Rutgers School of Environmental and Biological Sciences

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Landscape Architecture Foundation
2017 Landscape Performance Education Grant

**Instructor Reflection for Advanced Plants 548, Fall 2017**
Department of Landscape Architecture,
School of Environmental and Biological Sciences
Course Instructor: Prof. J. M. Hartman

## Integrating Landscape Performance

My class is a two-credit course taught in the final year of our MLA program. It is intended to extend and polish the plant knowledge of our students. As such, there are three distinct areas covered: basic botany, plant identification methods, and basic plant ecology. Adding landscape performance as a program layer proved to be worthwhile experiment; it provided a rubric within which we could discuss the three focus areas and demanded clarity of observation methods.

We set about defining our approach to quantifying **Rain Garden Landscape Performance**. Our goal was to identify important categories of information and find straight-forward objective and quantifiable subjective approaches. As a result, we hope that we have developed a clear process that could reasonably be completed by anyone, from landscape architect to student intern to citizen scientist.

But, this is only a beginning. I would love to get feedback from educators who try to follow our approach, especially from other parts of the country. What works? What needs adjustments? What do you think can be replaced by your idea?

## Our Process

Much of what we did and how we did it is well documented in the accompanying *Rain Garden Measurement & Evaluation Guide*. But what follows is a brief overview of the approach I took to the development of the overall process as a portion of class time and field study.

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During the first four weeks of class we developed a system of assessing the rain gardens landscape performance and eventually collected data at seven sites. Our goal was to create a system that would be straight-forward and could make assessments rapidly. We completed field work in less than two hours with four to seven students involved. Individual student assignments included running the soil texture analysis and creating the summary sheets; tasks were assigned as homework.

Here is a brief overview of our course-long process: We began with plant identification. We visited the rain garden in front of our building and collected examples of all the species we could find. In the classroom, students learned to use *Newcomb's Wildflower Guide* to identify forbs (herbaceous plants with showy flowers) and *Field Guide to the Grasses, Sedges and Rushes of the United States* to identify graminoids (grasses and grass-like plants). This exercise demonstrated the depth of species diversity on a site and taught how one differentiates plant species. In class discussion, we agreed that identification to species of all plants in a garden was not a realistic requirement for the rapid assessment tool we wished to develop. Therefore, we agreed that we would continue to find as many species as possible and, instead of identifying them to species, we would count the number of species in the following categories:

| Category | Sub-Category | Number of Species | Estimated % Cover |
|---|---|---|---|
| Ferns | | # | % |
| Gymnosperms | | # | % |
| Angiosperms | | - | - |
| | Trees | # | % |
| | Shrubs | # | % |
| | Vines | # | % |
| | Forbs | # | % |
| | Graminoids | # | % |
| | Other Monocots | # | % |

We agreed that using these categories would be within the capacity of any landscape architect and would provide a rapid and meaningful method for calculating diversity. *Species richness* can be calculated by adding the number of species in all of the categories.

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For *diversity*, we chose the simple and widely used Simpson Diversity Index:

$$D = 1 - \left( \frac{\Sigma\, n(n-1)}{N(N-1)} \right)$$

n = the total number of organisms of a particular species

N = the total number of organisms of all species

From: https://geographyfieldwork.com/SimpsonsDiversityIndex.htm

In our case we used the *% cover* for each category in the calculation. The other option would have been to use the number of taxa in each category, but again, our decision was informed by ease and speed of process while achieving reasonable accuracy.

The next step in developing our process addressed soil conditions. After two lectures/discussions about soils, we began collecting soil samples and performing water infiltration tests at each site we visited. The purchase of a Turf-Tec Infiltrometer and tube sampler soil probe facilitated this phase of work. We found that the following information was useful and easily collected:

(a) Site Level Soil Type (using the NRCS WebSoilSurvey),

(b) soil texture (with soil collected systematically in the garden and analyzed using a LaMott Soil Texture Kit), and

(c) saturated soil infiltration rate ($K_{sat}$) at systematically selected points in and near the garden.

Our final development in the process introduced methods for subjective quantification of Ecological and Aesthetic Considerations. The latter, the students agreed, was of particular importance if the rain garden was to be socially appreciated and accepted for the long-term in a landscape.

