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NOTE: APPENDIXES 1-5 AND 7 AND SOME OF THE DRAWINGS ARE NOT AVAILABLE ONLINE. PLEASE CONTACT TOM BEDICK, OM-FEB IF YOU NEED A FULL COPY OF THE REPORT.

1.0 INTRODUCTION

This landscape master plan for the National Institute of Environmental Health Sciences (NIEHS) was prepared to assist in managing the campus grounds in the most environmentally sensitive way possible while balancing the various needs and desires of NIEHS management and staff. Issues relating to the environment, grounds maintenance, access and safety, and aesthetics were the main concerns to be addressed in the master plan.

The planning process included an initial study of existing site documents and site reconnaissance to identify and verify conditions impacting the master plan. Findings were then documented on the Site Analysis drawings (Appendix 1). Schematic plans illustrating preliminary ideas were presented and reviewed, with subsequent preparation of the final Master Plan drawings (Appendix 2) and Maintenance Plan (appendix 4). NIEHS Project Officer Josee Crowell, Director of Grounds Maintenance Danny Sikes, the grounds committee, and the EAAC provided input and critical review.

The master plan provides a comprehensive guide for the future development and management of the NIEHS landscape. It is based on a concept that divides the site into zones that differ in landscape type or habitat, plant material, and type and degree of maintenance required. Further recommendations for redesigning key areas of the campus are also included. While detailed landscape designs are not included in the master plan, the recommendations will establish the character of any new work, provide potential plant species to be used, and allow flexibility and creativity to meet a variety of situations and changing needs on the NIEHS campus.

2.0 SITE ANALYSIS

This section summarizes the Site Analysis, the process by which information about the site was gathered and analyzed to determine opportunities and constraints for landscape planning. Refer to the drawings in Appendix 1 for more information.

Sheet 1 (Site Plan) of the Site Analysis identifies important site features and key areas of concern, including the site entrances, all campus buildings, roadways and traffic circle, and existing and proposed pedestrian walks/trails. General observations as well as issues and opportunities for improvements are noted. Also included is information about natural features of the site such as soils, seasonal sun and wind patterns and locations of major drainage ways. Sheets 2, 3 and 4 are enlargements of the main entrance, building 101 and shops area respectively. Sheet 5 is a compilation of photographs of existing site conditions.

2.1 General Landscape Character

The 82-acre campus is a manicured, park-like landscape carved out of mixed pine and hardwood forest. The native woods dominates NIEHS as well as much of the surrounding Research Triangle Park. Virtually all campus development, including buildings, roadways and parking, occurs in large clearings within the woods. The clearing creates a prominent vertical edge around the developed area where lawn grass and groupings of ornamental trees predominate. Remnants of the woods remain in a few places. The landscape is generally in good condition and well maintained but evidence of plant removal and/or replacement indicates disease or other problems. It is overall pleasant and park-like, but also somewhat unrelated to its natural surroundings by both

vegetation type and spatial form. The opportunity exists to develop a place more in harmony with its surroundings and in turn reduce maintenance, increase plant diversity, improve plant and animal habitat, and create an attractive and environmentally sensitive landscape.

2.2 Site Entrances

The entrances to NIEHS are doorways and welcoming points for employees and visitors. They identify the place and convey an image and first impression to anyone that enters or passes by. The main entrance on Alexander Drive and the secondary entrance on Hopson Road are similar in character to the landscape described above. Both have the potential to relate more to their natural surroundings as described. Both also present an opportunity for greater sense of entry and communication of image.

2.3 Building 101 (Rall Building)

This area of NIEHS is highly developed and intensively used. As such, much of the current landscape and level of maintenance is adequate. Opportunities remain however, to reduce maintenance and incorporate a consistent landscape concept. As plantings are replaced, there will be additional opportunities to select more desirable species and use the landscape to direct pedestrians, emphasize building entrances, and better integrate the building into the site.

The building mass appears initially to have been designed to front more to the lake, rather than the arrival point. For this reason, the arrival sequence is less articulated than it should be. Two of the employee walkways dead end at the parking areas adjacent to the building (lots B and E). From there, pedestrians must haphazardly make their way to poorly identified entrances, often loading docks or service doors. Multiple footpaths through the woods from parking lot F to the building indicate the need for a distinct route from that area as well. The entrance courtyard at the southwest corner of the building is a potential area for re-landscaping. There is also an opportunity to accentuate Research Lane as the main vehicular approach.

