GREYSTONE HALL: A COUNTRY ESTATE RESTORATION

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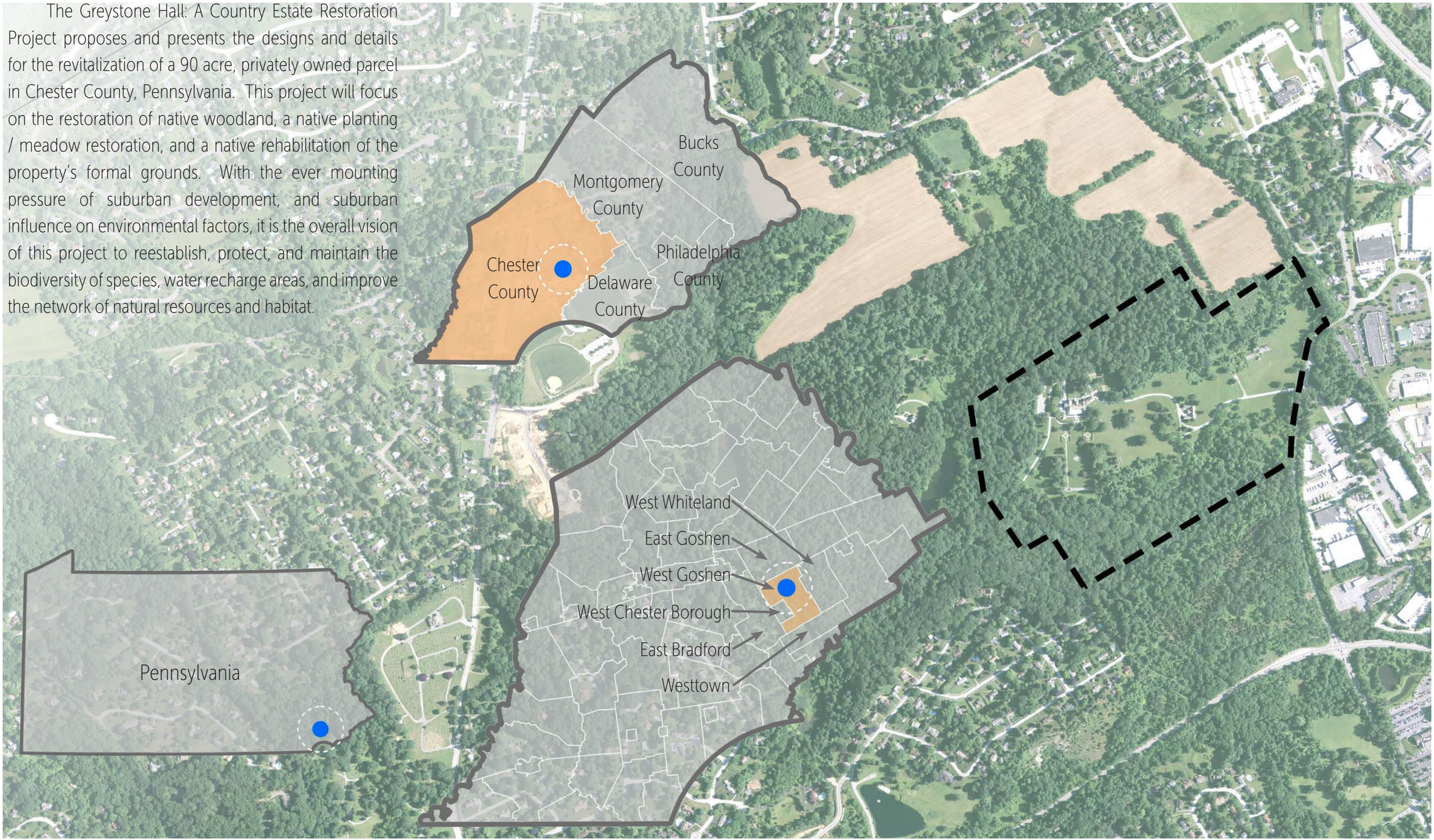
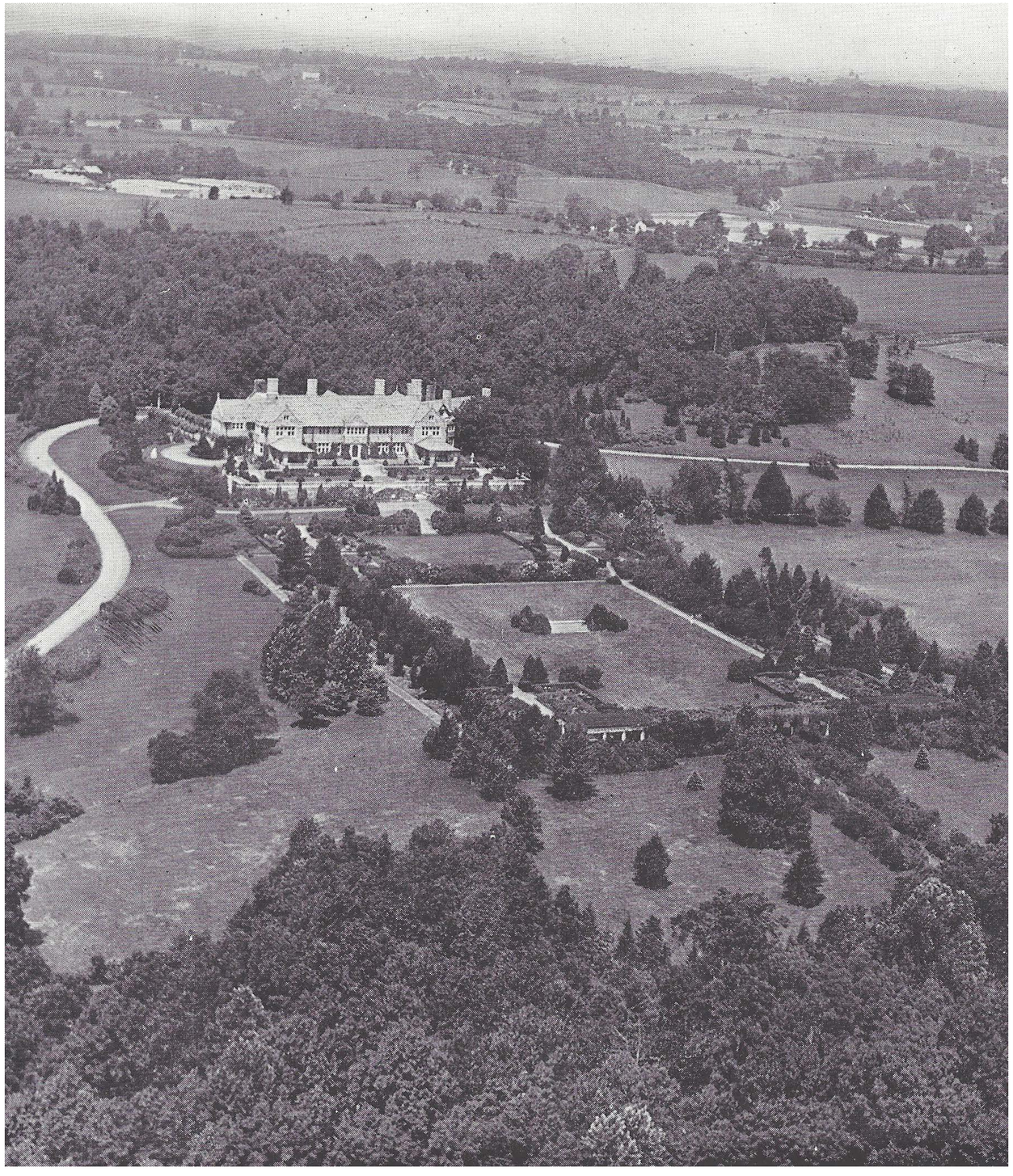
INTRODUCTION

The Greystone Hall: A Country Estate Restoration Project proposes and presents the designs and details for the revitalization of a 90 acre, privately owned parcel in Chester County, Pennsylvania. This project will focus on the restoration of native woodland, a native planting / meadow restoration, and a native rehabilitation of the property's formal grounds. With the ever mounting pressure of suburban development, and suburban influence on environmental factors, it is the overall vision of this project to reestablish, protect, and maintain the biodiversity of species, water recharge areas, and improve the network of natural resources and habitat.



HISTORY



Currently Greystone Hall totals out at 450 acres of woodland and fields, but at one point in its history was made up of nearly 700 acres of uninterrupted land. The property was originally owned by Philip M. Sharples, who at the turn of the twentieth century, had become an international success with the creation and sales of the first American cream separator. With his financial success, Sharples began buying parcels of farm land in Chester County with the hopes that he would create a gentleman's county estate. With the help of Philadelphia architect Charles Barton Keen, the construction of Greystone Hall began in 1905 and completed in 1908. Located on the highest elevation of the property, Greystone Hall was positioned so that the front of the house would provide wide, uninterrupted views of open space and formal gardens also designed by Keen, and local Landscape architect, Ogal B Paul.

Following the loss of his wife, Sharples' success was followed by financial ruin and Greystone Hall, which he had used as collateral on loans, was eventually foreclosed on. Sharples then moved to California and Greystone Hall and the surrounding property was purchased in 1942 by Aram K. of Philadelphia, an importer and appraiser of oriental rugs. Since its purchase, descendants of Aram K. Jerrehain still live on the second floor of the main house. Today, the surrounding outhouses are occupied by tenants, and the first floor of the main house and the surrounding gardens are available for weddings, receptions, banquets, rehearsal dinners, and special events as well as executive conferences, formal business entertaining and small private dinners.

GOALS

ECOLOGY

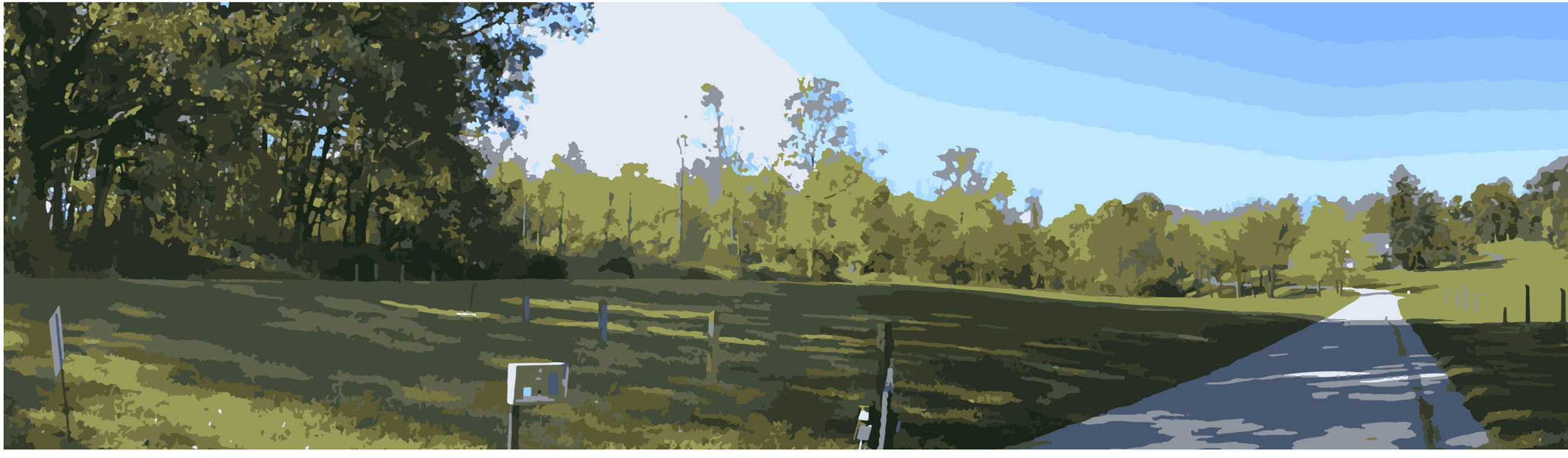
Showcase native plant diversity, beauty, and function by utilizing design principles that blend horticulture and ecology.

ECONOMY

Create a working landscape that promotes aesthetic, cultural, economic, and environmental values for both the owner and visitors.

SOCIAL

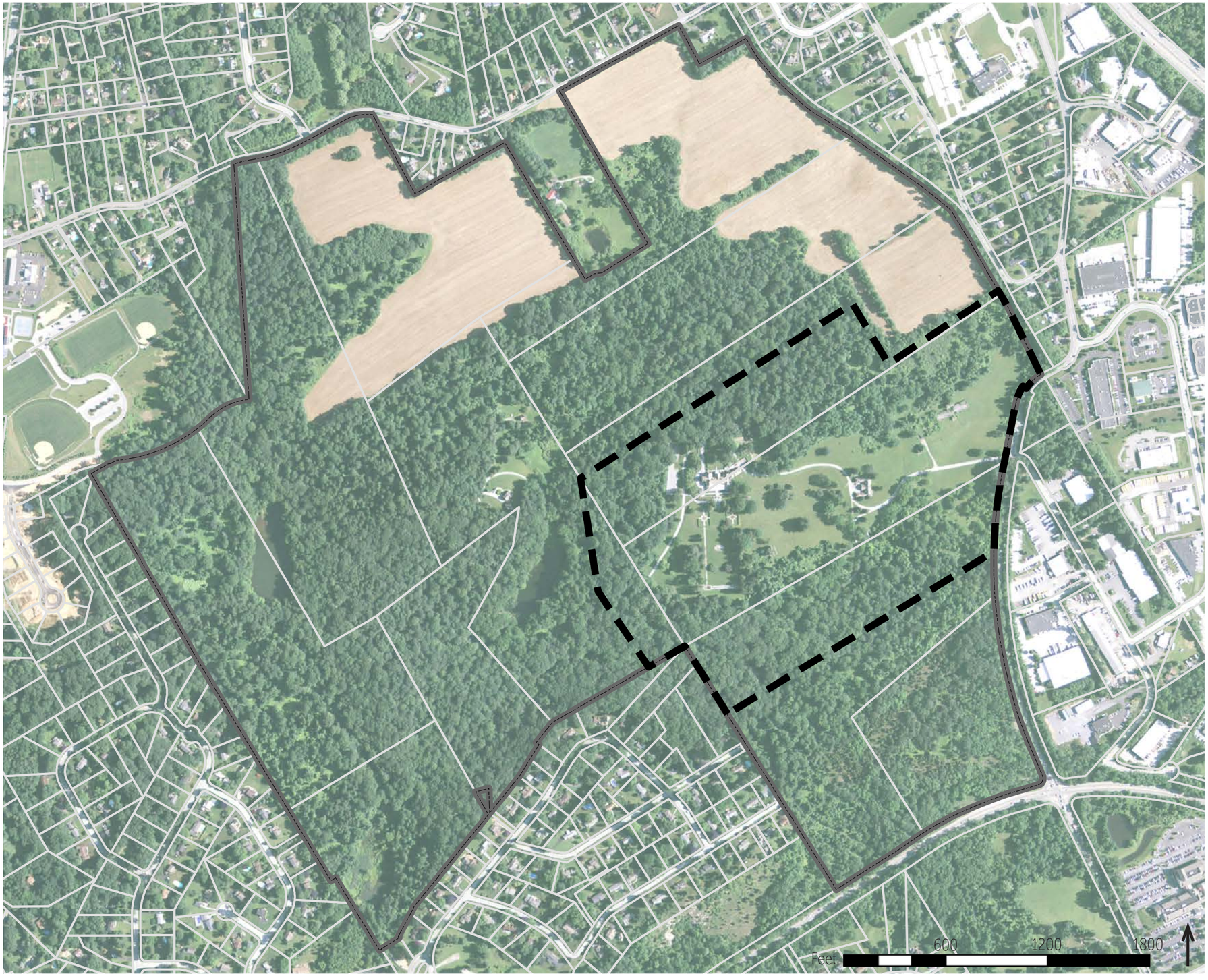
Create an environment that promotes collaboration with educators and the general public to extend the impact of educating for a sustainable future.