I will leave you to review the attached report for greater detail about the process and to examine several of the student generated assessments for the sites we visited. But worth noting, as we developed these processes and applied them in the field, I observed among the students a truly high level of engagement. They readily developed and tweaked sampling processes. They

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were eager to be involved in all parts of the site visits and found ways to take turns at different roles so that everyone could have a chance to do everything. As we got close to finishing the sampling and beginning the design exercise, I felt they had a good to excellent understanding of what was required to make a high performing rain garden.

## The Final Project

The final exercise for the class was the design of a rain garden for a site on Busch Campus in Piscataway, NJ. The site is relatively small and roof gutters are already draining into an area designed to manage stormwater, but instead of plants the present design only employs river stones. This assignment was intended to test how well the students understood the technical and aesthetic issues of developing a planting design for a rain garden. Four examples of the resulting designs are included as PDFs for your review. The design jury was made up of staff from campus Facilities Office who design or manage rain gardens. They found the designs to be realistic and will review them for possible implementation. The practical insights that students gained from their input was invaluable.

## What to change and improve

Thanks to the funding from LAF, this class included off-campus field trips and new pieces of equipment. Funding field trips can be difficult at our University, but enough examples of rain gardens can be visited on or near campus to teach how to use the methods. In future years, off campus rain gardens will be assigned as homework so students can visit them independently and report back to the class. The equipment and materials that were purchased for the class should last several years, so these parts of the exercises can certainly continue.

I was surprised at the aesthetic scores the students gave the sites we visited. The scores are higher than I would have assigned myself and I wonder if the students would give gardens that were not functioning rain gardens the same high scores. I may include some aesthetic and ecological assessments of campus gardens that are not designated as rain or conservation gardens with next year's students. I suspect I will see a difference in scores.

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One of my disappointments is that we did not systematically collect information about maintenance, management and related issues. At each site, we spoke to the designer, maintenance staff, or supervisory staff. Their stories, examples, points of pride and frustration would add an essential layer of information. Since I believe that ongoing maintenance is a necessity to long-term effectiveness of rain gardens, I regret this shortcoming and think I will re-engage the people who manage these sites and see if I can add the information.

**Some words of thanks**

James Erdogdu was very generous with his knowledge and time. His enthusiasm for creating more rain gardens on campus was contagious. His practical insights and the diversity of sites he showed the class helped shape our study and results.

Tobiah Horton kindly set up opportunities for us to visit some of the rain gardens he has designed over the past 5 years. His experience in design, implementation and community outreach informed our observations and our data collection process. His availability to answer questions and react to our development of ideas was critical.

Michelle Bakacs shared her experience with successful and failed designs. Her depth of knowledge about the site she showed us helped students grapple with the difference between design intentions and implementation realities. Her honest answers about the things that can go wrong are priceless.

Brian Clemson played several roles. He helped me find James. He gave an excellent lecture on planting design and provided important technical guidance in class. He also helped with technical reviews of student designs, giving feedback that will serve students well as they become professionals.

Megan Barnes' encouragement and positive attitude was consistent and appreciated. LAF's financial support made this work possible and enlightening. The way I teach Advanced Plants has been permanently improved.

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# Rain Garden Measurement & Evaluation Guide

Landscape Architecture Foundation
Rutgers MLA Program • Fall 2017
By: J.M. Hartman and M. Robison

# An Introduction to Rain Garden Measurement & Evaluation

Rain gardens have been hailed as the a tremendous ecological addition to our landscapes. They are capable of reducing runoff, slowing down the flow of water, keeping water out of the sewer system, cleaning the water that passes through them, and greatly increasing local biodiversity through the inclusion of native plants. With all of these positive capabilities, it is no wonder that their virtues have been extolled far and wide by gardeners, river keepers, and ecologists alike. In this exercise, we are questioning the concept of what a rain garden can do, and assessing what they really are capable of. Do rain gardens live up to their expectations? Through a multifaceted assessment, we aim to quantifiably answer that question.