The lakefront is a key area for redevelopment. Opportunities exist to improve the outdoor dining area by providing more shade and level space. The lakefront can be optimized by providing stronger physical and visual connections and by creating more usable space at water's edge. There is also a need to consider the problems caused by geese and beaver.

2.4 Shops Area

The landscape character of the shops area is similar to that already described although less intense use allows a greater opportunity to incorporate more natural plantings and reduce maintenance. Once completed, a large area under construction will need landscape improvements consistent with the master plan. The entry plaza at building 102 is a potential area for future redesign.

2.5 Roadways and Traffic Circle

The existing roadway corridors appear as abrupt cuts from the forest, with lawn filling the space from road edge to vertical woods edge. Currently requiring high maintenance, the corridors offer an opportunity to distinctly change the image and arrival sequence of the campus. Diverse plantings that establish a transition between the woods and mowed

lawn will help to create a more attractive roadway corridor and at the same time reduce maintenance and improve the environmental quality of those spaces. Accentuating visually prominent areas with more ornamental or contrasting plantings and additional landscaping in the medians will enhance the effect. New landscaping at the traffic circle has the opportunity to create a focal point there as well as reinforce the campus image and landscape style. Redesign or elimination of the circle could improve traffic flow and safety.

3.0 GOALS AND OBJECTIVES

The following goals and objectives, derived from input provided by NIEHS and the site analysis, form the basis for the Landscape Master Plan recommendations:

A. Environmental

1. Goal – Manage the site in an environmentally sensitive manner
Objectives:
 - a. Use ecological models for choosing plant species (North Carolina native plant communities)
 - b. Choose species appropriate for a given planting site
 - c. Avoid use of plants with known insect or disease problems
 - d. Practice good soil management
 - e. Incorporate the concepts of Integrated Pest Management (IPM) into landscape management techniques to reduce or eliminate use of pesticides and to provide alternative methods for pest control
2. Goal – Increase habitat diversity
Objectives:
 - a. Identify feasible habitat types for NIEHS using North Carolina native plant communities as models
 - b. Identify appropriate locations for habitat types on the campus
 - c. Develop a list of appropriate native plant species
3. Goal – Reduce goose related problems
Objectives:
 - a. Implement habitat modifications to discourage geese from using the site. Base modifications on current research and recommendations for goose control

B. Grounds maintenance

1. Goal – Reduce amount of lawn mowing
Objectives:
 - a. Identify zones of maintenance level, based on location, use and visibility
 - b. Replace lawn grasses that require mowing with alternative types of ground cover
 - c. Identify suitable species and locations for alternative ground cover
2. Goal – Reduce irrigation requirements
Objectives:
 - a. Choose native plant species that survive with little or no supplemental water
 - b. Review irrigation system and timing to insure that the correct quantity and frequency of water is applied

3. Goal – Reduce plant replacements or excessive maintenance required due to diseases or other mal-adaptation
Objectives:
 - a. Develop a list of native plants more likely to tolerate local site conditions
 - b. Choose species appropriate to specific planting site
 - c. Use IPM to eliminate use of pesticides or provide alternative methods for pest control

- C. Access/safety
 1. Goal – Improve access to campus and research park destinations
Objectives:
 - a. Evaluate proposed trail locations and/or identify new ones.
 - b. Determine safe locations for trails to cross roadways
 2. Goal – Upgrade pedestrian routes from employee parking areas to building entrances
Objectives:
 - a. Create safe and clear routes for pedestrians through parking lots to building entrances
 - b. Use plantings and/or hardscape to direct pedestrians in desired directions
 - c. Explore options for improving pedestrian tunnels
 - d. Expand plantings along walkways to allow pedestrians to experience a more diverse landscape
 3. Goal – Improve access from the Rall building to the lake and outdoor dining areas
Objectives:
 - a. Redesign the Rall building outdoor dining area to include more level space, shade and a connection to the lake