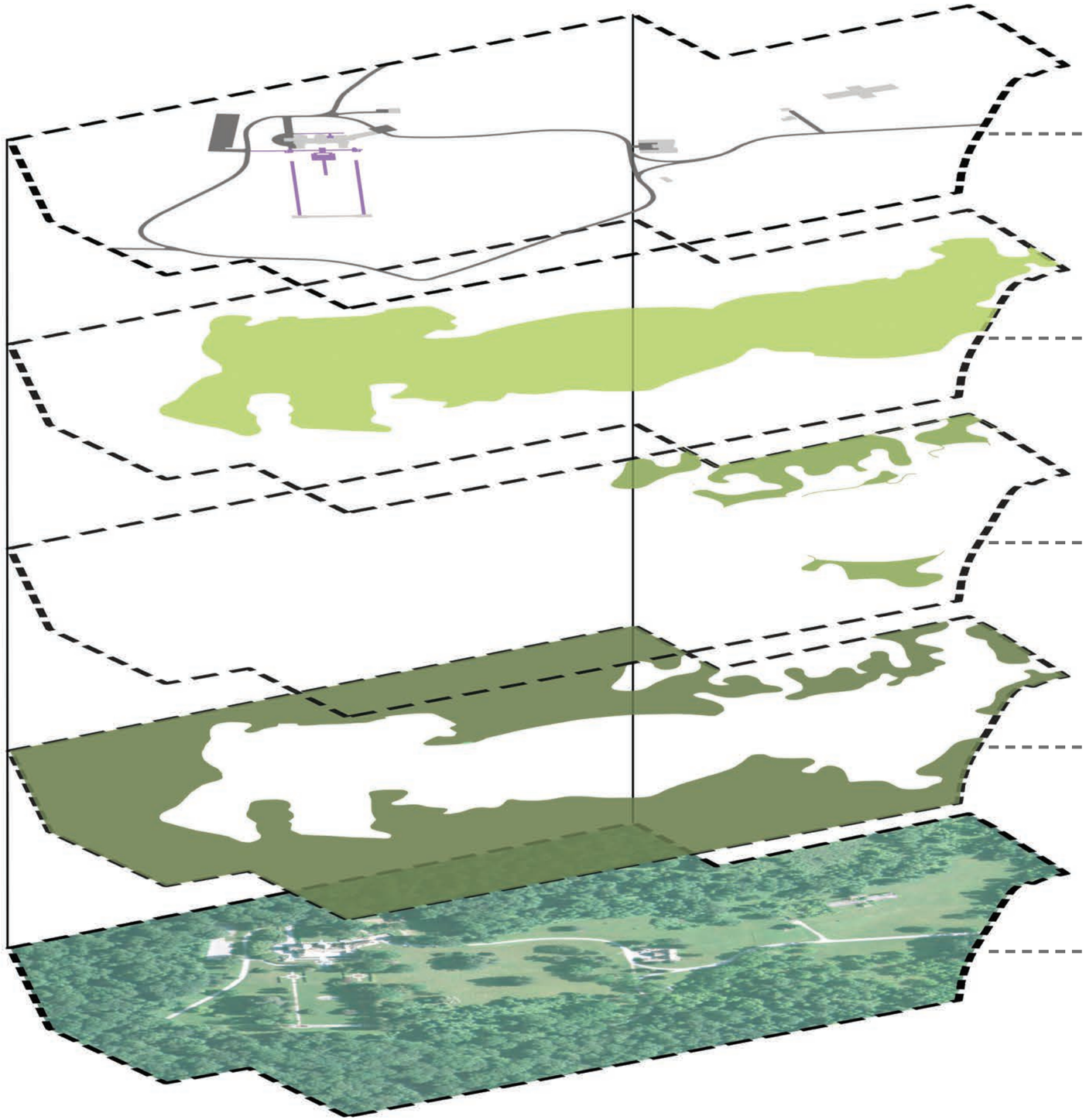
INVENTORY AND ANALYSIS

EXISTING CONDITIONS

Greystone Hall is located at 1034 Phoenixville Pike, West Chester PA, West Goshen Township, Chester County, Pennsylvania and the coordinates of the site are 39°59'11.17 N and 75°35'55.17" W. Currently the Greystone property is 417 acres, and is made up of buildings, formal gardens, vast lawn, agricultural land, forested areas, man-made lakes, roads and parking. Of this 417 acres, nearly half has been slated for suburban residential development. Of the remaining land, the 90 acre project boundary was chosen based on ecological degradation, design opportunities, and client input.. The project area is comprised of 30.54 acres of lawn, 7.53 acres of highly degraded invasive shrubland, 48.43 acres of woodland, 2.67 acres of gravel parking, gravel roads, and paved surfaces, and .83 acres of built structures. The Greystone Hall property is managed by Velda Jerrehain Moog, a decedent of the Jerrehain Family, and the grounds keeper is Michael Brun.



EXISTING CONDITIONS



Hardscape .04%

Lawn 33.9%

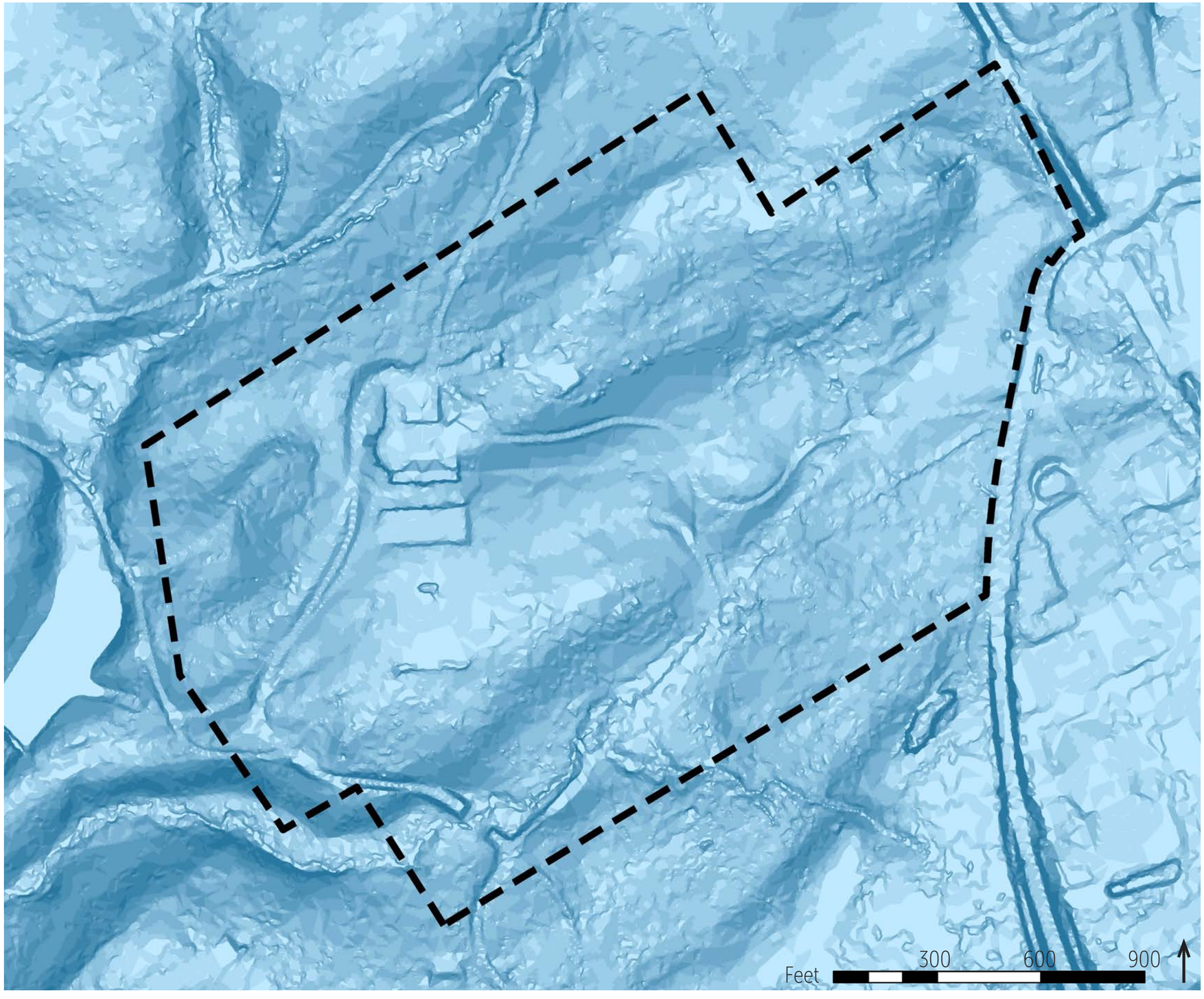
Shrubland .08%

Woodland 53.8%

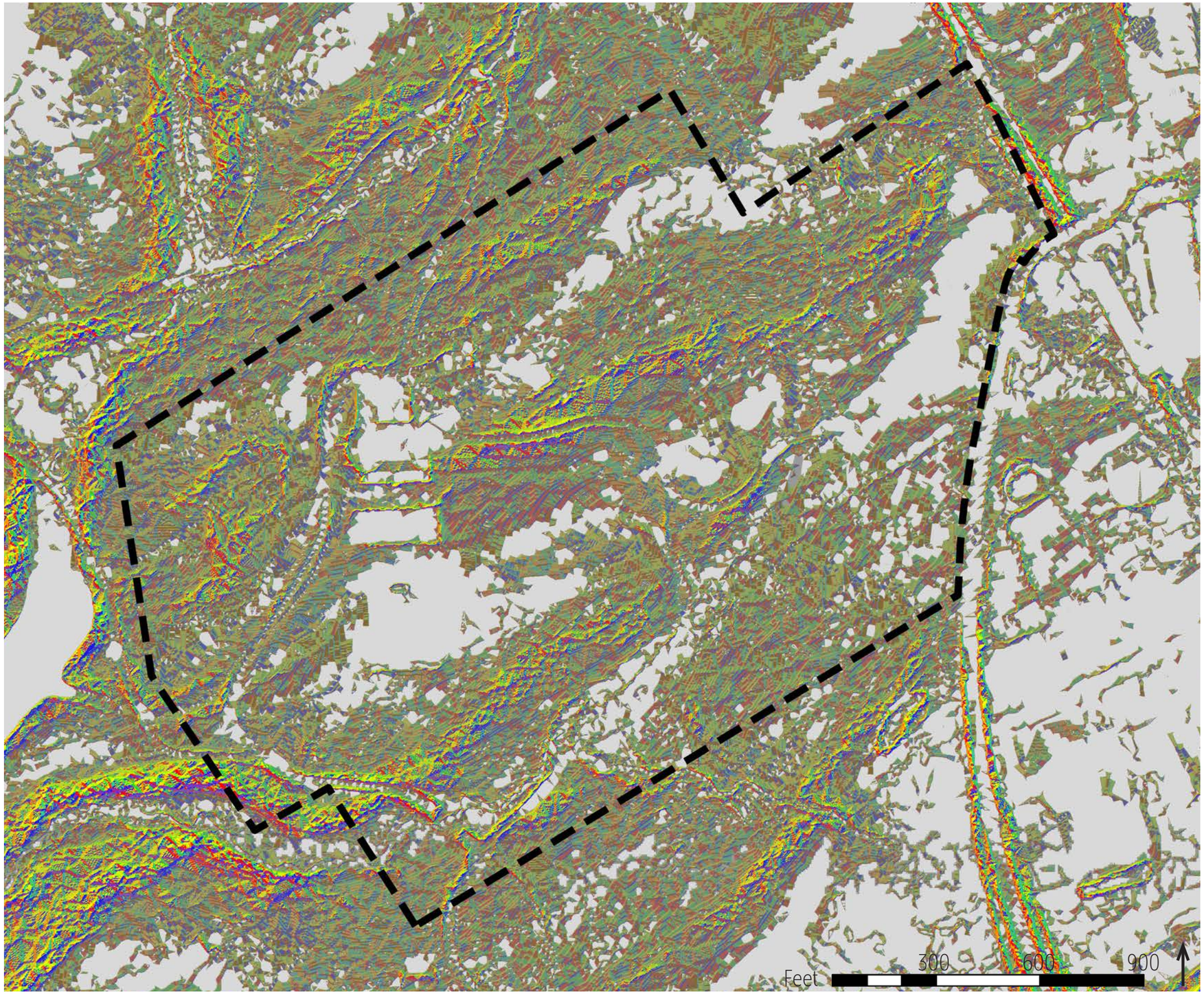
Project Site 90ac.

TOPOGRAPHY

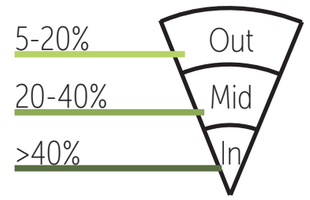
A topographic slope analysis was conducted in order to gain a more general understanding of the project sites terrain. The Greystone Revitalization Project area has a total elevation change of 125 feet, the lowest point being 387, and the highest point 512. By conducting this analysis, valuable data was created which served as a basis for better planning,future site management and steep slope stabilization priority areas.

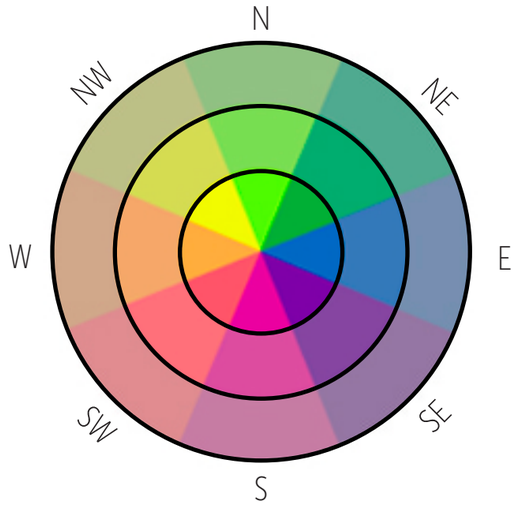


ASPECT



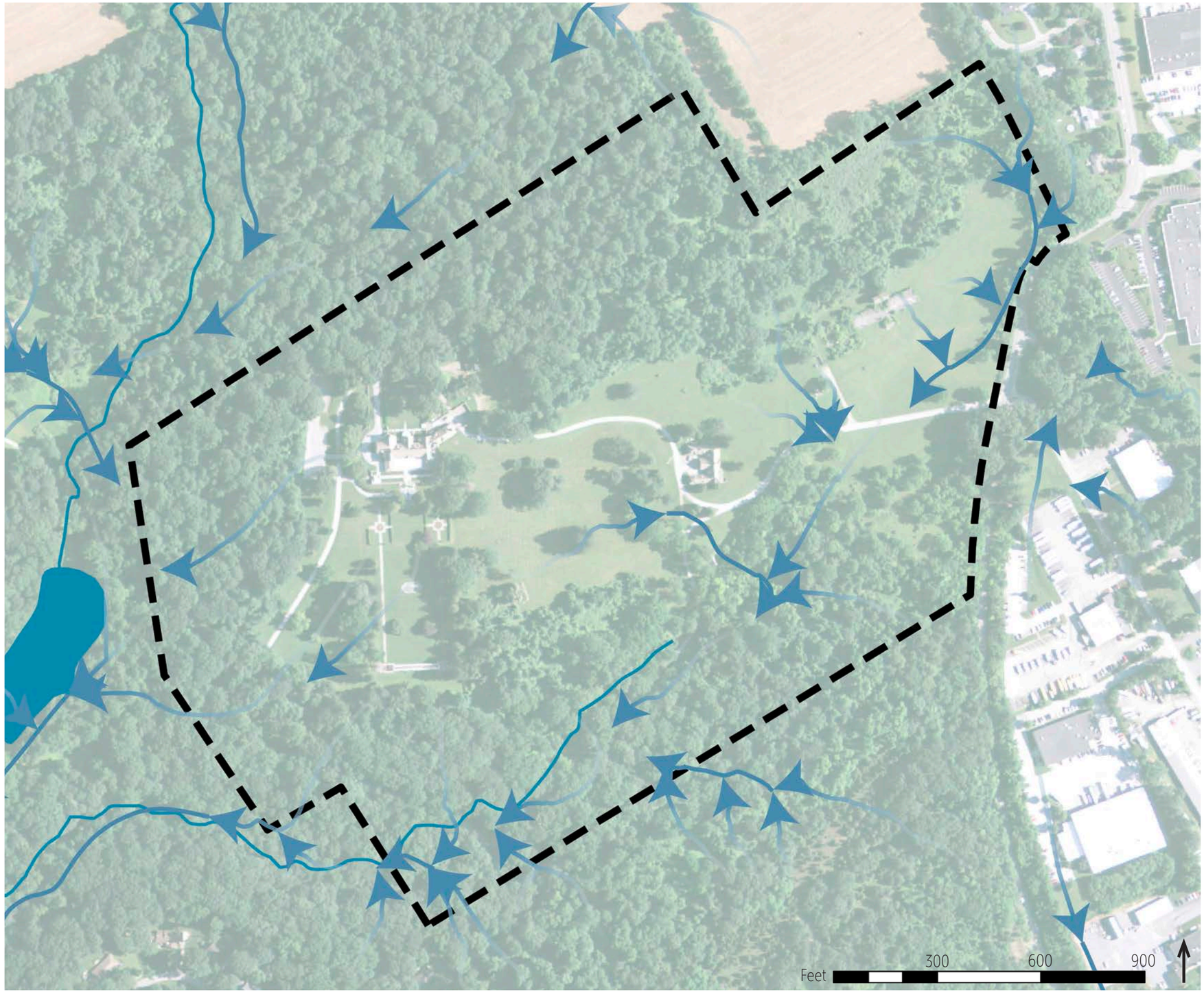
The map shown to the left displays the aspect (direction) and the degree (steepness) of the terrain simultaneously. The aspect is categorized using various colors to symbolize the cardinal and ordinal directions as well as the degree of slope which is indicated by the increase in saturation or intensity of the color. This is valuable information because the direction and intensity of a slope has a direct influence on the microclimate of any given slope. For example, a south facing slope will receive more sun than a north facing slope meaning that spring will arrive sooner on a south facing slope and fall conditions will arrive later. Additionally, slopes that face prevailing winds may receive more precipitation but will also have to contend with winds more frequently. All of this information has a direct influence when choosing the appropriate plant location for a restoration project.





HYDROLOGY

The Greystone Hall Revitalization project is located in the headwaters of the Brandywine Creek Watershed, which is one of four major watersheds of the Christina River Basin. On site is a first order, unnamed, spring fed tributary to Taylor Run Creek. Additionally, intermittent and ephemeral streams were also observed on site. The water that originates on this site contributes to the drinking water supply of more than 50% of New Castle County's population. The importance of first order streams in watersheds can not be understated as all streams have a strong influence on the integrity of waters downstream. By building off of the slope analysis, and through the generation of various models, using ArcMap, the next phase in site analysis was to determine the directional flow hydrology on site as well as surface flow from outside the project boundary. Using the topography of the site, this map shows areas of concentrated stormwater runoff accumulation which had a direct influence on site design and plant selection.



This site falls within the Northern Appalachian Piedmont, which is at the northern end of the Piedmont Plateau. This area is primarily a low-relief plain in the final stages of fluvial erosion. Most of the area occurs within the 300 to 1000 feet above sea level range and is generally gently sloped towards the Atlantic coast in the form of ridges, valleys and rolling hills.

CdB: Chester Silt Loam:3 to 8% slopes: .202ac

This soil is not so extensive. Most of it is wooded and has little or no erosion. The surface layer is covered with a thin mat of leached leaf mold. The soil has high available moisture capacity, is moderately fertile, and is easy to work. White oak, red oak, black oak, walnut, tulip-poplar, ash, and hickory are suited to this soil.

ChC2: Chrome gravelly silty clay loam, 8 to 15% slopes, moderately eroded: 8.04ac

This soil is shallow and moderately deep and is well drained. These soils have moderately slow permeability. The fairly heavy texture of the subsoil and the shallowness of the profile restrict the available moisture capacity. In most places there are stones on or near the surface. The steep areas and a few areas on ridge tops where the sols are very shallow are severely eroded. Black oak, pitch pine, Norway spruce, white pine, and scotch pine grow will on this soil.