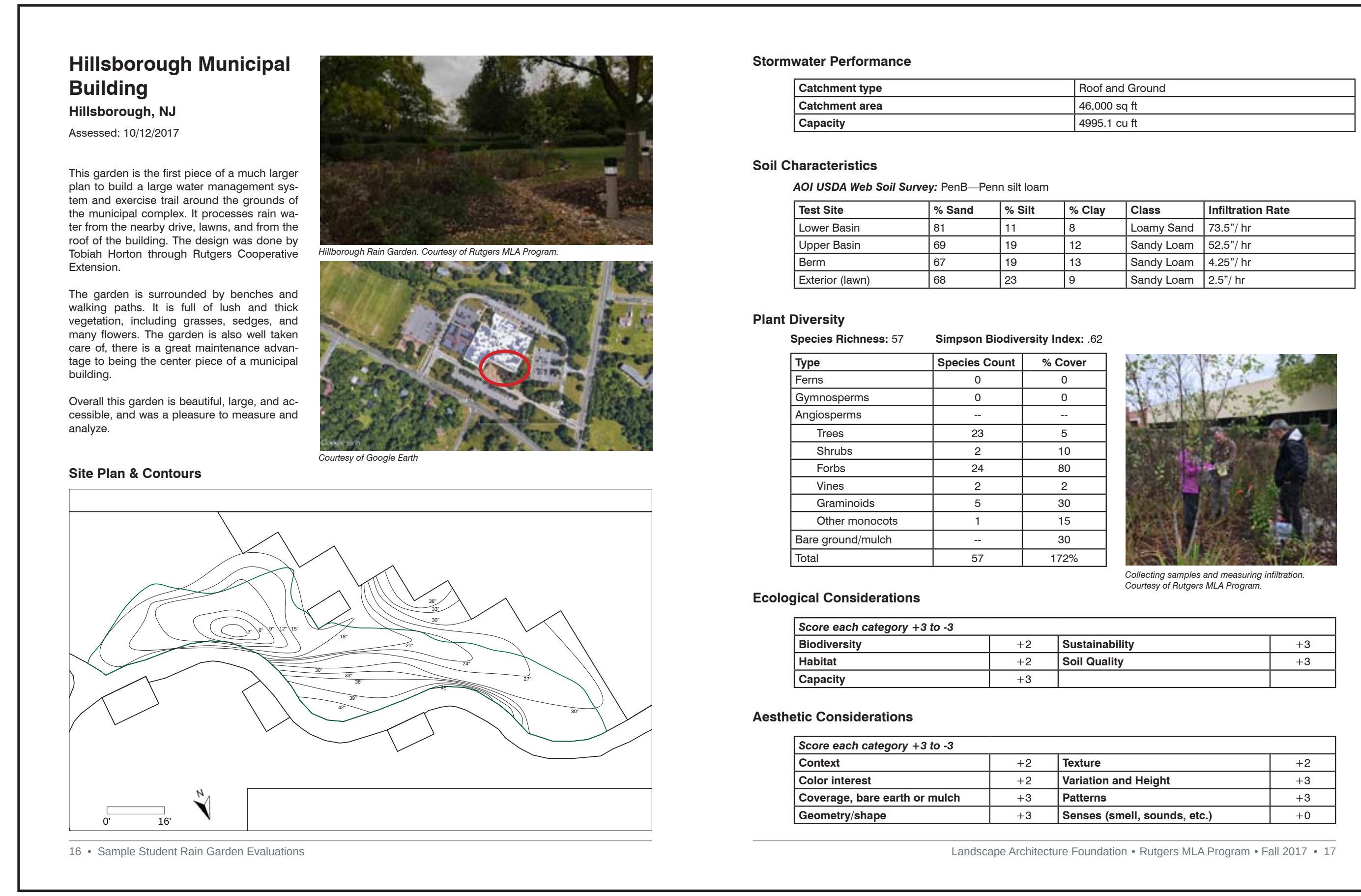
To make an objective assessment of a rain garden's performance, we chose to assess several specific characteristics:

- **Stormwater Performance**
- **Soil Characteristics & Water Infiltration**
- **Plant Diversity & Coverage**
- **Ecological Considerations**
- **Aesthetic Considerations**

Each of these contributes to the overall goals that rain gardens are thought to achieve. By making objective or quantifiable subjective assessments at a number of different rain gardens sites, we can better understand how they function and how well the gardens are achieving their purpose.

Rain gardens are important landscape tools for creating biodiversity, managing water, and adding beauty to the landscape. To determine what makes a rain garden successful, we created different rubrics by which we could measure and rate the success of the gardens. In studying, measuring, and analyzing several rain gardens we were not only able to learn how to assess a rain garden, but learn about what constitutes a successful rain garden. Through learning about what makes a rain garden succeed, we also intend to learn how to better design rain gardens.





