requirements and associated costs: porous pavement should be considered when applicable maintenance capacity is in place and site conditions allow
- Additional existing and potential future BMPs
- Protection and enhancement of campus wetlands and waterways, including brooks and streams

Training and Reference Materials to Support Watershed Protection

Landscape management references that support "good housekeeping" practices should be curated by this group and provided as references for campus staff and contractors who undertake outdoor campus maintenance activities and/or incorporated as updates to the Planning, Design and Construction Guidelines. These might include lists or best management practice guides that support pollution prevention, maintenance of green infrastructure, erosion prevention, etc.

4.3C Woodlands

A primary goal of university woodlands is sustainable forest management. These properties are third-party certified as a registered tree farm. During periodic audits, a team of tree farm inspectors review recent harvest activity and management practices as well as forest stocking levels. To monitor forest stocking levels and ensure sustainable management, the Woodlands Office maintains a system of over 1,000 continuous forest inventory plots that are remeasured on a ten-year interval. The information from these plots is used as a basis for management plans for each property that is updated on the same time sequence.

Management plans assess the current state of the properties and propose general management guidelines. Projects that support this management are then described in, and published as, an operations plan. This process is managed by the UNH land use coordinator but is overseen and approved by an existing Committee on Woodlands and Natural Areas. This committee is composed of university natural resource faculty members and Cooperative Extension professionals. Plan approvals and land management guidance are ultimately approved and overseen by the Dean of COLSA.

The UNH land use coordinator and Committee on Woodlands and Natural Areas will continue to be the primary implementors of this body of work, and the land use coordinator will continue to serve as a member of the EcoSystem Task Force. The EcoTF will request annual updates regarding the ecosystem health and needs of campus woodlands and natural areas and look for opportunities to collaborate with and support the efforts of the Committee and land use coordinator.

4.4 Priority Landscape Improvement Areas

Priority Landscape Improvement Areas are specific location-based recommendations, which are

in the greatest need. These recommendations have been organized according to project type, including eco-transition zones, selective restoration areas, and pedestrian enhancements.

Establishing Eco-Transition Zones

The campus is lucky to boast a robust woodland area, multiple wetlands, and an abundance of mature trees in its formal zones. To begin to both rehabilitate and knit together these fragmented areas, it is suggested that eco-transition zones be developed. These zones will create a buffer for existing ecological assets and introduce biodiverse plantings where they may be lacking. Planting strategies should include a mix of indigenous species and adaptive species to account for climate adaptation and resilience. Planting strategies should respond to existing conditions on campus, such as soil, light, and water conditions, and can potentially be facilitated by incorporating expertise from UNH Extension and other faculty. Preliminary location suggestions include:

The Ravine

The Dell includes underutilized open lawn space, which provides an opportunity to establish a riparian buffer zone between the Ravine and formal campus areas north of the Dell. In the area of the Ravine, the landscape surrounding the MUB, and the open space around Horton Hall, additional plant communities may be designed to incorporate trees and shrubs native to the Ravine while introducing a reduced mowing practice. The use of wildflower pollinator meadows (as recommended by UNH Extension) should be considered east of the Dimond Library and below the Thompson Hall parking lot, as well as during the design and planning phases for the revitalization of Academic Way and McDaniel Drive. The planting strategy here can also include indigenous shrubs and trees suitable for riparian zones, in addition to adaptive novel species.

The Memorial Union Building (MUB)

The south side of the MUB includes a large building overhang that has rendered the ground beneath it barren and prone to erosion. South of the overhang this area is home to more underutilized lawn space before reaching the Ravine once more. This is a good opportunity to extend a riparian buffer further east.

College Woods Peripheral Lawn

The College Woods are surrounded by lawn on all sides with the exception of the Oyster River on the southern border. These peripheral lawn areas should be considered as an opportunity to introduce biodiverse planting schemes, allowing for potential long term woodland migration and protecting the existing woodland condition from activities in adjacent formal zones.