Ggb: Glenelg silt loam, 3 to 8% slopes 24.95ac

This soil is moderately deep, well drained soils of uplands. They have moderate available moisture capacity. Permeability and fertility are also moderate. In areas that have not been limed, the soils are acidic throughout the profile. Red oak, white oak, black oak, tulip poplar, hickory, walnut, white pine, scotch pine, and Norway spruce are well suited to this soil.

GgC: Glenelg silt loam, 8 to 15% slopes 38.74ac

Most areas of this soil are wooded. The surface layer is cover with a thin map of leaf mold, (see above for soil description)

GlB: Glenville silt loam, 3 to 8% slopes 7.05ac

Most of this soil is wooded and the surface layer is covered with a thin layer of hardwood leaves and twigs. Just beneath the litter is a black mull of decayed or well-rotted leaves and roots. The soil has moderately high fertility, bit their permeability is moderately slow. The available moisture capacity is moderately high, and the moisture remains in them for fairly long periods. Areas that are not limed are strongly to very strongly acidic. The soil is easy to work and are free of stones in most places. Red oak, white oak, ash, red maple, hickory, and walnut are well suited to this soil.

MaD: Manor loam, 15 to 25 % slopes 6.74ac

The Manor loam soil consists of shallow well-drained soils of uplands that are shallow and well drained. This surface is nearly all forested. On the surface is a layer of leaf mold about 1 inch thick. This soils has moderately low available moisture capacity. It is easily penetrated by air, moisture, and plant roots. Because of the steep slopes it is highly susceptible to erosion. White oak, red oak, black oak, beech, hickory, and tulip-poplar are suited to this soil.

MaF: Manor loam, 35 to 60 % slopes 3.79ac

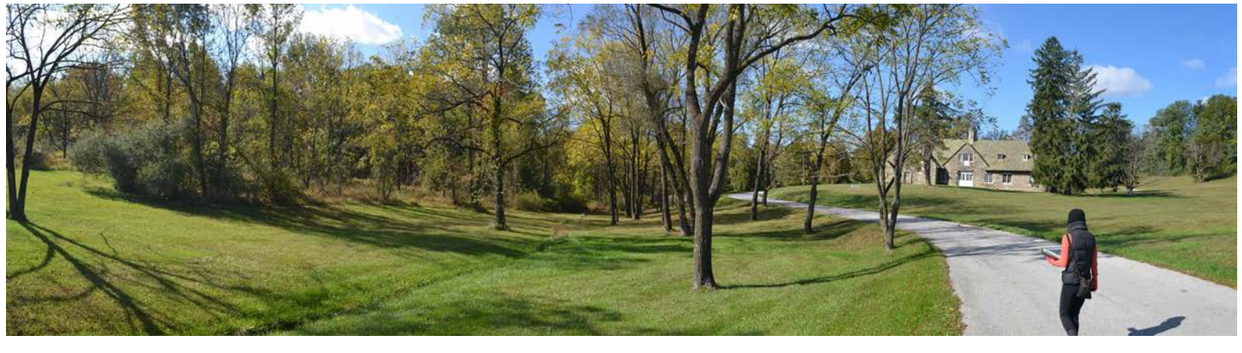
This soil is shallow. Most areas are wooded and have a thin layer of leaf mold. About one half inch thick on the surface. This soil is well suited for trees, which are needed to provide a permanent cover. Red oak, white oak, black oak, chestnut oak, beech, and hickory grow fairly well on these soils of the areas are not severely eroded. In areas that are severely eroded, red pine, Virginia pine, banks pine, white pine, and pitch pine can be grown.

NvB: Neshaminy silt loam, very deep over mafic gneiss, 3 to 8 % slopes .55ac

The Neshaminy soil is deep and well drained. They are moderately permeable and have moderate available moisture capacity. They developed mainly from serpentine and from gabbro and granodiorite of Precambrian age and are slightly acidic to neutral. White oak, red oak, black oak, tulip poplar, hickory, and ash are well suited to the soil.

SITE CHARACTER

The sweeping hills and valleys on the property naturally create feelings of open, playful and intimate spaces, and the history of the English style country estate is visible in Greystone Hall's remarkably preserved architectural integrity. However, the out buildings that in the peak of the property's production served various agricultural and housing purposes, have now been left to nature's destructive forces. Clay pipes that once helped to control stormwater runoff have now collapsed, causing stream edge undercutting and thus now undermines the quality of the spring fed headwaters just a few hundred feet down slope. Expansive lawns, which require vast amounts of time and energy to maintain, lead to various forms of forest edges and hedgerows, mostly composed of invasive species and exposed mature tree stands. The most redeeming quality of the property's woodland is the healthy canopy and sub canopy which help to stabilize the sites steep slopes. However, these wooded areas are over burdened by invasive shrub and herbaceous species, and the few remaining patches of natives are under threat as surrounding suburban development decrease viable deer habitat.



PLANT COMMUNITY


Quercus rubra


Acer rubrum


Quercus velutina


Betula alleghaniensis


Fraxinus americana


Fagus grandifolia


Carya ovata


Liriodendron tulipifera

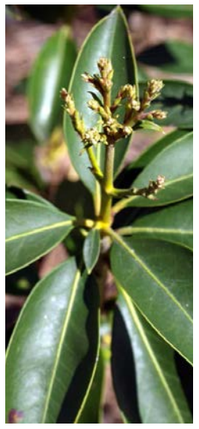

Viburnum recognitum


Viburnum acerifolium


Hamamelis virginiana


Amelanchier laevis


Amelanchier arborea

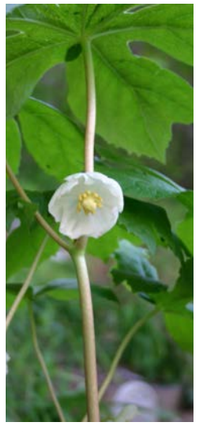

Kalmia latifolia


Carpinus caroliniana

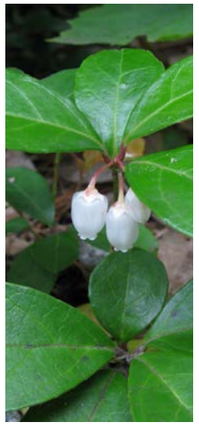

Lindera benzoin


Uvularia sessilifolia


Smilacina racemosa


Podophyllum peltatum


Chimaphila maculata


Gaultheria procumbens


Medeola virginiana


Caulophyllum thalictroides


Dennstaedtia punctilobula

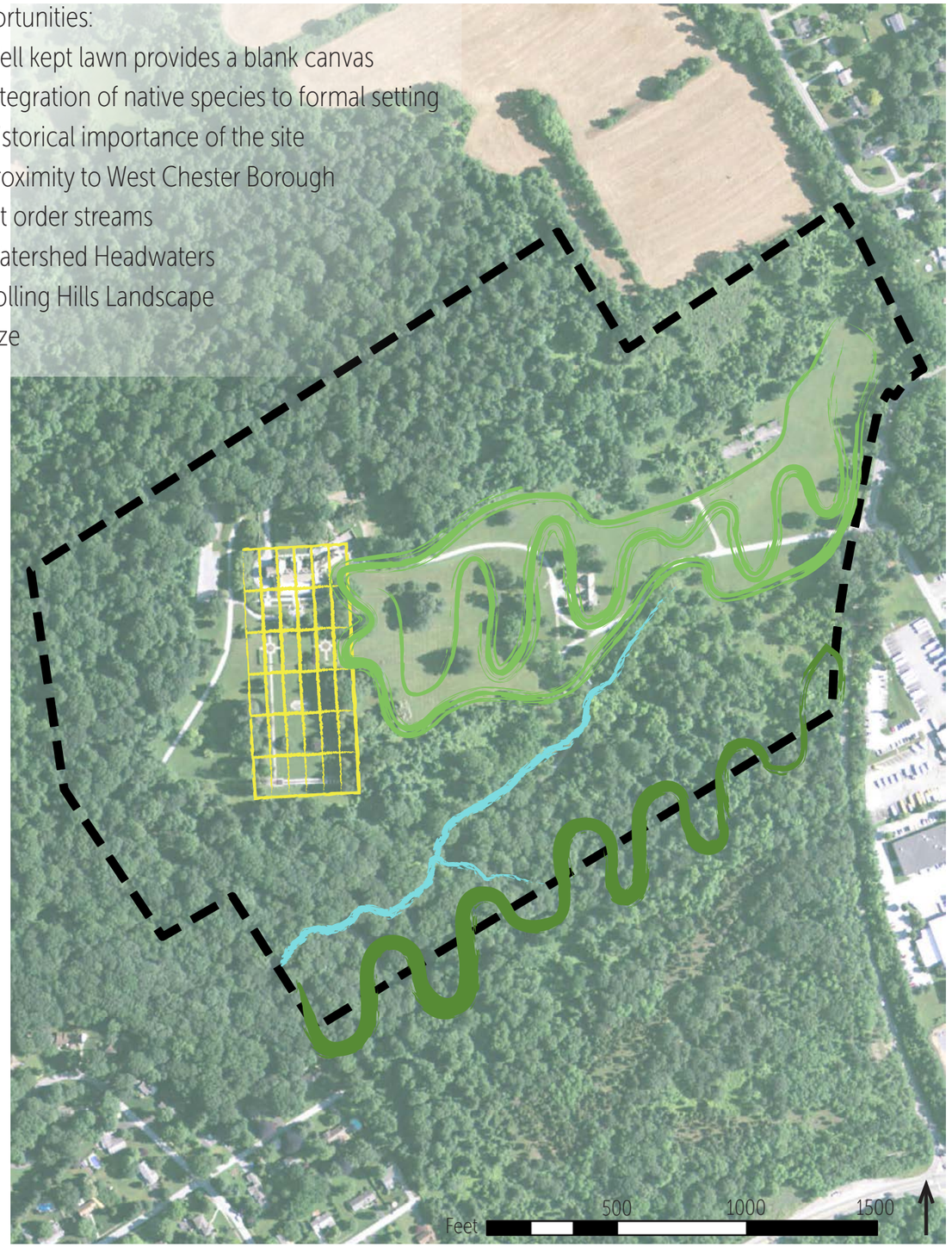
The project site lies in what is considered to be the Red-oak - mixed hardwood forest. The Terrestrial and Palustrine Plant Communities describes this community as the following:

This broadly defined community type includes much of Pennsylvania's hardwood-dominated forests occurring on fairly mesic sites, and is therefore quite variable in composition. Quercus rubra (northern red oak) is usually present, often dominant/codominant, most often with Acer rubrum (red maple), Quercus velutina (black oak), Q. alba (white oak), Carya tomentosa (mockernut hickory), C.ovata (shagbark hickory), Betula lenta (sweet birch), B. alleghaniensis (yellow birch), Fraxinus americana (white ash), Fagus grandifolia(American beech), and/or Liriodendron tulipifera (tuliptree). Shrubs include Viburnum recognitum (northern arrowwood), V. dentatum (southern arrowwood), V.acerifolium (maple-leaved viburnum), Amelanchier laevis (smooth serviceberry), A. arborea (shadbush), Kalmia latifolia (mountain laurel), Carpinus caroliniana (hornbeam), Ostrya virginiana (hop-hornbeam), Hamamelis virginiana (witch-hazel), and Lindera benzoin (spicebush). The herbaceous layer is highly variable. Representative species include Uvularia sessilifolia (wild-oats), Smilacina racemosa (false Solomon's-seal), Podophyllum peltatum (may-apple), Chimaphila maculata (pipissewa), Gaultheria procumbens (teaberry), Medeola virginiana (Indian cucumber-root), Caulophyllum thalictroides (blue cohosh)—on richer sites, Dryopteris spp. (wood ferns), and Dennstaedtia punctilobula (hayscented fern).

OPPORTUNITIES AND CONSTRAINTS

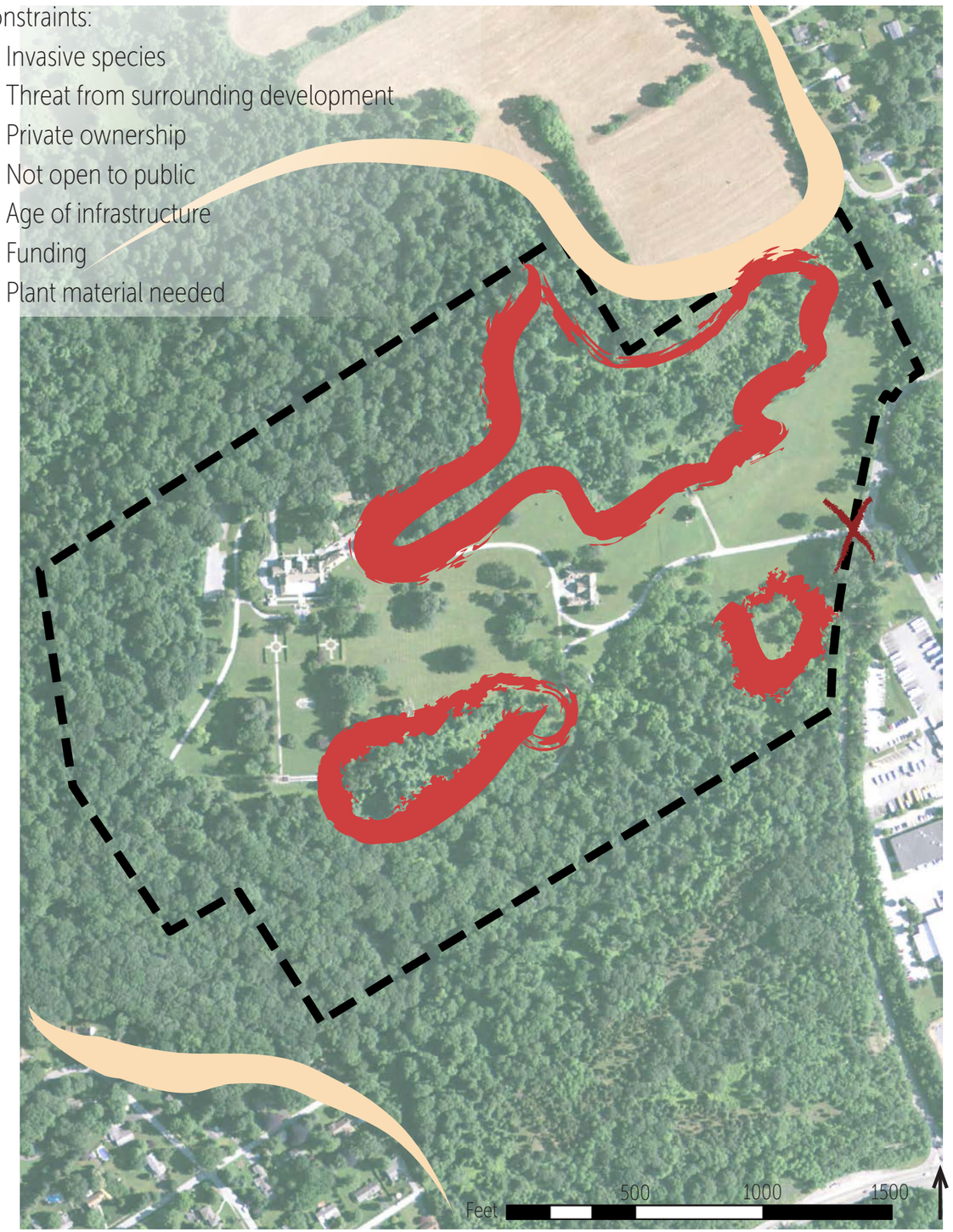
Opportunities:

- Well kept lawn provides a blank canvas
- Integration of native species to formal setting
- Historical importance of the site
- Proximity to West Chester Borough
- 1st order streams
- Watershed Headwaters
- Rolling Hills Landscape
- Size



Constraints:

- Invasive species
- Threat from surrounding development
- Private ownership
- Not open to public
- Age of infrastructure
- Funding
- Plant material needed



PRECEDENT: SHELBURNE FARMS

Located on the shores of Lake Champlain in Shelburne, Vermont, Shelburne Farms is a nonprofit organization whose mission is to educate for a sustainable future. They are located on a 1,400 acre working farm, forest, and National Historic Landmark.

The Shelburne Farms team believe that sustainability is grounded in individual awareness and actions starting in small communities. By focusing on young people, Shelburne Farms hopes to foster the care for sustainability and the improvement of quality of life.

Shelburne Farms are stewards of education. They partner closely with schools in an attempt to transform education by offering learning experiences that inspire young people to make informed, environmental, cultural, and sustainable decisions.

PRECEDENT: BOWMAN'S HILL

Bowman's Hill Wildflower Preserve is a non-profit 501(c)(3) organization located in New Hope, Pennsylvania. Their purpose is to showcase the extraordinary diversity of plants native to the Pennsylvania and Delaware Valley region, and their goal is to encourage the visitation of the public in order to promote the diversity and richness of Pennsylvania's natural heritage.

During visits, guests learn how meadows like Bowman's Hill, provide much needed habitat for wildlife, help to filter pollutants, stabilize soils, recharge ground water supplies, and the low level of maintenance required to maintain. Perhaps the most important quality, or conveying feature, is the beauty of the meadow, how it provides a succession of texture, form, and color as the seasons change.

Bowman's Hill
WILDFLOWER PRESERVE
Where Mind, Heart and Spirit Bloom

PRECEDENT: LONGWORD GARDENS MEADOW

Longwood Gardens is a world renowned garden located in Chadds Ford, Pennsylvania. They have many formal gardens, but in an attempt to bring the natural character of Brandywine Valley to the public eye, Longwood Gardens, along with Jonathan Alderson Landscape Architects, created a meadow installation utilizing under performing Longwood property. This meadow creation was not an attempt at a restoration project, rather, it was focused on utilizing design principles that support the ecology of the region. For this meadow to thrive, a blend of horticulture and ecology is necessary. This feature is also used for educational purposes with interpretive signs throughout, as well as regular tours and birding classes.