## Hillsborough Municipal Building

**Hillsborough, NJ**

Assessed: 10/12/2017

This garden is the first piece of a much larger plan to build a large water management system and exercise trail around the grounds of the municipal complex. It processes rain water from the nearby drive, lawns, and from the roof of the building. The design was done by Tobiah Horton through Rutgers Cooperative Extension.

The garden is surrounded by benches and walking paths. It is full of lush and thick vegetation, including grasses, sedges, and many flowers. The garden is also well taken care of, there is a great maintenance advantage to being the center piece of a municipal building.

Overall this garden is beautiful, large, and accessible, and was a pleasure to measure and analyze.

*Hillborough Rain Garden. Courtesy of Rutgers MLA Program.*

*Courtesy of Google Earth*

**Site Plan & Contours**

16 • Sample Student Rain Garden Evaluations

**Stormwater Performance**

| | |
|---|---|
| **Catchment type** | Roof and Ground |
| **Catchment area** | 46,000 sq ft |
| **Capacity** | 4995.1 cu ft |

**Soil Characteristics**

***AOI USDA Web Soil Survey:*** PenB—Penn silt loam

| Test Site | % Sand | % Silt | % Clay | Class | Infiltration Rate |
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**Species Richness:** 57 **Simpson Biodiversity Index:** .62

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| Vines | 2 | 2 |
| Graminoids | 5 | 30 |
| Other monocots | 1 | 15 |
| Bare ground/mulch | -- | 30 |
| Total | 57 | 172% |

*Collecting samples and measuring infiltration. Courtesy of Rutgers MLA Program.*

**Ecological Considerations**

| *Score each category +3 to -3* | | | |
|---|---|---|---|
| **Biodiversity** | +2 | **Sustainability** | +3 |
| **Habitat** | +2 | **Soil Quality** | +3 |
| **Capacity** | +3 | | |

**Aesthetic Considerations**

| *Score each category +3 to -3* | | | |
|---|---|---|---|
| **Context** | +2 | **Texture** | +2 |
| **Color interest** | +2 | **Variation and Height** | +3 |
| **Coverage, bare earth or mulch** | +3 | **Patterns** | +3 |
| **Geometry/shape** | +3 | **Senses (smell, sounds, etc.)** | +0 |

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### *Methods of Measurement: Worksheet & Site Description*

Each student was required to complete a Rain Garden Analysis Worksheet, a sample of which is illustrated above. The name of the building site, town and state, and date of assessment was noted. A brief description was also provided that included contextual and historical notes, as well as any other relevant observations. Photos are included to give a general overview of the site, provide context in the greater landscape and illustrate the relationship to nearby architecture.

The following pages will discuss the specific rain garden characteristics previously mentioned in detail, the approach to assessment and the method of measurement and data collection on the worksheet in detail.