Selective Restoration

While ecological restoration is not always appropriate due to inhospitable conditions such as contaminated waterways and a changing climate, in some cases it is well worth the effort made. Restoration propositions should be strategic and selective, taking into account probability of success 10, 20 and 30 years from the date of installation. Contractors, engineering firms, and design firms should be carefully vetted for previous restoration successes and failures to insure the work is implemented effectively. The following areas should be prioritized:

Mast Road and Main Street Wetland

For much of its history, the university encroached on wetlands and wetland buffers, often filling them in, burying them, and channelizing them for a variety of land uses at the expense of natural stormwater management and ecological performance assets. At the corner of Mast Road and Main Street, in the southeastern quadrant, is the site of a former wetland that makes up a section of College Brook and was drained through the use of clay tiles and channelized into a human dug ditch. This intervention was done to create a farming field that is currently mowed for hay production. As a result, downstream flooding on campus greatly increased in both frequency and volume, resulting in costly repairs and rehabilitation projects. It is recommended that as part of the development of the *Comprehensive Stormwater Management Plan*, if not before its completion, this area be considered for wetland restoration accompanied by adjacent stormwater treatment BMPs to prevent watershed contamination, downstream flooding, and undue sediment deposition.

Pettee Brook

Portions of Pettee Brook have been buried under parking lots, roads, and railroad tracks while other portions have been channelized and redirected. Portions of the brook that have been channelized should be considered for restoration, such as between Edgewood Road and the Adams Tower West. While daylighting the brook in some cases would be very costly if not infeasible, there are some sections where it may be more feasible, such as north of the Whittemore Center Arena.

Pedestrian Enhancements

The campus pedestrian circulation system comprises corridors that connect and help unify disparate spaces into a cohesive whole. While some corridors must accommodate limited vehicular circulation, it is important that the walkway be of a pedestrian scale and utilize attractive site furnishings such as benches, lights, and trash receptacles and pedestrian scaled paving details. While pedestrian walkways are primarily designed to support cross campus circulation, they also serve as important meeting and gathering spaces. Updates to pedestrian spaces are a good opportunity to incorporate the following:

- Paving design details for ecological health, including a consistent methodology for handling intersections of pedestrian walkways to avoid “dead zones”
- Porous paving accompanied by necessary resource allocation for maintenance
- Strategic biodiverse planting
- Regrading to prevent erosion and to encourage stormwater infiltration
- Addition of street furnishings where useful.

Suggested areas for priority rehabilitation projects include:

- Academic Way
- University Trail linkages including the College Woods entrance at Colovos Road and Waterworks Road
- Evergreen Drive and Quad Way Connection

Investments in these Priority Landscape Improvement areas can enhance the health, functionality and utility of our campus landscape long into the future, and yield "return on investment" in the form of increased ecosystem and climate resilience, and the continued ability to leverage our beautiful and unique campus as a recruitment and retention asset.

Conclusion

In 2019, four strategic priorities were established to "[guide] UNH toward a bold, overarching aspiration: to be among the nation's top 25 public universities in the most important measures of academic performance." One of those measures is UNH's performance in the arena of sustainability.[8]

This Landscape Master Plan 2021 not only supports our overall sustainability performance, but also each of the four strategic priorities outlined in that vision of "The Future of UNH"[9]:

1. Student Success and Well-Being – by stewarding spaces that nourish student wellness, contribute to retention, and support "state of the art teaching and learning environments."
2. Academic Excellence – by providing opportunities to use the campus as a laboratory to do "distinguished research, scholarship and doctoral education will be recognized worldwide, including its contributions to global sustainability challenges." This has long been a tradition at UNH, but we have missed many opportunities to utilize and refine the knowledge that is generated right here on campus. The implementation startegies outlined in Chapter 4 aim to better leverage this opportunity.
3. Embrace NH – by helping visitors identify they are in a distinctive NH environment that reflects the local culture and landscape. And, by model best practices to "meet the most pressing challenges" to creating this sense of place.
4. Financial Strength – Investments in sustainable campuses practices can have a high return. – by reducing the need for expensive remediation or replacement measures for campus landscape elements, and by supporting recruitment and retention of students and staff who value UNH's leadership and the experience of being on UNH's beautiful, healthy, resilient and sustainable campus.

This 2021 Landscape Master Plan presents a framework for sustainable and resilient design that will move UNH toward that vision—aligning campus practices with our sustainability values and strategic priorities, continuing to leverage our physical campus as a powerful tool for high-impact learning, and ensuring that the ecosystems, people, and built environment cohabit the university lands in balanced ways that are beneficial to each.

[8] Specifically, the metric used is our score from the AASHE Sustainability Assessment Tracking and Rating System (STARS). See https://reports.aashe.org/institutions/university-of-new-hampshire-nh/report/
[9] and https://www.unh.edu/main/future-of-unh

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