CONCEPT ONE: REFLECTION

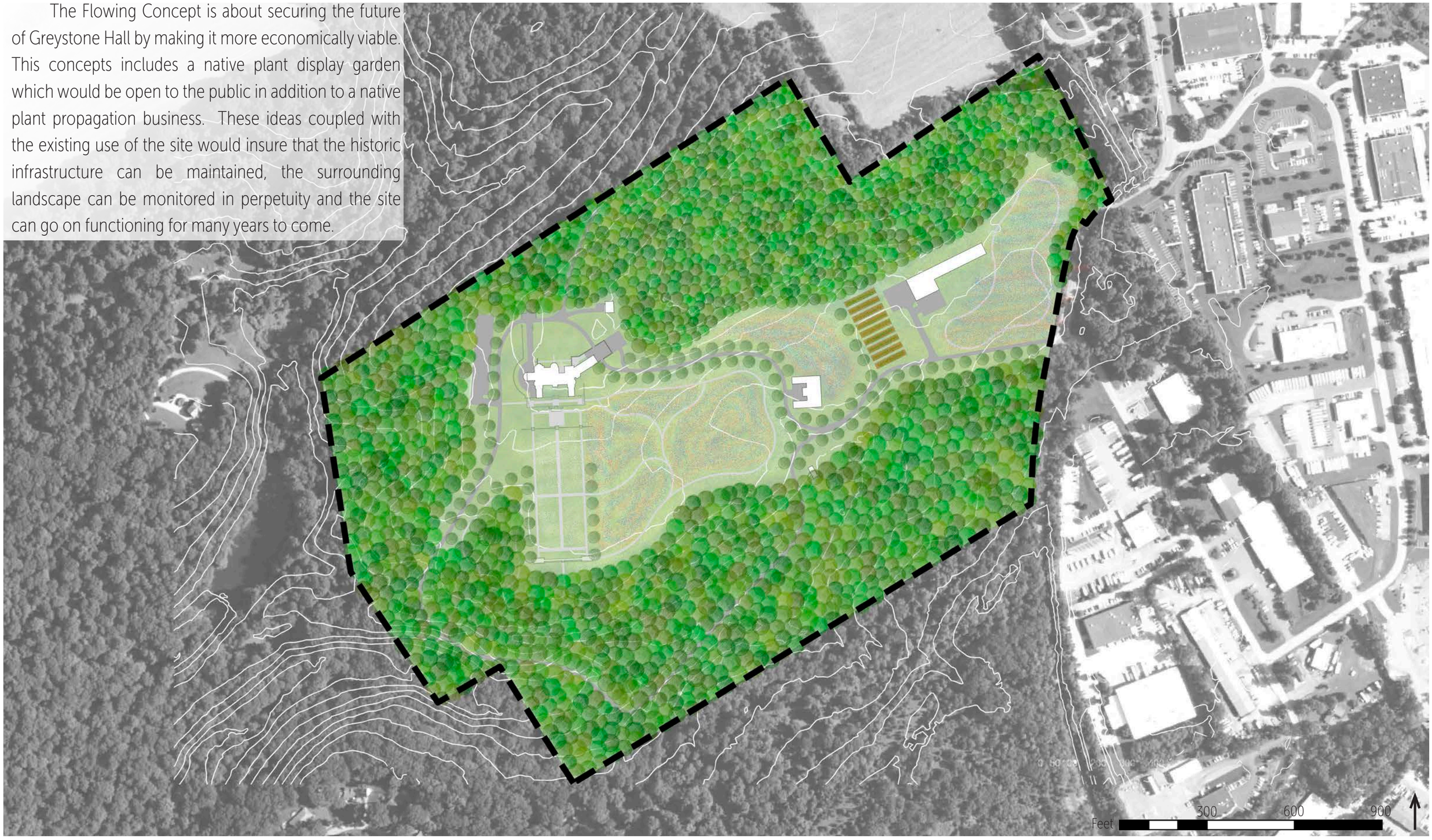
The purpose of the Refection Concept is to bring the element of open water to the Greystone Hall project. This will serve the ecological functions of collecting water on site, recharging ground water, preventing downstream flooding, reducing sedimentation, and providing additional flora and fauna biodiversity. These water surfaces also introduce another dimension into the gardens and open space areas by creating mirror like surfaces on which the surrounding landscape can be reflected.

CONCEPT TWO: OPEN SPACE

The Open Space Concept was created to explore the possibility of further opening the lawn areas to create the scenario for a major meadow restoration to coincide with the surrounding woodland restoration and create both framed and open viewsheds. This concept would also provide for the greatest amount of songbird habitat creation. Additionally, this concept allows the property to more closely resembles the rolling Chester County landscape which first inspired the Greystone Hall location.

CONCEPT THREE: FLOWERING

The Flowing Concept is about securing the future of Greystone Hall by making it more economically viable. This concepts includes a native plant display garden which would be open to the public in addition to a native plant propagation business. These ideas coupled with the existing use of the site would insure that the historic infrastructure can be maintained, the surrounding landscape can be monitored in perpetuity and the site can go on functioning for many years to come.

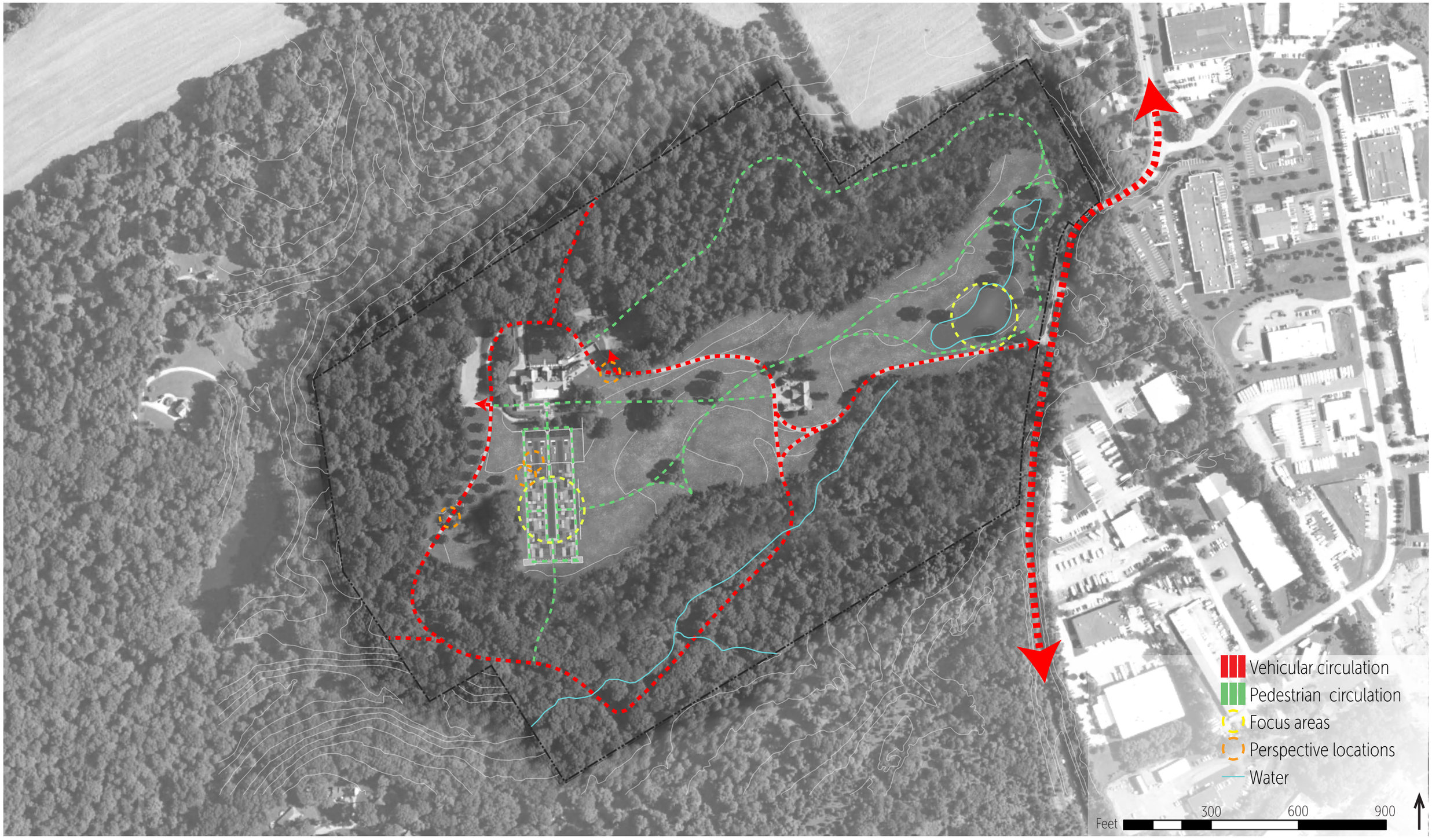


MASTER PLAN AND DESIGN

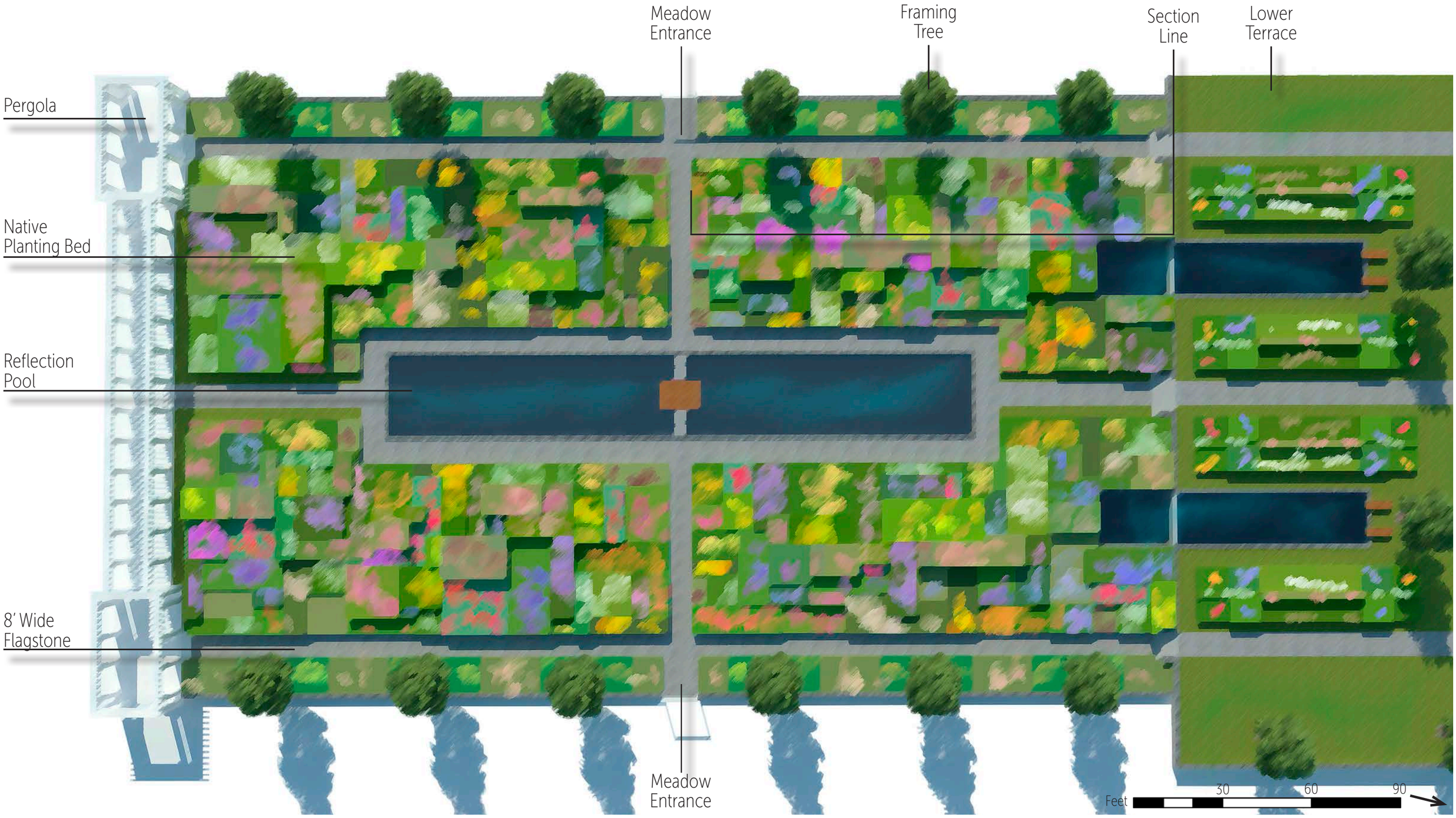
MASTER PLAN

As guest arrive at Greystone Hall, the entry drive is bordered by woodlands, wildflower meadows, and a pond, drawing visitors into the site. The scene forces the eye to scan across the rolling landscape with the sites kinetic energy on display as the masses of plants move with every push and pull of the wind. The driveway continues towards the southern corner of the site, leading the guest into a beautifully intimate woodland drive. As visitors move further into the site the driveway sweeps north and the tree line breaks, giving way to a framed view of Greystone Hall, perched atop the hill. After disembarking from their vehicles, the guest arrive on the upper terrace of the formal gardens, which provides an overlook of the property. From this vantage point guests have the best view of the property. Descending into the formal gardens, the beauty of the native plants are on display and the reflection pools add both literal and metaphorical features. As guests move through the gardens the temptation to move into the meadows is irresistible. Mowed paths follow the curves of topography allowing guests to meander through the site leading to overlook destinations and allow guests to experience the plants on display in the formal gardens in their natural setting. The site is activated with the movement of wildlife and the various colors of the palette advancing and receding as the intensity and hue of the sun vary with the passing of the day.

CIRCULATION



NATIVE GARDEN DETAIL



NATIVE GARDEN SECTION

AC	*Allium cernuum* Nodding Wild Onion	AL	*Aster laevis* Smooth aster	MD	*Monarda didyma* Bee-Balm Oswego Tea	SS	*Schizachyrium scoparium* Little Bluestem	SH	*Sporobolus heterolepis* Prairie Dropseed
ATV	*Amsonia tabernaemontana var.* Willow Leaf Bluestar	BA	*Baptisia australis* Blue False indigo	PV	*Pycnanthemum virginianum* Mountain Mint	SR	*Solidago rigida* Stiff Goldenrod	TF	*Tridens flavus* Purple Top
AG	Andropogon gerardii Big Bluestem	LS	*Lobelia siphilitica* Blue Lobelia	RP	*Ratibida pinnata* Gray-headed Coneflower	SN	*Sorghastrum nutans* Indian Grass	VG	*Vernonia glauca* Upland Ironweed

Feet 10 20 30

PLANT SELECTION AND PLACEMENT METHOD

The overarching purpose of the formal native garden is to displaying the beauty of native plants and it was decided that planting in drifts and masses was the best approach to accomplishing that goal. Planting in drifts and masses sets the scene to draw the eye through the landscape, creates a sense of flow and provides instant design appeal. It also displays the kinetic energy of the site as the plants move gracefully with any breeze of the wind.

The venn-diagram displayed in the figure to the right, is a graphic representation of how plants were selected. From the pool of plants generated, each plants characteristics then determined where in the garden it would be placed. The mixture contains species that can handle full and partial shade exposure and can handle dry to moist conditions. Determining characteristics such as height, bloom time, and form and color are more lenient in their variation as they determine the gardens aesthetics. Below is a more in depth look at how form and color determine the experience of the space.

Form

Spires: Thrust vision skyward, clarity and lift in the garden, best seen in clumps, dramatic contrast with other flower heads.

Buttons and Globes: Concentrated colors, good contrast against plumes, stand out in winter,transparent.

Plumes: Between spires and umbels, non directional,blur, convey fussiness transparent, fluffy quality, effective in masses.

Daisies: Association with the sun, similar to umbels in complexity, serve as buttons after dropping petals.

Screens and Curtains: Transparent, loose stems, impression that the screen is everywhere, feel of mystery and romance.

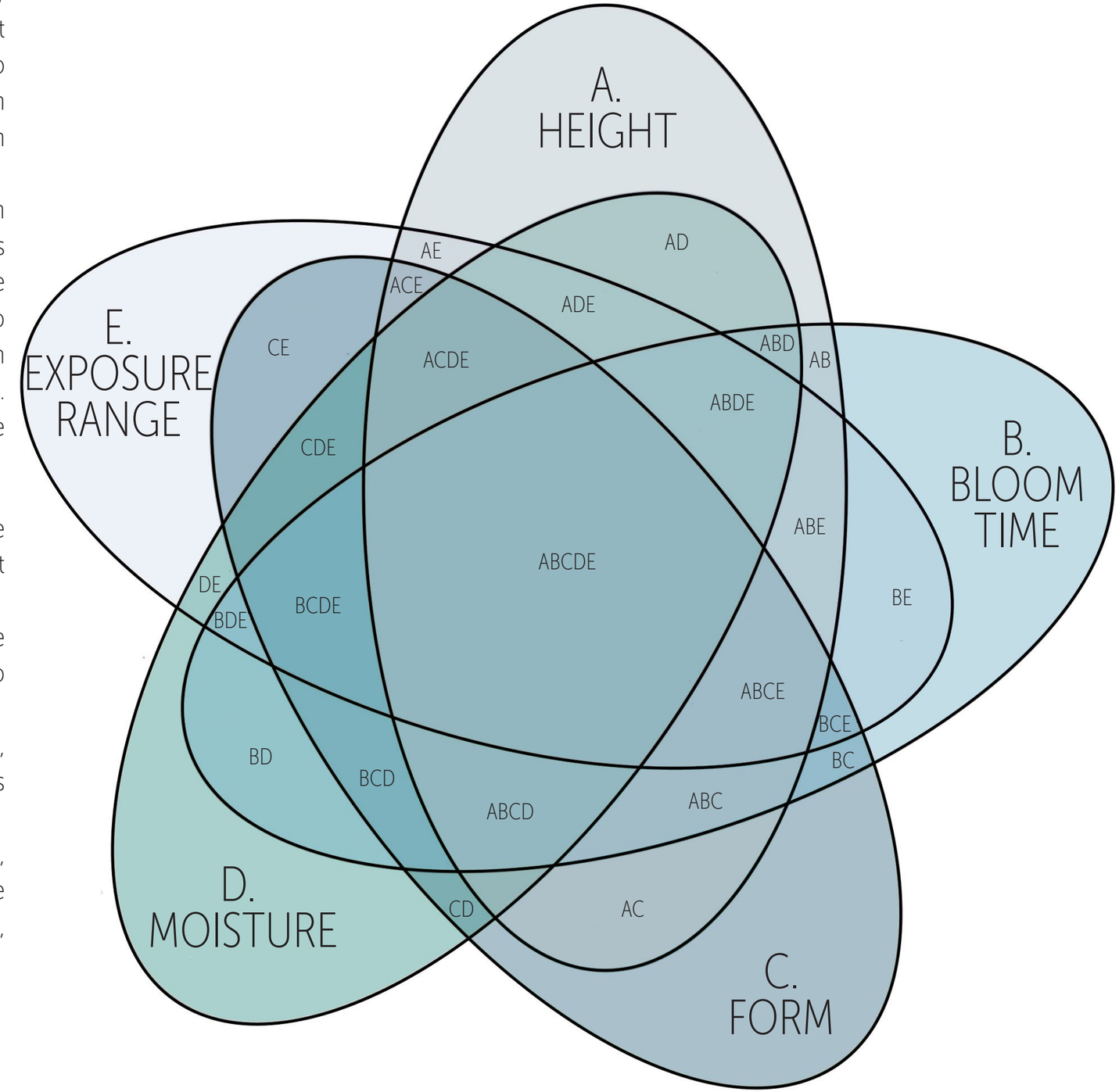
Color

Hot: Warm colors - psychologically more dynamic, red is the first color to fade at dusk.