- D. Aesthetics
 1. Goal – Make the NIEHS campus attractive and inviting to visitors and employees
Objectives:
 - a. Design outdoor spaces with a limited palette of ornamental native plants to visually tie different components of the site together
 - b. Use contrasting plantings to emphasize and accentuate key areas such as site and building entrances, intersections or other visually prominent places
 - c. Create a transition between the woods and manicured landscape by introducing intermediate landscape types comprised of tall grasses, shrubs and small trees
 - d. Integrate campus buildings with the site by repeating or extending architectural forms into the landscape
 - e. Provide a sense of organization to the campus by providing clear pedestrian and vehicular circulation routes
 - f. Provide appropriate type and degree of maintenance
 2. Goal – Improve/enhance the campus image and identity
Objectives:
 - a. Establish a dominant landscape style or theme that is used consistently throughout the site
 - b. Accentuate the theme at site entrances and other visually prominent areas
 3. Goal – Create an environment in harmony with its natural surroundings
Objectives:
 - a. Develop a list of native plant species adapted to local conditions
 - b. Create transitions between the woods and built landscape
 - c. Provide appropriate type and degree of maintenance
 4. Goal – Optimize the lake as a landscape amenity

Objectives:

- a. Create a more natural edge by planting native aquatic species in selected locations
- b. Provide access and usable space at appropriate locations
- c. Screen undesirable views, and frame or create desirable views across the lake

4.0 MASTER PLAN RECOMMENDATIONS

The Landscape Master Plan illustrates the concept and main landscape features proposed for the NIEHS campus. Refer to the drawings in Appendix 2 for more information. Sheet 1 shows the site divided into numbered sections representing 9 subsequent plan enlargements (Sheets 2-10). Sheet 11 is a plant list from which species can be selected when creating detailed planting plans. The list includes common and scientific name plus a recommendation on how and where to use each plant.

4.1 Landscape Maintenance Zones

The essence of the plan is a division of the site into three maintenance zones (see Appendix 4 for the complete maintenance plan). Each zone has unique goals, potential plant species and maintenance requirements. The drawings show specific locations of each zone.

Zone A includes the campus areas that will remain similar in character to the existing landscape. They are generally located in the highest use areas such as site and building entrances, patios and courtyards, and directly adjacent to walks, parking lots and roadways. The main goals are to maximize the ornamental and aesthetic aspects of these areas and retain a manicured and well-maintained appearance. Plants can include mowed grass, individually planted trees and shrubs, and mulched planting beds of shrubs, annuals or perennials. Non-native species can be used but suitable native ones are recommended.

Zone B primarily includes the campus areas where mowed lawn can be substituted with alternative types of ground cover. The more natural character of these areas will require less maintenance, particularly mowing, but will still appear cared for. The increased plant diversity will improve plant and animal habitat and aesthetically blend the campus with its natural surroundings. Zone B plantings will typically be located near but not directly adjacent to walks, parking lots and roadways, and within roadway medians and along the woods edge. Native grasses and wildflowers, ornamental native trees and shrubs are recommended plants. Mowed lawn is not included, and non-native trees and shrubs should be replaced over time.

Zone C will include locations along the woods edge, in the woodland understory or in locations designated as woodland restoration. The focus of this zone will be on developing different general types of plant communities such as meadow, savanna or woodland. The emphasis will be on developing the “edge effect”, areas of very high diversity where two types of habitat meet. Maintenance will be significantly reduced from current levels as natural processes are allowed to dominate. Natural succession patterns may be allowed to take place in some areas.

Typical spatial character of the landscape zones is illustrated by cross sections through the roadway corridor in various locations (see Sheets 2,4 and 5).

4.2 Landscape Features

The master plan also recommends additions or improvements to several landscape features. One of these is the main entrance to NIEHS at Alexander Drive. Refer to Sheet 5 in Appendix 2. Existing trees in the triangles and on either side of the road are removed to completely open up the area. The berms in the triangles are enlarged but set back enough from Alexander Dr. so that visibility is not blocked; a new more prominent sign and plantings of ornamental grasses, annuals or wildflowers and flowering shrubs accentuate the sign and berms. At the same time, masses of native evergreens planted just beyond the triangles constrict the roadway corridor and create a “doorway” in contrast to the openness of the triangles. The evergreens also extend the woods into the site. Overall, these changes create a distinct natural landscape style that is attractive in 4 seasons with strong identification and emphasis of the main entrance.

Beyond the entrance, the formality of the rows of trees in the roadway median is reduced by removal and replacement of selected trees with additional species.

The sketch on Sheet 9 shows improvements to the south entrance on Hopson Road. Recommendations include a large area of native plants around the sign to emphasize the entrance and establish the landscape style. Other new plantings screen the fence and overhead wires.