## Stormwater Performance

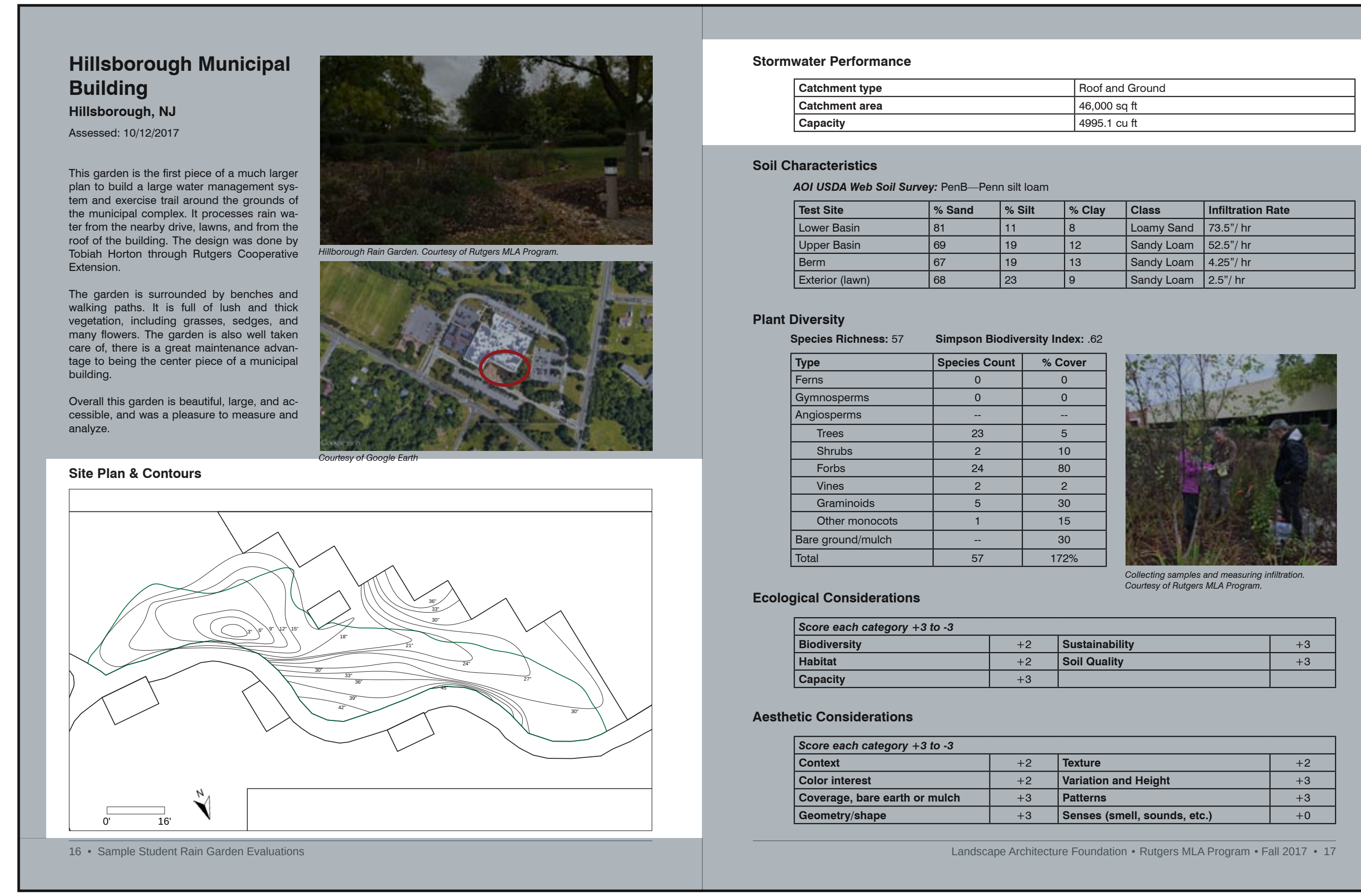
Rain water and runoff infiltration are the primary functions of rain gardens. If they cannot do this, then they really are just regular gardens, or perhaps something worse. Every rain garden should be designed to hold a certain volume of water from a predetermined catchment area. To assess the garden’s performance, we measured the garden’s volume. It is important that a rain garden be appropriately sized for its catchment area. If a garden is too small, it will overflow during too many rain events and not be effective at keeping water out of the storm or combined sewer system. If a garden is too large, the plants growing in it will not receive enough water, and the garden will be in a permanently droughty condition. This will likely reduce biodiversity and ground cover over time. A correctly sized garden is of prime importance to the function of the garden—managing water.

***Methods of Measurement: Catchment Type, Catchment Area & Stormwater Capacity***

During site visits students make observations to determine obvious catchment areas for the rain garden. These may include building roof downspouts or ground level non-permeable surfaces, such as parking lots, sidewalks and compacted lawn areas that create run-off into the garden. **Stormwater Type** was then categorized on the worksheet as *Roof, Ground* or *Roof and Ground***.**

On-site measurements and satellite images sourced from tools such as Google Maps allow students to determine reasonable approximations of a total **Catchment Area** for the rain garden and are recorded as *square feet*.