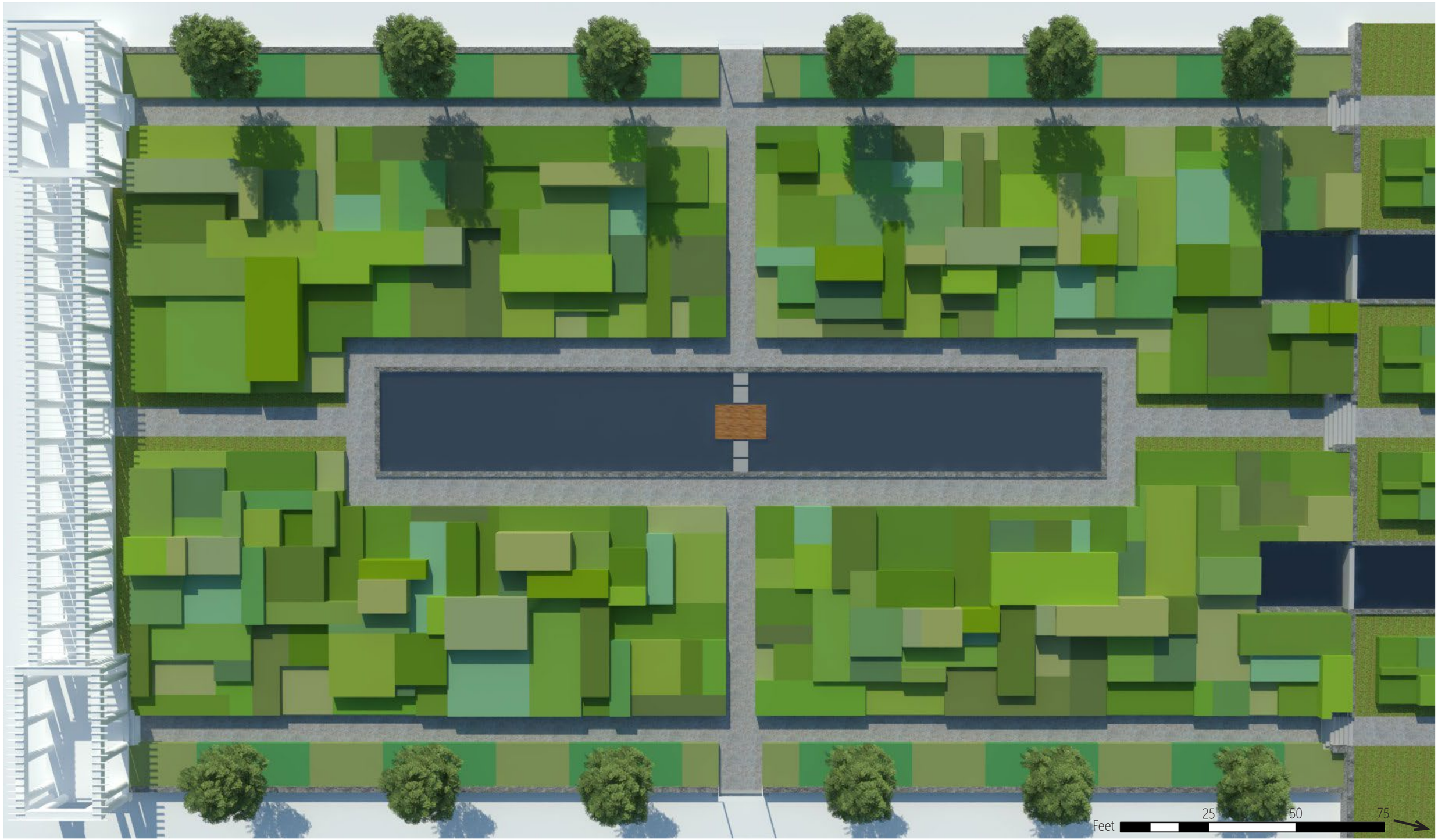
Cool: Looks best in morning and late afternoon sun, recessive, adds depth to beds, combines with red and violet.

Somber: Dark foliage / flower color, valuable for unusual quality, mysterious quality, useful as surprise elements

Earthy: Brown, the color that is not a color, everywhere in different shades, end of the years is the most rewarding for browns, blend in with bare soil



FOLIAGE DIAGRAM



SPRING BLOOM

SPRING BLOOM PLANT LIST

Amsonia tabernaemontana var.

Common Name	
Willow Leaf Bluestar	
Height	**Bloom Time**
1-3'	May
Form	
Daisies/Plume	
Moisture	
Moist	
Exposure Range	
Sun-P/S	
Planting Area	**Size**
1178sqft	2" plug
Spacing	**Quantity**
10"	1665
Wildlife Value	
Butterfly	

Aquilegia canadensis

Common Name	
Wild Columbine	
Height	**Bloom Time**
1-3'	May
Form	
Daisies	
Moisture	
Dry-Moist	
Exposure Range	
P/S	
Planting Area	**Size**
1250sqft	2" plug
Spacing	**Quantity**
10"	1770
Wildlife Value	
Hummingbird	

Carex pensylvanica

Common Name	
Pennsylvania Sedge	
Height	**Bloom Time**
12-18"	May
Form	
Rounded Clump	
Moisture	
Dry-Moist	
Exposure Range	
P/S Shade	
Planting Area	**Size**
4464 sqft	2" plug
Spacing	**Quantity**
10"	6513
Wildlife Value	

Polygonatum cimmutatum

Common Name	
Great Solman's Seal	
Height	**Bloom Time**
3-4'	May-June
Form	
Bells	
Moisture	
Dry-Moist	
Exposure Range	
P/S-Shade	
Planting Area	**Size**
1047sqft	2" plug
Spacing	**Quantity**
10"	1474
Wildlife Value	

Tradescantia ohiensus

Common Name	
Spiderwort	
Height	**Bloom Time**
2-4'	May-Aug
Form	
Daisies	
Moisture	
Dry-Moist	
Exposure Range	
Sun-P/S	
Planting Area	**Size**
1400sqft	2" plug
Spacing	**Quantity**
10"	1989
Wildlife Value	

Zizia aptera

Common Name	
Heart-leaved Alexanders	
Height	**Bloom Time**
1-3'	April-May
Form	
Plume	
Moisture	
Dry-Moist	
Exposure Range	
Sun-P/S	
Planting Area	**Size**
2050sqft	2" plug
Spacing	**Quantity**
10"	2944
Wildlife Value	
Butterfly	

SUMMER BLOOM

SUMMER BLOOM PLANT LIST

Allium cernuum

Common Name	
Nodding Wild Onion	
Height	**Bloom Time**
1-2′	July-Aug
Form	
Daisies	
Moisture	
Dry-Moist	
Exposure Range	
Sun-P/S	
Planting Area	**Size**
1227 sqft	2″ plug
Spacing	**Quantity**
10″	1736
Wildlife Value	
Butterfly	

Andropogon gerardii

Common Name	
Big Bluestem	
Height	**Bloom Time**
5-8′	Aug-Oct
Form	
Upright Clump	
Moisture	
Dry-Moist	
Exposure Range	
Sun	
Planting Area	**Size**
1471 sqft	2″ plug
Spacing	**Quantity**
10″.	2093
Wildlife Value	
Butterfly, Hummingbird	

Asclepias tuberosa

Common Name	
Butterfly Weed	
Height	**Bloom Time**
1-2′	June-Aug
Form	
Daisies/Plume	
Moisture	
Dry-Moist	
Exposure Range	
Sun	
Planting Area	**Size**
2000 sqft	2″ plug
Spacing	**Quantity**
10″	2878
Wildlife Value	
Butterfly	

Baptisia australis

Common Name	
Blue False Indigo	
Height	**Bloom Time**
3-4′	May-June
Form	
Spire	
Moisture	
Dry-Moist	
Exposure Range	
Sun-P/S	
Planting Area	**Size**
2623 sqft	2″ plug
Spacing	**Quantity**
10″	3788
Wildlife Value	
Butterfly	

Delphinium exaltatum

Common Name	
Tall Larkspur	
Height	**Bloom Time**
3-5′	July-Sep
Form	
Spire	
Moisture	
Moist	
Exposure Range	
P/S-Shade	
Planting Area	**Size**
680sqft	2″ plug
Spacing	**Quantity**
10″	941
Wildlife Value	
Butterfly	

Deschampsia flexuosa

Common Name	
Common Hair rass	
Height	**Bloom Time**
6-18″	July-Sep
Form	
Upright Clump	
Moisture	
Dry-Moist	
Exposure Range	
P/S Shade	
Planting Area	**Size**
3155 sqft	2″ plug
Spacing	**Quantity**
10″	4574
Wildlife Value	

Eragrostis spectabilis

Common Name	
Purple Love Grass	
Height	**Bloom Time**
1-2′	June-Aug
Form	
Mounded Clump	
Moisture	
Dry-Moist	
Exposure Range	
Sun	
Planting Area	**Size**
1323 sqft	2″ plug
Spacing	**Quantity**
10″	1877
Wildlife Value	
Butterfly, Songbird	

Eupatorium maculatum

Common Name	
Joe-Pye Weed	
Height	**Bloom Time**
5-6′	June-Sep
Form	
Plume	
Moisture	
Moist-Wet	
Exposure Range	
Sun-P/S	
Planting Area	**Size**
307sqft	2″ plug
Spacing	**Quantity**
10″	406
Wildlife Value	
Butterfly	

Monarda didyma

Common Name	
Bee-Balm Oswego Tea	
Height	**Bloom Time**
3-4′	June-Aug
Form	
Daisies	
Moisture	
Dry-Moist	
Exposure Range	
Sun-P/S	
Planting Area	**Size**
2195sqft	2″ plug
Spacing	**Quantity**
10″	3157
Wildlife Value	
Butterfly, Hummingbird	

Monarda fistulosa

Common Name	
Wild Bergamot	
Height	**Bloom Time**
2-3′	July-Aug
Form	
Daisies	
Moisture	
Dry-Moist	
Exposure Range	
Sun	
Planting Area	**Size**
1296sqft	2″ plug
Spacing	**Quantity**
10″	1837
Wildlife Value	
Butterfly, Hummingbird	

Panicum virgatum

Common Name	
Switchgrass-Shenondoah	
Height	**Bloom Time**
3-7′	Aug-Sep
Form	
Upright Clump	
Moisture	
Dry-Moist	
Exposure Range	
Sun	
Planting Area	**Size**
1131 sqft	2″ plug
Spacing	**Quantity**
10″	1596
Wildlife Value	
Butterfly, Songbird	

Pycnanthemum virginianum

Common Name	
Mountain Mint	
Height	**Bloom Time**
2-3′	July-Sep
Form	
Plume	
Moisture	
Dry-Moist	
Exposure Range	
Sun-P/S	
Planting Area	**Size**
2123sqft	2″ plug
Spacing	**Quantity**
10″	3051
Wildlife Value	
Butterfly	

Ratibida pinnata

Common Name	
Grey Coneflower	
Height	**Bloom Time**
4-6′	July-Sep
Form	
Daisies	
Moisture	
Dry-Moist	
Exposure Range	
Sun-P/S	
Planting Area	**Size**
1929sqft	2″ plug
Spacing	**Quantity**
10″	2766
Wildlife Value	
Butterfly, Songbird	

Tridens flavus

Common Name	
Purple Top	
Height	**Bloom Time**
3-5′	July-Sep
Form	
Upright Clump	
Moisture	
Dry-Moist	
Exposure Range	
Sun-P/S	
Planting Area	**Size**
2038 sqft	2″ plug
Spacing	**Quantity**
10″	2926
Wildlife Value	
Butterfly, Songbird	

LATE SUMMER AND FALL BLOOM

LATE SUMMER A ND FALL BLOOM PLANT LIST

Aster laevis

Common Name	
Smooth Aster	
Height	**Bloom Time**
3-5'	Sep-Oct
Form	
Daisies	
Moisture	
Dry-Moist	
Exposure Range	
Sun-P/S	
Planting Area	**Size**
1971sqft	2" plug
Spacing	**Quantity**
10"	2827
Wildlife Value	
Butterfly, Songbird	

Lobelia siphilitica

Common Name	
Blue Lobelia	
Height	**Bloom Time**
1-3'	Aug-Oct
Form	
Spire	
Moisture	
Moist-Wet	
Exposure Range	
P/S	
Planting Area	**Size**
232sqft	2" plug
Spacing	**Quantity**
10"	301
Wildlife Value	
Butterfly, Hummingbird	

Rudbekia filgida

Common Name	
Black-eyed Susan	
Height	**Bloom Time**
1-3'	Sep-Oct
Form	
Daisies	
Moisture	
Dry-Moist	
Exposure Range	
Sun-P/S	
Planting Area	**Size**
2058sqft	2" plug
Spacing	**Quantity**
10"	2995
Wildlife Value	
Butterfly, Songbird	

Schizachyrium scoparium

Common Name	
Little Bluestem	
Height	**Bloom Time**
2-3'	Aug-Oct
Form	
Upright Clump	
Moisture	
Dry-Moist	
Exposure Range	
Sun	
Planting Area	**Size**
2434 sqft	2" plug
Spacing	**Quantity**
10"	3509
Wildlife Value	
Butterfly, Songbird	

Solidago rigida

Common Name	
Stiff Goldenrod	
Height	**Bloom Time**
3-5'	Sep-Oct
Form	
Spire/Plume	
Moisture	
Dry-Moist	
Exposure Range	
Sun	
Planting Area	**Size**
1183sqft	2" plug
Spacing	**Quantity**
10"	1672
Wildlife Value	
Butterfly, Songbird	

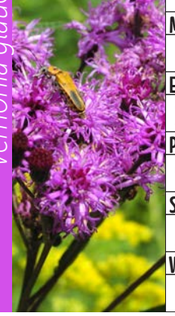
Sorghastrum nutans

Common Name	
Indian Grass	
Height	**Bloom Time**
4-7'	Aug-Sep
Form	
Upright Clump	
Moisture	
Dry-Moist	
Exposure Range	
Sun	
Planting Area	**Size**
1273 sqft	2" plug
Spacing	**Quantity**
10"	1803
Wildlife Value	
Butterfly, Songbird	

Sporobolus heterolepis

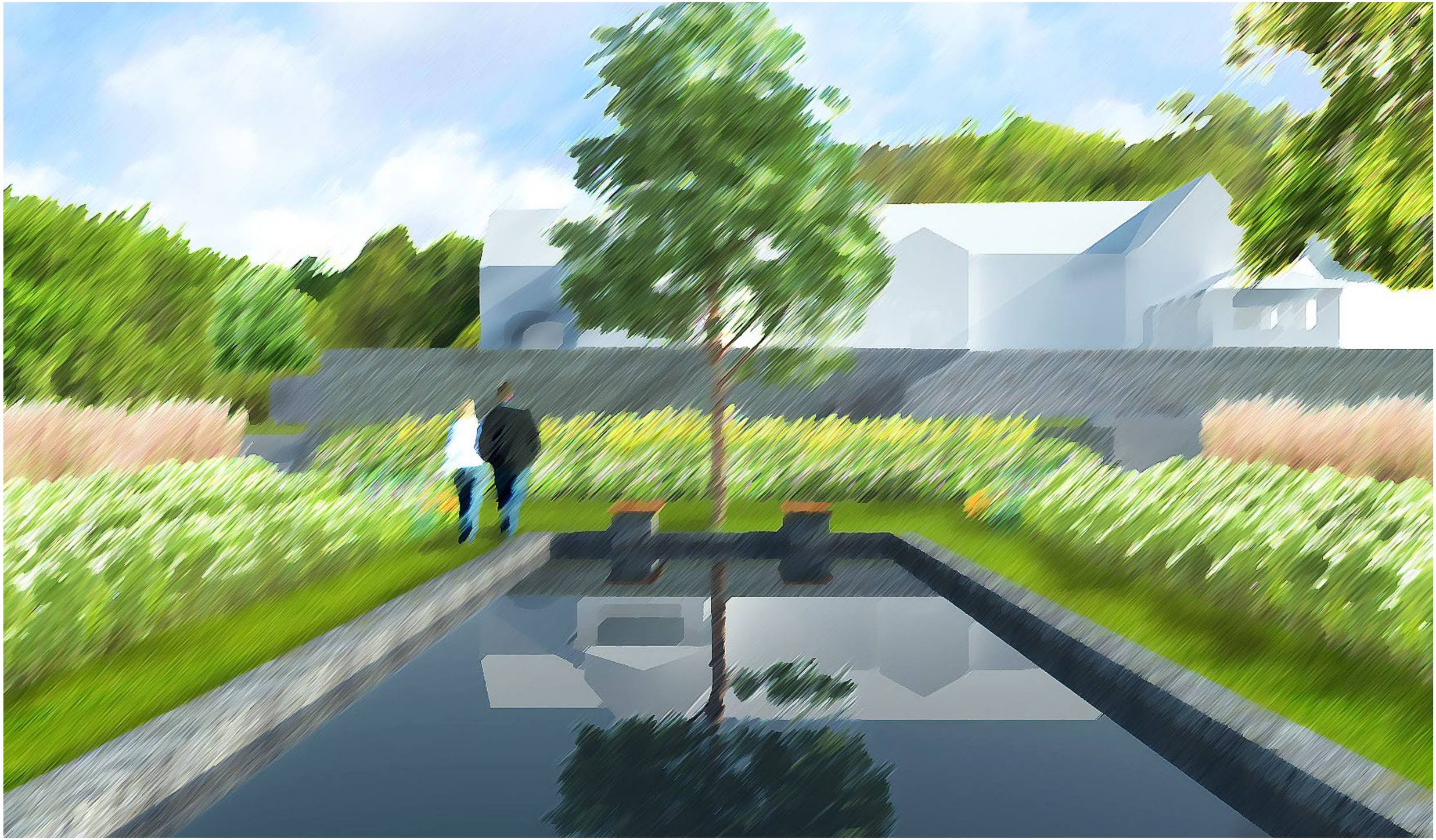
Common Name	
Prairie Dropseed	
Height	**Bloom Time**
2-3'	Aug-Sep
Form	
Rounded Clump	
Moisture	
Dry-Moist	
Exposure Range	
Sun	
Planting Area	**Size**
1703 sqft	2" plug
Spacing	**Quantity**
10"	2434
Wildlife Value	
Butterfly, Songbird	