Terracing the slopes of the pedestrian tunnels with planters and seat walls breaks up the expanse of brick and eliminates the problems with the existing evergreen plantings. Trees and shrubs in the planters provide shade and more attractive walkways.

Minimal development is suggested for the softball field area (see Sheet 8). Selective removal of trees to open views between the pavilion and ball field, new shade trees and a trail connection make this area more user friendly.

The Master Plan drawings also show a new trail system that connects campus destinations with each other and with the Research Triangle Park trail.

4.3 Plant List

The Plant List in Appendix 3 is a more detailed version of the list shown on Sheet 11 of the Master Plan. In addition to common and scientific name, it includes each plant’s mature size, native range, a summary of its ornamental characteristics and growth requirements, and how and where it is best used on the campus. It is not intended to be an exhaustive list of all species native to the area, nor should it be used without a thorough understanding of the specific planting site. It does however provide a generous list of well-adapted plants from which to choose when preparing detailed planting plans.

4.4 Irrigation

4.5 Phasing and Implementation

It is most logical and economical to pair master plan projects with related campus construction projects. Re-landscaping the main entrance of the Rall Building has already

begun as part of the paver replacement project in that area. (See Appendix 7 for detailed plans.) Upcoming projects such as road reconstruction and Rall building patio improvements are other opportunities for implementation of master plan recommendations. (See Appendix 8 for patio/lakefront terrace concept plan.) Many projects may need to occur separately with funds specifically allocated for that use. Others may be completed with funds transferred from another use. For example, transition of fescue lawn to natural groundcover can begin almost immediately as the cost of annual over-seeding is transferred to native grasses and wildflowers. Since priority is not critical, NIEHS management is free to determine the exact timing and scope of each project depending on need and funding.

5.0 REFERENCES

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6.0 APPENDIXES

1. Site Analysis drawings (Sheets 1-5)
2. Master Plan drawings (Sheets 1-11)
3. Plant List
4. Maintenance Plan
5. Concepts of Integrated Pest Management
6. Goose Management
7. Rall Building Lakefront Terrace Concept Plan

NOTE: APPENDIXES 1-5 AND 7 ARE NOT AVAILABLE ONLINE. PLEASE CONTACT TOM BEDICK, OM-FEB, IF YOU NEED A FULL COPY OF THE REPORT.

Appendix 6 – Goose Management

Goose control techniques fall into the general categories of discontinuance of hand feeding, habitat modification, hazing and scaring, repellants, inhibiting reproduction, and removal. Unfortunately there is no single technique or easy method to reduce the goose population and its related problems on the NIEHS campus. An integrated approach using several techniques in combination is most likely to succeed. The Landscape Master Plan focuses only on habitat modification. Other techniques are described and may be required as components of a comprehensive goose management plan.

HABITAT MODIFICATION

Habitat modification includes modifying, reducing or eliminating the areas that currently are attractive to geese. Habitat modification alone usually cannot prevent geese from using an area, especially after the flock is established. Geese are extremely adaptable and individual geese respond differently to different management techniques. It is also possible that geese leaving the NIEHS area may exacerbate problems elsewhere in Research Triangle Park, necessitating a more regional control effort.

The geese most commonly found in urban areas of the eastern and mid-western United States are called giant Canada geese. Their preferred habitat is large unobstructed lawn area close to open water. They usually nest within 150 feet of water at sites with good views of the surrounding area. Nesting females prefer to use the same immediate area year after year. Nests may be found as close as 6 to 10 feet apart.

Nesting occurs in spring when an average of 5 eggs is laid per nest. The average incubation period is 26 to 28 days. If the nest is destroyed or predators destroy the eggs, geese may re-nest in or near the first one especially if it occurs shortly after laying. Within 24 hours of hatching, the goslings may be led up to 2 miles to grassy feeding areas near water.

Preferred feeding areas are grassy with open views to spot potential predators. Geese prefer fertilized plants over unfertilized ones. Adult geese molt each summer usually in open areas near their nesting and feeding sites. The process takes about 1 month and renders the birds flightless and vulnerable at that time. Most giant Canada geese generally only migrate short distances. They may fly to nearby areas to feed.

RECOMMENDED HABITAT MODIFICATION TECHNIQUES

1. Vegetative barriers

Shrub masses may block favored pathways of geese or obstruct their line of sight. Vegetative cover also enhances the attractiveness and long term effectiveness of barrier fences. This technique also works best when goose numbers are low and there is other available habitat nearby. It will not discourage flying geese or those accustomed to walking through taller plant material.