Line level measurements are taken by students at each rain garden. Spot elevations are later interpolated to create contour maps for each site. The contours allow students to calculate the volume between the berm of the rain garden and its catchment basin providing a reasonably accurate description of **Stormwater Capacity** of the rain garden and is recorded on the work sheet as *cubic feet.*



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**Site Plan & Contours**

**Stormwater Performance**

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| Bare ground/mulch | -- | 30 |
| Total | 57 | 172% |

*Collecting samples and measuring infiltration. Courtesy of Rutgers MLA Program.*

**Ecological Considerations**

| *Score each category +3 to -3* | | | |
|---|---|---|---|
| **Biodiversity** | +2 | **Sustainability** | +3 |
| **Habitat** | +2 | **Soil Quality** | +3 |
| **Capacity** | +3 | | |

**Aesthetic Considerations**

| *Score each category +3 to -3* | | | |
|---|---|---|---|
| **Context** | +2 | **Texture** | +2 |
| **Color interest** | +2 | **Variation and Height** | +3 |
| **Coverage, bare earth or mulch** | +3 | **Patterns** | +3 |
| **Geometry/shape** | +3 | **Senses (smell, sounds, etc.)** | +0 |

16 • Sample Student Rain Garden Evaluations

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# Soil Characteristics & Water Infiltration

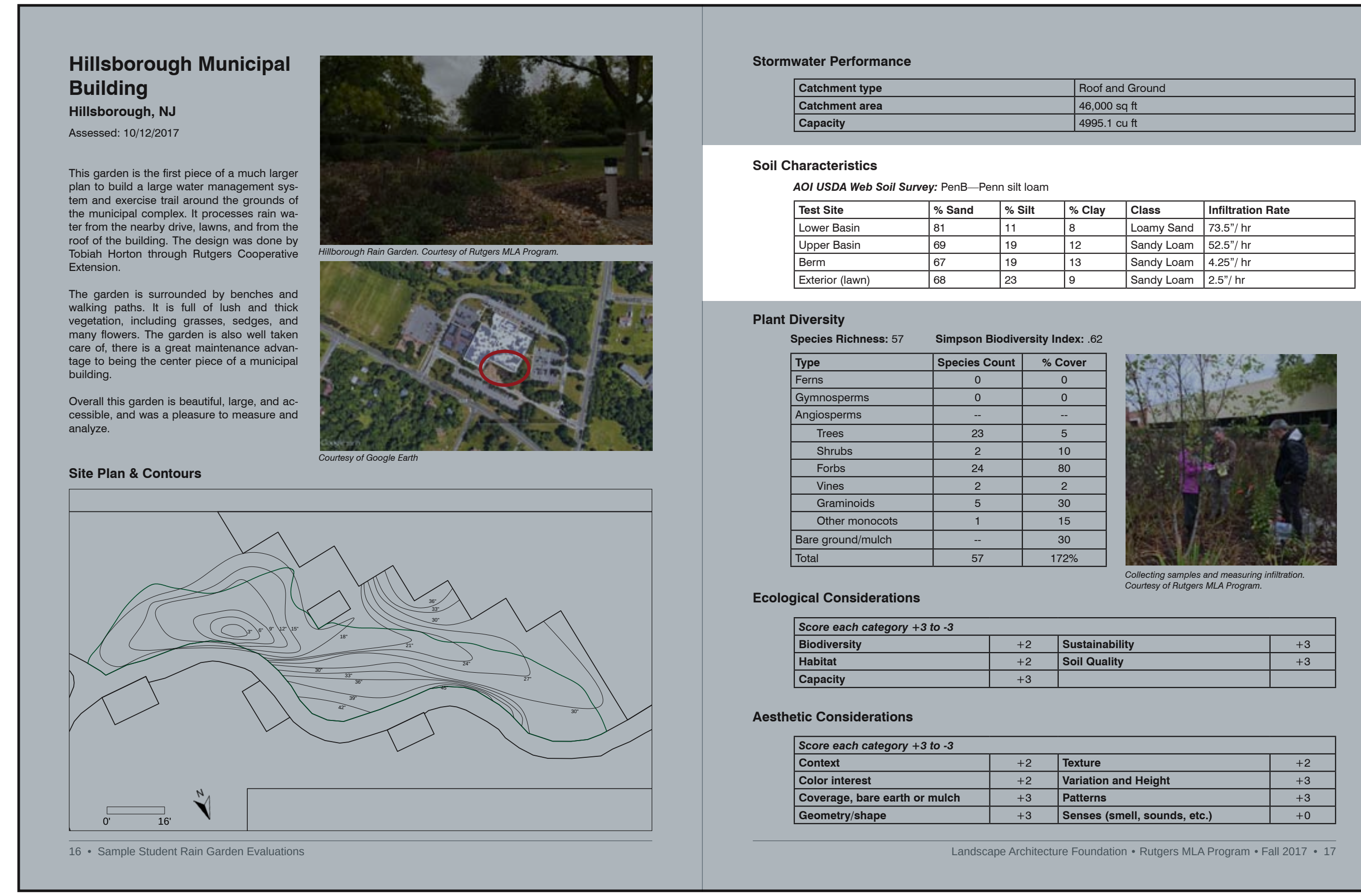
Rain gardens need to strike a careful balance between quickly infiltrating water and holding enough water and nutrients to successfully support a diverse array of plants. If a garden has the appropriate soil texture, it will be able to do all of these things. Additionally, it will need to have different soil textures in different areas of the garden. The basin of the garden needs to infiltrate large volumes of water quickly, while the sides need to support the shape of the garden and its plantings against potential erosion. To measure the success of the gardens and to learn about which soil textures supported the best gardens, we collected soil samples from different areas of each garden. We analyzed the texture of these samples to compare them and determine how the soil supports the function of the garden. And finally, we considered the types of soils present in comparison to the results of water infiltration test results at these locations.