Vernonia glauca



Common Name	
Upland Ironweed	
Height	**Bloom Time**
3-5'	Aug-Sep
Form	
Plume	
Moisture	
Dry-Moist	
Exposure Range	
Sun	
Planting Area	**Size**
937sqft	2" plug
Spacing	**Quantity**
10"	1313
Wildlife Value	
Butterfly	

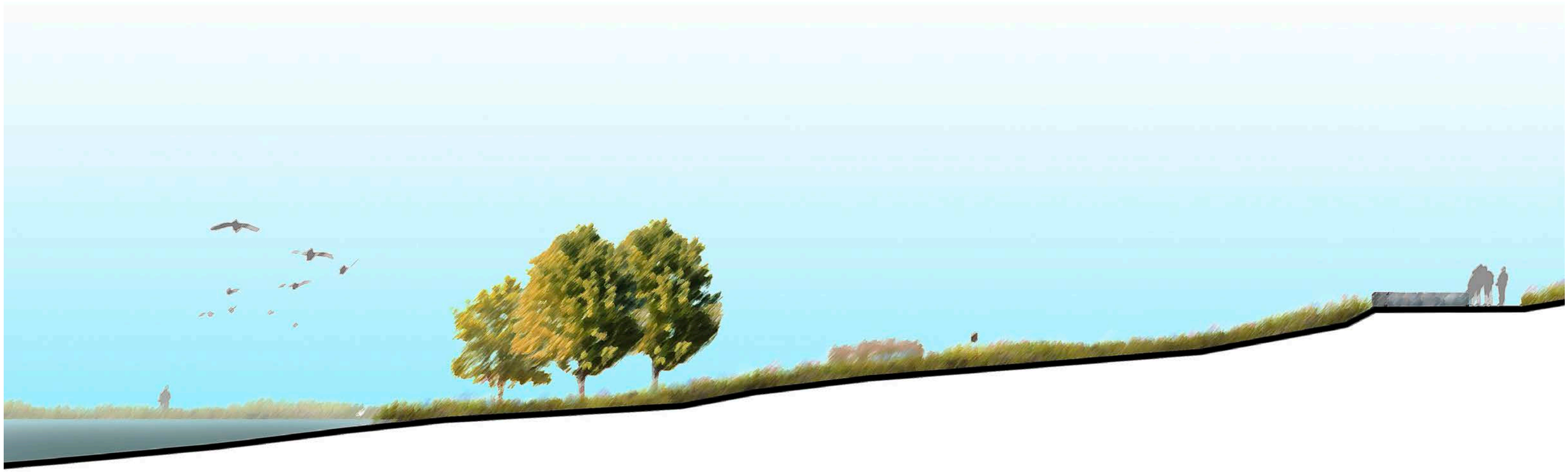
REFLECTION PERSPECTIVE



NATIVE GARDEN PERSPECTIVE

WETLAND DETAIL

WETLAND OVERLOOK SECTION



Wetland Area | Wet Meadow | Upland Meadow | Wetland Overlook and Path

Feet 15 30 60

DETAIL PERSPECTIVE

RESTORATION REPORT

INVASIVE MANAGEMENT PLAN

SITE DESCRIPTION

The site of this invasive species management plan is the Greystone Hall Property, henceforth referred to as Greystone, is located at 1034 Phoenixville Pike, West Chester PA, West Goshen Township, Chester County, Pennsylvania. The coordinates of this site are 39°59'11.17 N and 75°35'55.17" W. (Please see Location Map on Page 8).

The Greystone property is currently 417 acres, and is made up of building pads, formal gardens, vast lawn, agricultural land, forested areas, man-made lakes, roads and parking. Of this 417 acres, nearly half has been slated for suburban residential development. Of the remaining area, this report focuses on 117 acres of approximately 200 acres that are to be saved. (Please see Location Map 2). This site falls within the Northern Appalachian Piedmont, which is at the northern end of the Piedmont Plateau, and is a section of the Eastern Broadleaf Forest. This area is primarily a low-relief plain in final stages of fluvial erosion. Most of this area occurs within the 300 to 1,000 feet above sea level range and is generally gently sloped towards the Atlantic coast in the form of ridges valleys, and rolling hills. The annual precipitation in this region ranges between 39 and 47 inches, with 27 to 40 inches of snowfall and, an annual temperature range from 40 to 55 degrees F. The growing season in this region is generally 160 to 250 days per year. More specifically, this areas is considered a Red-oak, mixed hardwood forest. A description of the Red-oak forest can be found on page 15. Related types include the "Hemlock (white pine) - red oak -mixed hardwood forest" which is distinguishable by the presence of at least 25% relative cover by hemlock and/or white pine. Another is The "Northern hardwood forest" which is distinguished by a greater percentage of birches, maples, and beech, and less oak.

DESIRED CONDITION: REDUCED POPULATIONS OF INVASIVE SPECIES

In order to plan for change, there needs to be an understanding of the natural dynamics which exist in the current system. By taking advantage of exploring and understanding these natural trends it becomes easier to meet management expectations and improve the ecological conditions. Executive Order 13112 has defined invasive species as species that are alien to the ecosystem under consideration whose introduction does or is likely to cause economic or environmental harm or harm to human health. Invasive species can be plants, animals, or microorganisms, and they are found in a wide range of terrestrial, freshwater, and marine habitats. Invasive species areas can lessen the environment function in the following ways:

Impact plant and animal communities.

Interfere with natural resource management operations.

Reduce threatened and endangered species populations.

Damage cultural and historic resources.

Reduce the value of forest and non-forest land

By removing existing invasive species you also subdue the impacts that are listed above. A healthy ecosystem at this site would maintain its current canopy coverage, as most of the mature trees on site are healthy, and mature. The understory layer of this property would regenerate much more quickly and become more well establish, ensure the future succession in case of mature tree die off or damage from natural weather events and the forest floor would see much better regeneration of native plants.

It is known that the success of oak regeneration is very much dependent on light and moisture. Oaks do not regenerate in moist and shaded conditions, and because we know that there are no issues with moisture levels on this area, we can confirm the suspicion that Oaks are being hindered in their development in part to being shaded out by invasive plant presence. If we eliminate this problem, we would see better oak regeneration bounce back rapidly in the following years, although, white tail deer presence must be accounted for as they would eat the fallen acorns and small saplings. Because Oaks are not the only tree species present on this site, we know that we would also see the regeneration of other tree species as they are more mesic and shade tolerant, meaning Red Maple will likely start to dominate. When this occurs, the forest canopy structure will improve along with ecological interactions between vegetation and the environment. We know that within forested ecosystems, the mature canopy trees are the primary influence on productivity as well as the cycling of water and nutrients, but just as important is the understory. This vegetated layer is made up of the graminoids, shrubs, vines, seedlings of tree species, and accounts for majority of the vascular plant diversity. The success of this layer is directly related to the presence of invasive species, and with their removal we would see greater diversity, and regeneration among the native plants.

CURRENT CONDITION

Currently on the Greystone property there 6 heavily infested areas which are shown on the High Priority Invasive Areas map. These data areas were collected using the collector application distributed by Esri, the creators of ArcGIS. The areas shown are reaching the point where the native ground cover and shrubs have almost been completely displaced by invasive species. In some areas invasives have led to the partial collapse of two buildings. In areas such as the formal gardens, and surrounding lawn, invasive species are kept at bay by constant maintenance, and mowing. However, just because they are invasive free does not mean that the areas are reaching their highest ecological function and are there-

fore also in need of restoration. The table below summarizes the invasive species found on the site and their associated location and abundance which coincide with the numbers and locations shown on the High Priority Invasive Areas map. If the invasives listed below continued to grow unchecked, eventually they will displace much of the native understory, and in the case where vines, start to take hold, the mature canopy will start to disappear.

INVASIVE SPECIES MANAGEMENT PRIORITIZATION AND TIMELINE

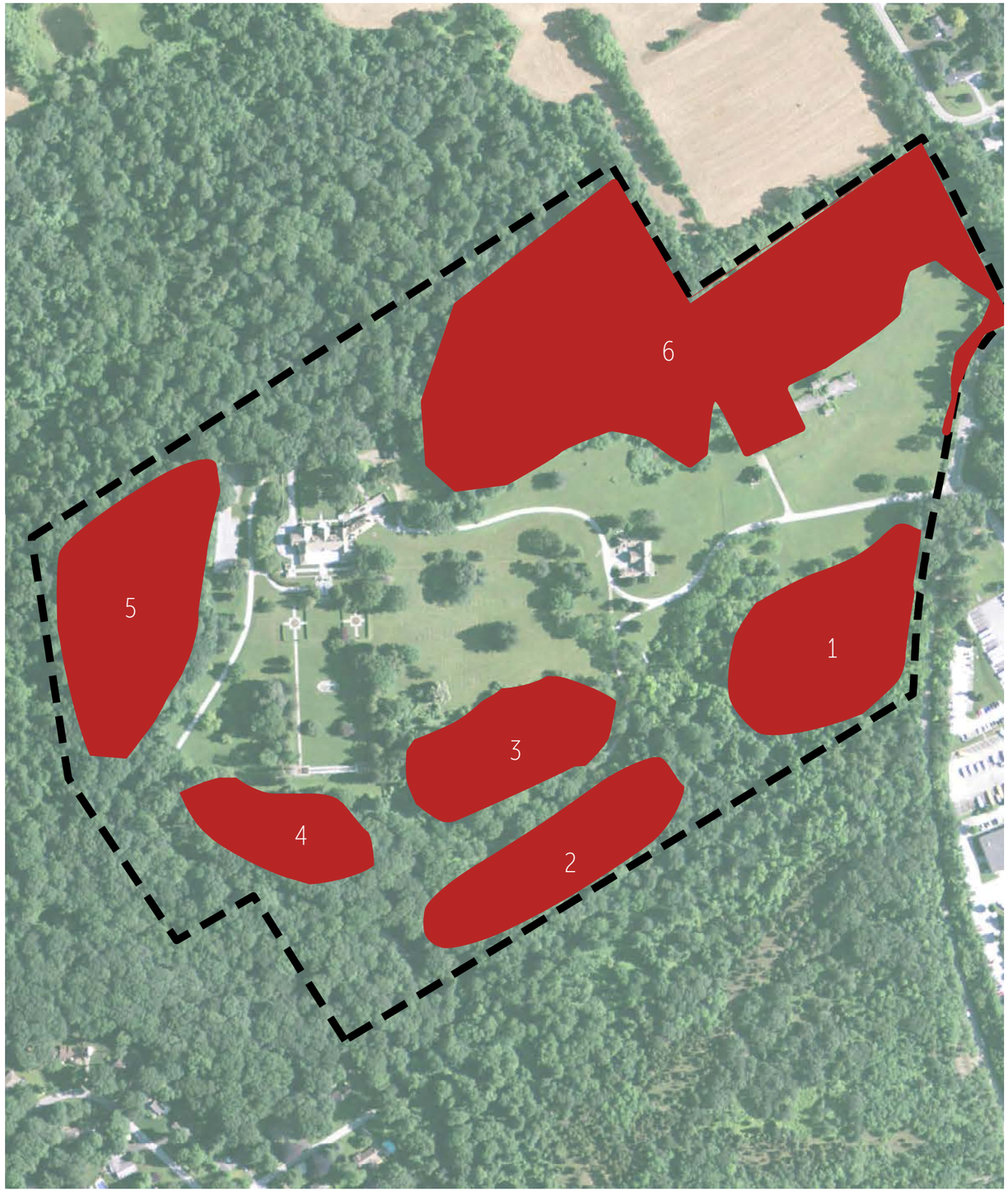
The work plan described below will guide invasive species management efforts in the project area for the next ten years (2015-2025). At the end of this period, partners will assess progress made toward their goals. Due to the number of invasive species, and the density of several of these species, it will not be feasible to eliminate all occurrences of all invasive species from the project area. With steady work each year, however, many patches can be reduced or eliminated, further spread can be checked, new infestations can be prevented, and native species will be allowed to thrive.

The following section outlines the weed management plan. It includes a) an outline of prioritization by species; b) a timeline of seasonal activities that identifies when activities will take place, lists needed equipment, and staffing and/or volunteer needs; and, c) a species-b- species summary of management options. This information was developed using available research and guidance from the nature conservancy outline for invasive species management projects.

This plan is currently designed to address the invasive plant control priorities of Cory Speroff and Greystone property manager Velda Moog. The plan was developed in consult with and/or reviewed by The Nature Conservancy and The Brandywine Conservancy. It was approved by the Pennsylvania Department of Conservation on such November 19, 2014.

It should be known that there are some limitation to the processes that occur on this site due to multiple factors. This property is privately owned, and abuts other privately owned, single family residential land. This will have implications on the type of management practices that can be used and all but eliminates the option of using prescribed burns. Additionally due to its surroundings, and future development, invasive ornamental plants that have tendencies to overtake native areas are more likely to flood into Greystone's natural areas. Other areas that are cause for concern are the surrounding road edges, which are classic entry points for invasive species. Due to these factors there will need to be constant monitoring. The ideal management goals are to gain control of the invasive areas, to a point where they are easily controlled and kept in check, with the eventually goal of eradication. From there it will best to monitor edges where the site is most vulnerable.

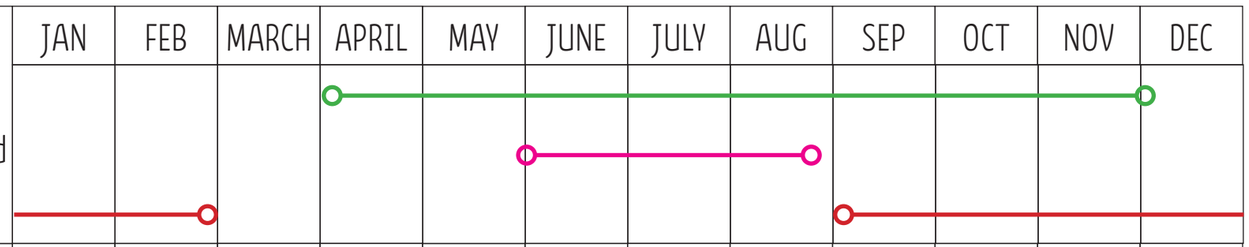
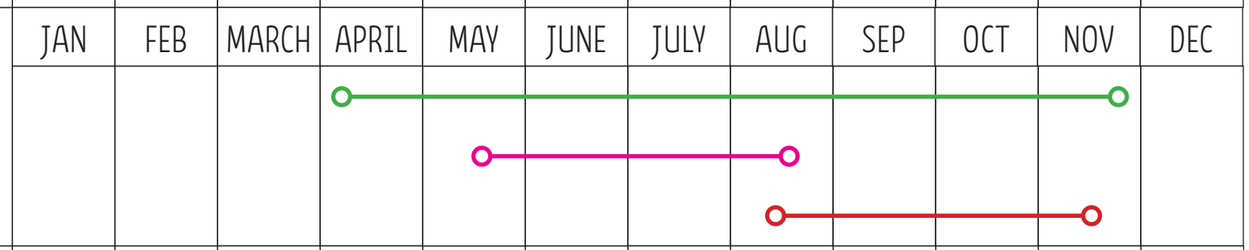
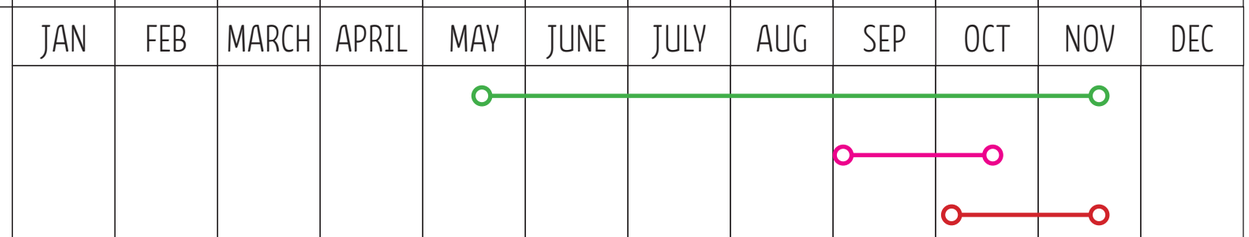
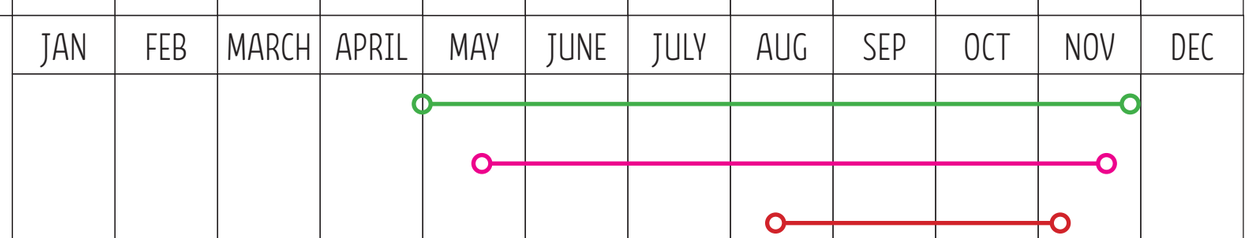
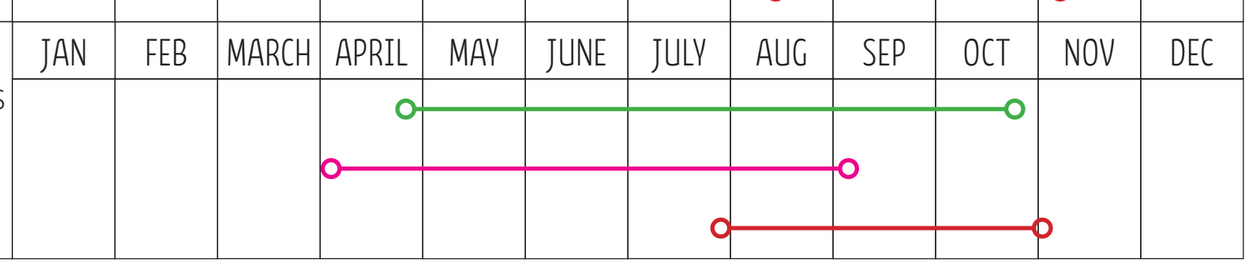
INVASIVE LOCATION MAP