2. Decreased attractiveness of grazing areas
Grasses allowed to grow taller than 6" reduces the amount of young shoots that geese prefer to eat. Allowing grass to go dormant also reduces shoot production. Reducing fertilizer usage may decrease an area's attractiveness for feeding. Reducing the size of mowed grassy areas minimizes feeding areas forcing geese to find food elsewhere. Certain plant species such as vinca, myrtle, pachysandra, English ivy, euonymous and junipers tend to be avoided by Canada geese.
3. Alternative feeding areas
This technique is suitable only if a resident goose population can be tolerated on the site, but it can increase the effectiveness of other habitat modifications and hazing techniques. A nearby crop of grain or a well-fertilized and mowed lawn can lure the geese to the alternate site, provided it occurs at the same time the geese are being removed from the problem area.
4. Fence barriers
Fences can prevent geese from walking from water to grazing areas. A variety of materials and construction methods can be used. One successful type is constructed of 20-pound test monofilament line spaced 7 and 12 inches above the ground on poles spaced 6 feet apart. It should be long enough to discourage the geese from walking around the ends and be flagged or signed to prevent people from tripping on the fence. This technique is most effective when goslings are present, during the molting period, and when used along with vegetative barriers.
5. Rock barriers
Boulders at least 2 feet in diameter hinder geese as they leave the water and obstruct views and paths to feeding areas. A combination of a rock barrier and dense vegetation placed above the boulders may enhance the effectiveness of both methods. Other shoreline construction such as a boardwalk would also act as a barrier.
6. Placement of walking paths by water
Geese are less likely to use the areas directly adjacent to water for feeding or resting if there is human activity there. This method is ineffective if an established flock is already accustomed to human activity.

Other habitat modifications such as altering the shoreline, modifying the water level, and placing grids or wires above or on the water have been rejected as infeasible for use on the NIEHS campus.

In addition to habitat modifications, a permanent solution to goose related problems would likely require the use of additional techniques.

OTHER CONTROL TECHNIQUES

1. Discontinuance of hand feeding
Many people enjoy interacting with geese by hand feeding them. This however encourages them to congregate in an area and makes them more comfortable around

humans. Discontinuance of feeding is harmless to the geese since they are efficient grazers and do not need to rely on human handouts.

2. Hazing and Scaring Techniques

These techniques are designed to frighten geese away from problem sites. It is permissible to harass Canada geese without a state or federal permit as long as the geese are not touched or handled by a person or an agent of a person (e.g. a trained dog). Some disadvantages of hazing techniques are habituation of the geese to the devices, failure to cause geese to leave an area for any length of time, and complaints about noise. It is difficult to haze or scare birds that are accustomed to using an area. The use of a combination of techniques is always more effective than using one alone. Noisemakers, visual frightening devices and border collies are typical techniques.

3. Chemical Repellents

Chemical repellents are visually and acoustically unobtrusive, may be applied directly to the problem area and may not harm the geese permanently. Disadvantages include cost, necessity to reapply frequently and inconsistent results. Repellents only deter grazing, not resting or swimming. The repellents are made from a naturally occurring, nontoxic, biodegradable food ingredient called methylantranilate (MA).

4. Control of Reproduction

Because Canada geese can live as long as 20 years, impairing reproduction can prevent a flock from increasing in size and may eventually reduce its size. All forms of reproduction interference require federal and state permits. Methods include removing new nests daily, destroying eggs or replacing eggs with dummy eggs.

5. Removal

This technique's main advantage is that its effects are immediate and obvious. Permits are required and lethal techniques are almost always controversial. Translocation of geese has had mixed success because adults often return to their former nesting sites and few locations will accept them. Although hunting is the major cause of death in Canada geese, urban flocks are often protected from this threat. Where possible, harvesting geese can enhance other potential management options. Hunting may increase the overall disturbance encountered by the geese, reduce the protected areas available to the flocks, increase the effectiveness of acoustical harassment, and remove adult geese that contribute to the substantial population growth. Hunting can occur during a regular hunting season or by special-purpose permits.

A more complete discussion of the above techniques can be found in the publication *Managing Canada Geese in Urban Environments* by A.E. Smith, S.R. Craven, and P.D. Curtis, 1999, Jack Berryman Institute Publication 16 published by Cornell University Cooperative Extension, Ithaca, NY. (Phone: 607-255-2080)