INVASIVE MANAGEMENT PLAN

Leaves — Flowering — Seed

Species	Location and Abundance	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC
Ailanthis altissma Tree of Heaven	*Ailanthis altissma* currently grows in only a few locations in the project area, the most prevalent areas of growth however are located along road edges on the boarders of the site and along some of the access roads within the site.												
Alliaria petiolata Garlic Mustard	*Alliaria petiolata* was found in small patches throughout the targeted area, mainly observed in the more wet forested areas of the site.												
Ampelopsis brevipedunclata Porcelainberry	*Ampelopsis brevipedunclata* is most abundant in area 6 where it has started to take over the trees, and unoccupied buildings. It is unchecked, is killing trees, and is causing structural damage to the historic buildings												
Aralia spinosa Devil's Walkings Stick	*Aralia spinosa* was only witnessed in one grouping of mature shrubs in area 4. It seems as though it has been limited to this area because of topography.												
Berberis thunbergii Japanese Barberry	*Berberis thunbergii* is currently growing in area 1 and is the dominate shrub in this area, previously a lawn and meadow area.												
Celastrus orbiculatus Oriental Bittersweet	*Celastrus orbiculatusis* also growing in area 6 and appears to be competing with Ampelopsis brevipedunclata for growing space.												

Species	Location and Abundance	Leaves / Flowering / Seed
Ligustrum obtusifolium Privets	*Ligustrum obtusifolium once* used as hedgerows in the area has become established in the understory of area 3, however, is not considered a significant infestation.	
Lonicera maakii Bush Honeysuckle	*Lonicera maakii* is present throughout the Greystone property. The heaviest infestations are located in areas 3 and 4.	
Microstegium vimineum Japanese Stilt Grass	*Microstegium vimineum is* the most prevalent invasive within the focus area and is most heavily concentrated in areas 1, 2, 3 and 5.	
Rosa multiflora Multiflora Rose	*Rosa multiflora is* located in area 1, but is not as prevalent as other invasive within that space.	
Wisteria sinensis Chinese Wisteria	*Wisteria sinensis* is made up small infestations primarily located on steeper sloping hill sides of the property.	

INVASIVE MANAGEMENT PLAN

IDENTIFYING INVASIVE PLANT MANAGEMENT PRIORITIES

In such cases, as the one that exists on the Greystone Property, eradication is not a reasonable goal given the uncontrollable factors surrounding the site. This includes the development of land and invasive seed intrusion via road edges. The most logical ecological priority, and most feasible objective, is to slow the rate of invasive take over, and by doing so, lessening the impacts the invasives have within this area. Long term management goals and objectives by using short term management tools.

RECREATIONAL LAND USES:

Future recreational use with in this site will most likely consists of a trail network allowing the residents of the surrounding neighborhoods to have access to the natural lands of the property, with the exception of the days which special events will occur. Activity on the site will be highly restricted to walking, running and hiking. Other activities pose a much greater risk of invasive seed dispersal.

AVAILABLE RESOURCES:

There are a great deal of resources available to this site. Because of the historic nature of the site, and the well-known name, Greystone would be capable of rallying support in terms of fundraising. Additionally, working with entities such as The Brandywine Conservancy and The Nature Conservancy, there is access to professionals with ecological, planning, and volunteer organizing experience which benefit this project greatly. Because there is a full time maintenance staff available to the Greystone property, tools are already available for use, however, some equipment will need to be purchased, such as, weed wrenches, and backpack herbicide sprayers.

INVASIVE MANAGEMENT TECHNIQUES:

"It can be easier, more cost-effective, and more ecologically beneficial to manage certain species than others. In addition, there are a number of techniques for controlling invasives species, some more effective than others. Therefore it is important to make management decisions based on the ability to control one or more species, the techniques available at a specific site, and concerns for impact to native species. These factors have been considered in this management plan. Each year, as work progresses and resources change, the year's work plan may shift slightly. However, consistent management targeting priority species in priority areas will offer the best results. It is also critical to keep in that invasive species management needs to become an ongoing management task." (The Nature Conservancy).

For this project we feel it is most appropriate to follow the guide of the National Invasive Species Council (NISC), whom uses an Integrated Pest Management method. This approach uses scientific information, target population monitoring, and considers the effectiveness of control methods in selecting and implementing a range of complementary and environmentally sound technologies and methods to achieve the desired objectives.

RECOMMENDED INVASIVE SPECIES CONTROL PRIORITIES WITHIN THE PROJECT AREA

Based on the identified ecological and land-use priorities within the project area and the realities of invasive plant control (available resources and known techniques for plant control) we recommend focusing control actions on the following:

HIGH PRIORITY:

Ampelopsis brevipedunclata (Porcelainberry): Currently the most destructive forces on site, and the most un-managed at this junction. It is most highly concentrated in one area, but it is a large area. Within this area it has started to consume historic buildings and is beginning to out compete the trees canopy. If left to its current processes it will reach the forest edge closet to the main house within 2 years.

Celastrus orbiculatus (Oriental Bittersweet): This is growing alongside the Ampelopsis brevipedunclata but heading away from the main house. It is however doing considerable damage to the trees it has latched on too. It is advisable that this be dealt with in the first round of management to prevent further die off of native plants.

Microstegium vimineum (Japanese Stilt grass): Microstegium vimineum is absolutely everywhere on this site. It has essentially moved into every possible location, even growing between other invasives. It was especially noticeable in the forested areas where it is out competing much of the native ground cover.

MEDIUM PRIORITY:

Aralia spinosa (Devil's Walkings Stick): Because this invasive likes to grow in groups within the shrub layer, it is critical that Aralia spinosa be controlled before becoming more ingrained and detrimental.

Berberis thunbergii (Japanese Barberry): Limited right now to only meadow like areas, and is attempting to move in on lawn areas but is being kept at bay by consistent mowing. It has started to from a Barberry thicket making it difficult do access the core areas of its infestation and therefore hindering full awareness of its condition. A large mower would do a lot of good in order to get a handle on this invasive.

Ligustrum obtusifolium (Privet): Because this appears to have been used to create hedgerows within the Greystone Property's formal gardens at some point in its history, this invasive is quite established. Despite being in multiple locations, those locations are not heavily infested.

Wisteria sinensis (Chinese Wisteria): is not very prevalent on site but is extremely damaging to the existing mature tree canopy, the destruction of which will lead to other negative ecological impacts.

LOW PRIORITY:

Ailanthis altissma (Tree of Heaven): Though it is a fast growing tree and very capable of out competing native plants, this invasive is currently concentrated around the outside of the site and is relatively easy to mitigate with the cut and paint technique.

Alliaria petiolata (Garlic Mustard): Alliaria petiolata is only growing in a few areas and is very easy to pull and is therefore being placed on the Low Priority List.

Lonicera maakii (Bush Honeysuckle): Though prevalent throughout the property this invasive is quite manageable in terms of processes for eliminating it from this particular site.

Rosa multiflora (Multiflora Rose): This large sprawling shrub is currently competing with the Berberis thunbergii and seems to be losing, and is therefore b3ing placed on the Low Priority list.

EARLY DETECTION, RAPID RESPONSE

Invasive plants will likely continue to be introduced and/or persist in this natural community. In order to prevent the further spread of existing invasive plants into non-infested areas, and to manage the likely introduction of new species, it will be important to regularly monitor the site for new invasions. Early detection is achievable by giving the responsibility of looking for new invasive establishment and having it mapped. Ideally one would focus there monitoring on species of the most concern and within high risk areas.

After locating any newly established invasive species, rapid assessment is the next natural step. This involves recommending a response, and discussing future prevention and management strategies for that specific species. The last step in this process is the Rapid Response. This involves making efforts to contain the new growth if possible, and eradicating the invasive species of possible. The Early Detection, Rapid Response technique is going to require a watchful and willing group of employees and volunteers. Any new identification should follow the general idea described above as well as include placement on an overarching priority list that will be based on prevalence as well as destruction of natural and built environment.

TIME-LINE OF SEASONAL ACTIVITIES

When dealing with invasive species there is a multitude of options for the control and management. A detailed description of each of the seasonal activities is described below.

SEASON: Early Spring (March -May)

ACTIVITY: Pulling:

The act of pulling invasives can be done at any time during the growing season however, in the early spring months of the y ear certain invasives are easier to identify than others. For example Garlic Mustard are one of the first invasives to turn green. This time of year is also ideal for pulling woody stem invasives such as Barberry and Honeysuckle, as well as Wisteria. At this point the plants listed above should only be sprouting and therefore easy to pull. Larger plants can also be pulled however they will require much more labor and the use of special tools such as a weed wrench and chainsaw.

EQUIPMENT: Gloves, Buckets, Trash Bags, Small Garden Shovel, Pruners, Chainsaw, Weed Wrench

TIME: Volunteers will be needed for multiple days of pulling for the first pass in March and early April and a second round of management in early May. This can be done with any number of volunteers but given the size of the Greystone site, the more the better.

SEASON: Late Summer and Early Fall (September -October)

ACTIVITY: Cut and Paint

The best time to cut the base of more established, woody invasives, is late in the season as they start to enter the dormant stage and draw the most amount of energy into the roots. The stem of the plant must be cut on an angle to provide the largest surface area, and then it must be painted with concentrated herbicide. Ideally this will enter into to root system, killing the plant and preventing sprouting from the stump.

EQUIPMENT: Gloves, Chainsaw, Hand Saw, Hatchet, Herbicide, Goggles, Skin Protection, Any Class respirator, Bucket, Paint Brush, Some Kind of Marking Paint, Small Bucket to Carry Herbicide.

TIME: This process works best with three teams working in the same area. Team one, or the cutting team need varying amounts of member depending on the tool of choice. For a chainsaw, two people can make quick work of an infested area. With slower cutting tools you will need to increase the number of volunteers performing that activity. Those on this team should be experienced with the tools they are using to prevent possible injury. The second team will need to be just as large, if not larger than team one, and their main concern is removing the cut debris being careful not to distribute the plants seeds any further. The third team, should be qualified herbicide handlers coming behind the cleanup crew painting the stumps of the cut invasives. Someone should be designated to tag the stumps that have already been painted to ensure the painting of all the targeted plants.

SEASON: Growing Season

ACTIVITY: Monitoring

INVASIVE MANAGEMENT PLAN

Annual walks within the site boundaries, especially along vulnerable edges to map populations of existing and newly sprouting groups of invasives. Activities and processes for conducting monitoring are included in the monitoring report section of this publication.

EQUIPMENT: Maps, Clipboards, GPS if available, Geotagged Photo Capabilities. Cellphones with map collecting applications can be used as a basic level mapping system.

TIME: Multiple visits a year. See Monitoring plan for specifics.

INTRODUCTION AND PURPOSE

It is the purpose of the monitoring plan to describe the necessary actions required to monitor the success or failure of the Greystone Hall restoration elements. This plan is intended as a companion document to the Greystone Hall: A Country Estate Revitalization design and restoration plan booklet and assumes that all suggested designs are in place. Monitoring is key throughout the development of the project and therefore requires multiple stages. Data collected up to this point shall provide baseline data for pre-project monitoring. For implementation data, during construction monitoring will be required, and for restoration effectiveness data, due to the expected habitat and associated wildlife responses post-project monitoring is also required. Monitoring will take place 5 times a year for the first five years, and then will be scaled back to twice a year but shall continue indefinitely.

PERFORMING THE MONITORING PLAN

The main goal of Greystone Hall restoration project is to create a working landscape that promotes aesthetic, cultural, economic and environmental values through the use of native plant diversity and utilize design principles that blend horticulture and ecology. Therefore, this project will require the property owner, and grounds manager be knowledgeable in ecological practices.

The monitoring plan will be carried out by the grounds manager, Michael Brun. Mr. Brun will be present and trained during all stages of implementation. Any monitoring practices that fall outside or Mr. Brun's training will need to be carried out by specialists in the necessary field, or the project designer and their partners.

ITEMS TO BE MONITORED

Vegetation establishment percentage
Vegetation success rates
Vegetation Growth Rates
Colonization of invasive species
Naturally occurring native plant establishment
Species composition and diversity
Wildlife
Stream bank erosion

SHORT TERM MONITORING OBJECTIVES

Short term monitoring objectives have been developed to evaluate and ensure the initial success of the restoration plan. In most instances data from the short term monitoring objectives represent the best available information. The specific purpose of the short term monitoring is to observe and record the progress of vegetation establishment on site at a bi-weekly to monthly intervals for a two year span. This will allow the monitoring team to take preemptive actions that will prevent more serious issues later on.

LONG TERM MONITORING OBJECTIVES

Long term monitoring objectives have been developed to evaluate and ensure the long term success of the restoration plan. They must implement efficient statistical approaches for collecting and analyzing data. Post the short term monitoring period, the monitoring frequency will decrease to four times a year and correspond with the changes of the seasons and should last indefinitely.

METHODS

PLANT ESTABLISHMENT SUCCESS

The purpose of the plant establishment success monitoring is to evaluate the success of the planting stock. Techniques for monitoring plant establishment success include a visual study of installed plants and more detailed studies of plant species and groups of plant communities using randomly and systematically placed quadrats and other sampling units which are discussed below. Bi weekly to monthly site checks will help to ensure that plants are staying healthy. More detailed assessments should occur twice a year to observe and collect data on vegetation health, growth, and self-colonization of unplanted natives.

PHOTO MONITORING

Photographic monitoring points are fixed, predetermined locations used as a part of the qualitative monitoring that help to display changes in vegetation from season to season and is a useful monitoring tool in tracking vegetation structure (plant density, growth rates, plant health) over time. With each photograph, the observer should not the date, time coordinates, and weather conditions. The locations, directions and type of photograph the photographer should face are noted on the (Monitoring Plan Photo location Map). The types of photos to occur and how to execute them are as follows:

PANORAMIC (P)

To take a panoramic photo, the observer should stay in one place so the pictures all originate from the same viewpoint. Keeping the camera level, focus on a horizon and hold that level for each photograph taken. Start from left to right and overlap each photo by 1/4th to allow for post production merging. Be sure to use the same focal length and exposure for all photographs.

MONITORING REPORT

OBLIQUE (O)

Oblique photos are taken from a high point which is at an angle that is neither horizontal nor perpendicular to the area being photographed. These can be represented by aerial photographs of the site, or they can be used for close up shots aimed at showing a specific detail. They are also referred to as axonometric photos, which are restricted to a 45 degree downward angle. Simply standing, shoot downwards at the object of interest in the center of your frame.

ELEVATION (E)

Taking a photograph from an elevation offers a different perspective on the site the subject is observing. This method is best used when views from the ground plan will not produce desirable, or valuable information. For this photo, simply take the photo from a higher elevation, hills and truck beds are easy solutions, if tree stands are present, these are also great perches from which to photograph. Make sure the view frame is wide, or use in conjunction with a panoramic style photograph.

CANOPY (C)

Standing in an area with any kind of canopy, preferably in more mature forest settings, stand at least 20 feet away from the bases of the trees of which create the canopy and with a wide angle lens or with the zoom at its smallest limit, take a picture of the canopy above. The closer one can get to having a 90 degree angle looking up, the better, as it will include more canopy in their shot.

STEREOSCOPIC (S)

With your weight on your left foot, and left shoulder lined up with your left foot, compose your shot with the object or scene of interest in the center of your view finder. Take note of a detail in the upper or lower corner, and take the first picture. Then, shifting your weight to your right and aligning your right shoulder and right foot, compose the object or scene so that it has the same vertical positioning as the first image, and take the photo.

REFERENCE PLOTS

To determine and monitor the success and growth of restoration areas, reference plots will serve as the method to analyze native plant composition as well as invasive species presence. Reference plots will be taken at specific locations (See Map X) to insure cover type representation in data collection.

Tree / Forest Plots are conducted by creating a 50' x 100' area, and using the Forest Plot reference material (Appendix X) fill in the locations of species, making sure to account for estimated canopy width, diameter of tress at breast height for trees over 4" in diameter, shrub locations, as well as marking the general herbaceous layer coverage. One should also be sure record and list the quantities and presence of all species. Be sure to include a cross section as well, using a clinometer to estimate tree height. In areas of dense shrub growth and grouping, shrub plots should be established using a 20' x 40' dimension, and for the herbaceous layer use a 10' x 20' plot where growth is at its most dense. In more open meadow areas, it is suggested that a small 3' x 3' frame be set to record herbaceous presences. Rather than setting specific sites to revisit, it is best to use random sampling, a common standard that eliminates bias.

TRANSECTS

Like the reference plots, predetermined and permanently marked transects will also be used to monitor the restoration projects health, as well as species regeneration and diversity. Transects will measure 100' in length with 5 points marked at 0, 25', 50', 75', and 100'. The observer will move along this path and at each point, within a 5ft radius of the point, count species occurrences while also obtaining the distance from the transect to the object. The transect operation will result in an estimate of the area covered and be able to calculate the actual density of objects through using raw count and a probability function. Transect information will also reveal when the observer has crossed boundaries from one plant community to another (Buckland, S.T., Anderson, D.R., Burnham, K.P and Laake, J.L. 1993).

WILDLIFE

Essential to the process is the observation of wildlife. During each monitoring event wildlife sittings and signs shall be recorded. This can include but is not limited to; deer browse, buck rub, tracks, animal droppings, and nests. One of the most important determinant factors which indicates the success of a restoration is the presence of songbirds. Below is the procedure by which to monitor their presence and abundance.

SONGBIRDS

To determine richness and abundance of songbirds and desired condition songbird species, 6 avian point count stations should be established 200 meters apart surrounding the meadow restoration area. Additional point count stations should also be located in edge and forest edge locations. Point counts should begin 15 minutes before sunrise and finish no later than four hours after sunrise. Those conducting the observation should record all birds seen or heard within 10 minutes within 50 m of the point count stations. In order

to calculate abundance, observers will average the number of individuals detected within 50 m of the point count stations across three surveys and then divide by the number of points sampled to correct for differences in the number of points surveyed at each site

ADAPTIVE MANAGEMENT PLAN

Key to the success of this monitoring report, and the overall success of the restoration are adaptive management strategies which will be implemented when the data collected on site reveals that action needs to be taken. If it is found that any part of the project is failing, the issue must be recorded and will warrant the intervention and open a dialogue between project managers and current land managers. Triggers for the initiation of the adaptive management strategy include but are not limited to the decline of vegetation survival rates that drop below 80% and if any invasive species are found within the restoration boundary.

"Because of the changing conditions and uncertainties, ecosystem stability can only be viewed as a short-term objective. Long-term restoration must be an ongoing process whereby restoration implementation becomes a continuing series of management decisions. Each decision should be based upon a growing pool of research information, updated measurements of ecosystem responses, and evaluations of degrees of progress in reaching a set of goals or targets that have been identified as indicative of ecosystem vitality" (Davis and Ogden 1994).

FUTURE DIRECTIONS / CONCLUSION

The monitoring plan presented above is an attempt to create a multiple indicator, multiple partner approach at the Greystone Hall: A Country Estate Revitalization Project. It will draw on data collected by multiple parties and will extract said data to create meaningful indicators. The implementation of this plan is necessary to ensure the short term establishment success and the long term, continued success of the restoration project.

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Grasses								
Scientific Name	Common Name	Height x Spread	Form	Bloom Month	Flower Color	Moisture Range	Exposure Range	Specific Wildlife Value
Andropogon gerardii	Big Bluestem	5-8′	Upright Clump	Aug - Oct		Dry - Moist	Sun	Butterfly, Songbird
Carex Pensylvanica	Pennsylvania Sedge	12-18″	Rounded Clump	May		Dry - Moist	P/S - Shade	
Deschampsia flexuosa	Common Hairgrass	6-18″	Upright Clump	July-Sep		Dry - Moist	P/S - Shade	
Eragrostis spectabilis	Purple Love Grass	1-2′	Mounded Clump	June - Aug		Dry - Moist	Sun	Butterfly, Songbird
Panicum virgatum	Switchgrass (Shenondoah)	3-7′	Upright Clump	Aug - Sep		Dry - Moist	Sun	Butterfly, Songbird
Schizachyrium scoparium	Little Bluestem	2-3′	Upright Clump	Aug - Oct		Dry - Moist	Sun	Butterfly, Songbird
Sorghastrum nutans	Indian Grass	4-7′	Upright Clump	Aug - Sep		Dry - Moist	Sun	Butterfly, Songbird
Sporobolus heterolepis	Prairie Dropseed	2-3′	Rounded Clump	Aug - Sep		Dry - Moist	Sun	Butterfly, Songbird
Tridens flavus	Purple Top	3-5′	Upright Clump	July - Sep		Dry - Moist	Sun - P/S	Butterfly, Songbird
Forbs								
Scientific Name	Common Name	Height x Spread	Form	Bloom Month	Flower Color	Moisture Range	Exposure Range	Specific Wildlife Value
Allium cernuum	Nodding Wild Onion	1-2′	Daisies	July - Aug	Flower Color	Dry - Moist	Sun - P/S	
Amsonia tabernaemontana var.	Willow Leaf Bluestar	1-3′	Daisies / Plume	May	Flower Color	Moist	Sun - P/S	Butterfly
Aquilegia canadensis	Wild Columbine	1-3′	Daisies	May	Flower Color	Dry - Moist	P/S	Hummingbird
Asclepias tuberosa	Butterfly Weed	1-2′	Daisies / Plume	June - Aug	Flower Color	Dry - Moist	Sun	Butterfly
Aster laevis	Smooth aster	3-5′	Daisies	Sep - Oct	Flower Color	Dry - Moist	Sun - P/S	Butterfly, Songbird
Baptisia australis	Blue False indigo	3-4′	Spire	May- June	Flower Color	Dry - Moist	Sun - P/S	Butterfly
Delphinium exaltatum	Tall Larkspur	3-5′	Spire	July - Sep	Flower Color	Moist	P/S - Shade	
Eupatorium maculatum ‘Gateway’	Joe-Pye Weed	5-6′	Plume	June - Sep	Flower Color	Moist - Wet	Sun - P/S	Butterfly
Lobelia siphilitica	Blue Lobelia	1-3′	Spire	Aug - Oct	Flower Color	Moist - Wet	P/S	Butterfly, Hummingbird
Monarda didyma	Bee-Balm Oswego Tea	3-4′	Daisies	June - Aug	Flower Color	Dry - Moist	Sun - P/S	Butterfly, Hummingbird
Monarda fistulosa	Wild Bergamot	2-3′	Daisies	July - Aug	Flower Color	Dry - Moist	Sun	Butterfly, Hummingbird
Polygonatum commutatum	Great Soloman’s Seal	3-4′	Bells	May - June	Flower Color	Dry - Moist	P/S - Shade	
Pycnanthemum virginianum	Mountain Mint	2-3′	Plume	July - Sep	Flower Color	Dry - Moist	Sun - P/S	Butterfly
Ratibida pinnata	Gray-headed Coneflower	4-6′	Daisies	July - Sep	Flower Color	Dry - Moist	Sun - P/S	Butterfly, Songbird
Rudbeckia fulgida var. fulgida	Black-eyed Susan	1-3′	Daisies	Sep - Oct	Flower Color	Dry - Moist	Sun - P/S	Butterfly, Songbird
Solidago rigida	Stiff Goldenrod	3-5′	Spires	Sep - Oct	Flower Color	Dry - Moist	Sun	Butterfly, Songbird
Tradescantia ohiensis	Spiderwort	2-4′	Daisies	May - Aug	Flower Color	Dry - Moist	Sun - P/S	
Vernonia glauca	Upland Ironweed	3-5′	Daisies	Aug - Sep	Flower Color	Dry - Moist	Sun	Butterfly
Zizia aptera	Heart-leaved Alexanders	1-3′	Plume	April - May	Flower Color	Dry - Moist	Sun - P/S	Butterfly

APPENDIX

Directions to Site:

From Center City Philadelphia:

Take Route 76 West 20 minutes, exit to Route 202 S (to West Chester) 20 minutes, exit at "Boot Road," bear right onto Boot Road. At first light, turn left onto Phoenixville Pike. After 1-1/4 miles, immediately after sharp S curve, turn right onto private road (1034) (Greystone Hall's entrance is directly opposite Saunder's Lane) Follow signs to Greystone Hall (guests).

From West Philadelphia:

Take Route 3 West (to West Chester) 40 minutes to outskirts of West Chester. Turn right onto Routes 202N/322W (after Starbucks) Exit at "Downingtown/322W" exit (2nd exit). At first light, turn right onto Phoenixville Pike Go 4/10 mile, make first left onto private road (1034) (Greystone Hall's entrance is directly opposite Saunders Lane) Follow signs to Greystone Hall (guests).

From New Jersey, New York, and other Northern Points:

Take New Jersey Turnpike South to Exit 6. Becomes PA Turnpike (Route 276). Stay on PA Turnpike approximately 30 minutes. Take Exit #326 (Valley Forge). Follow signs to Route 202 South (to West Chester). Stay on Route 202 South - 20 minutes. Exit at "Boot Road," bear right onto Boot Road. Make left at first traffic light onto Phoenixville Pike. After 1-1/4 miles, immediately after sharp S curve, turn right onto private road (1034) (Greystone Hall's entrance is directly opposite Saunders Lane) Follow signs to Greystone Hall (guests).

From Wilmington and other Southern Points:

From I-95 North near Wilmington take Route 202 exit. Follow signs for Route 202 North (to West Chester). Stay on Route 202 N to outskirts of West Chester. Bear to right at sign for 202 North/322W. After traffic light at Matlack Road, pass three W.C. exits (Westtown Road, Route 3 and Paoli Pike). Exit at "Downingtown/322W" exit. Turn right at traffic light onto Phoenixville Pike. Go 4/10's mile, make first left onto private road (1034) (Greystone Hall's entrance is directly opposite Saunders Lane) Follow signs to Greystone Hall (guests).

FOREST PLOT PLANT LIST FROM

FOREST PLOT:_____	DATE:_____	COORDINATES:_____
SPECIES NAME	QUANTITY	NOTES
ADDITIONAL NOTES: (Wildlife, Disturbance, etc.)		

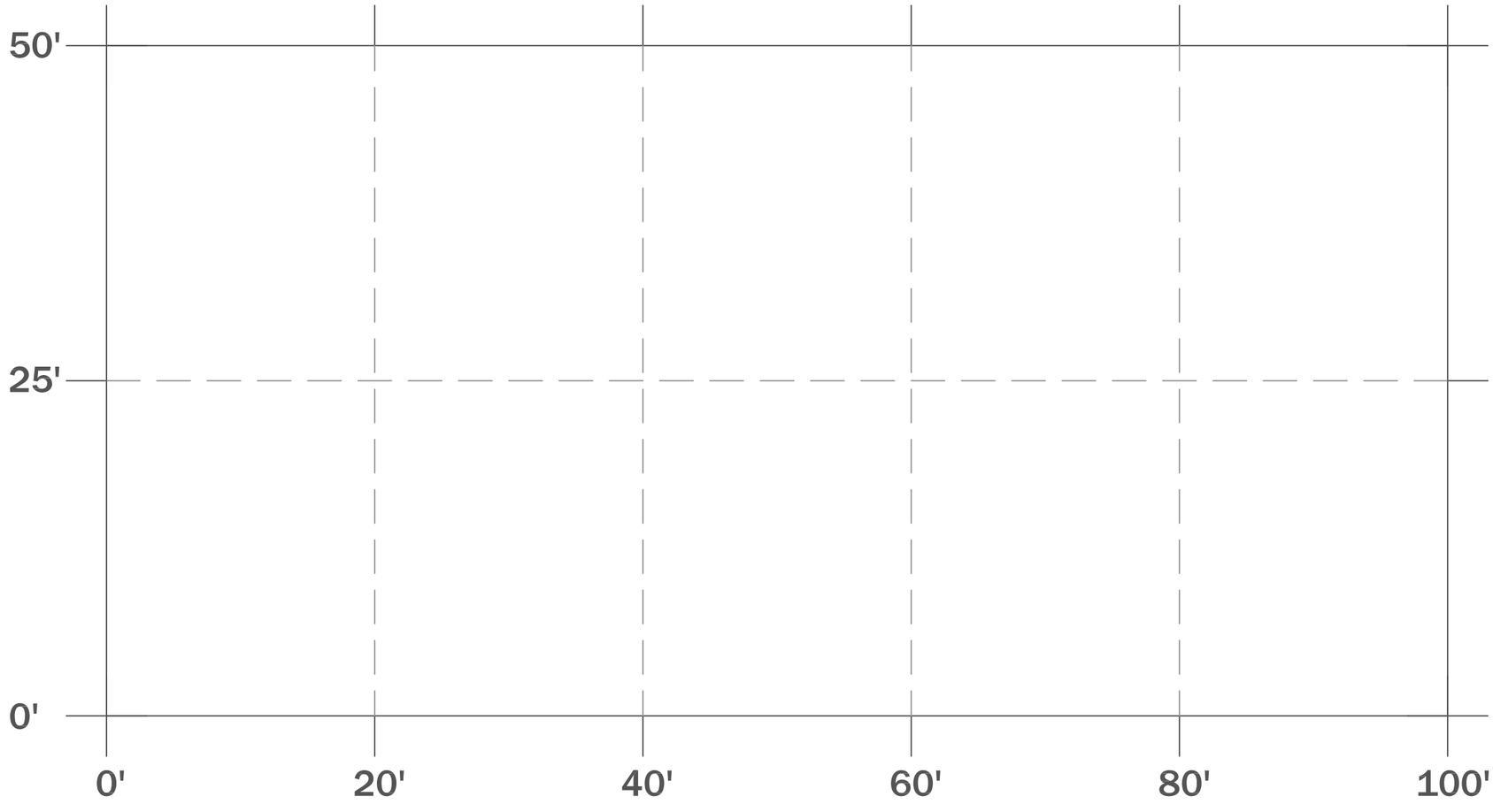
SHRUB PLOT PLANT LIST FORM

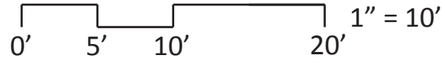
SHRUB PLOT:_____	DATE:_____	COORDINATES:_____
SPECIES NAME	QUANTITY	NOTES
ADDITIONAL NOTES: (Wildlife, Disturbance, etc.)		

HERB PLOT PLANT LIST FORM

HERB PLOT:_____	DATE:_____	COORDINATES:_____
SPECIES NAME	QUANTITY	NOTES
ADDITIONAL NOTES: (Wildlife, Disturbance, etc.)		

FOREST REFERENCE PLOT





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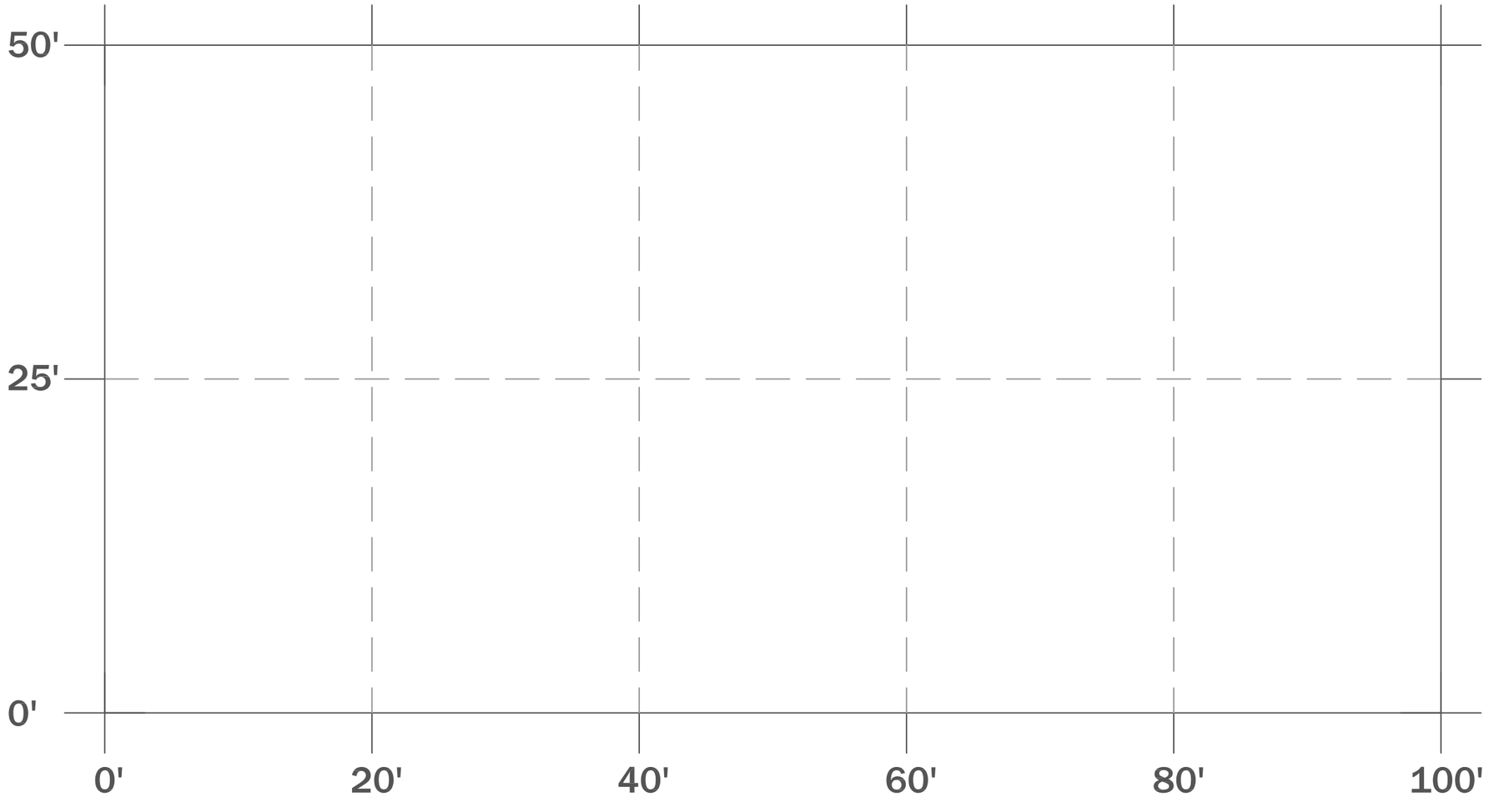

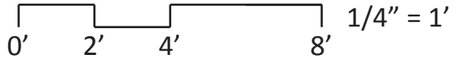

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