For a garden to effectively infiltrate water, it needs to be able to hold water long enough to hydrate the plants, but infiltrate the soil quickly enough that mosquitoes cannot begin to breed. Since infiltration is a primary function of rain gardens, measurement was of critical importance. Determining how fast a rain garden allows water to infiltrate the soil we can determine if it can do its job effectively.

### *Methods of Measurement: USDA Web Soil Survey, Soil Texture Tests & Infiltration Rates*

Students examine the topography of the rain garden and identify four areas for testing: *Lower Basin*, the lowest point in the rain garden; *Upper Basin*, a higher point still in the basin bowl; *Berm*, the top point of the constructed berm, or if absent, the highest limiting edge of the basin; and *Exterior*, a point in the nearby surrounding landscape, often a lawn, to compare average existing soil.

Soil samples are taken using a *tube sampler soil probe*. The samples are bagged and taken back to a lab where they are tested using a *LaMotte Soil Texture Kit.* Each sample is then noted for its percentage of each *soil separate (***sand, silt clay***)*. **Soil classification** is then determined using the *soil triangle*.



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**Site Plan & Contours**

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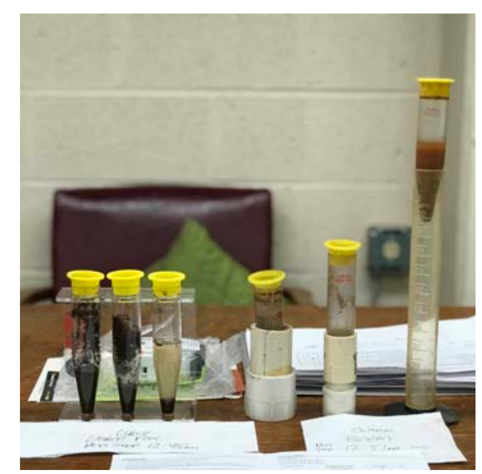


At each test site, students use an *Turf-tec Infiltrometer*, to determine the saturated soil infiltration rate (a.k.a. $K_{sat}$). The cutting blades are inserted into the soil test site to the level of the depth limiting ring. The double rings of the instrument are then both filled with clean water brought to the site in a collapsible bag and a timer was set for 15 minutes. A reading on the scale above the floating gauge ia taken at the end of the 15 minutes test. At sites where infiltration was particularly quick, readings were taken at shorter regular intervals. Ultimately, a one hour saturated soil **infiltration rate** was calculated for each test site from the data.

# Plant Diversity & Coverage

Rain gardens have abilities besides managing water, they may also be small pockets of intense biodiversity. This is not only an important secondary attribute of rain gardens, but helps support the first intention. Plants absorb water, and plant roots help to clean the water while also helping increase soil permeability. Biodiversity means more than just a few different kinds of plant species planted in the garden. It also means more than thick plant coverage. Biodiversity means that there are many different species or plants and different types of plants. To assess this aspect, we cataloged the number of plant species present for several different categories. This included every different kind of plant present in the garden, from trees to tiny weeds. Having a great number of different plant species in different categories is a good indicator that the garden that it well-constructed and healthy.

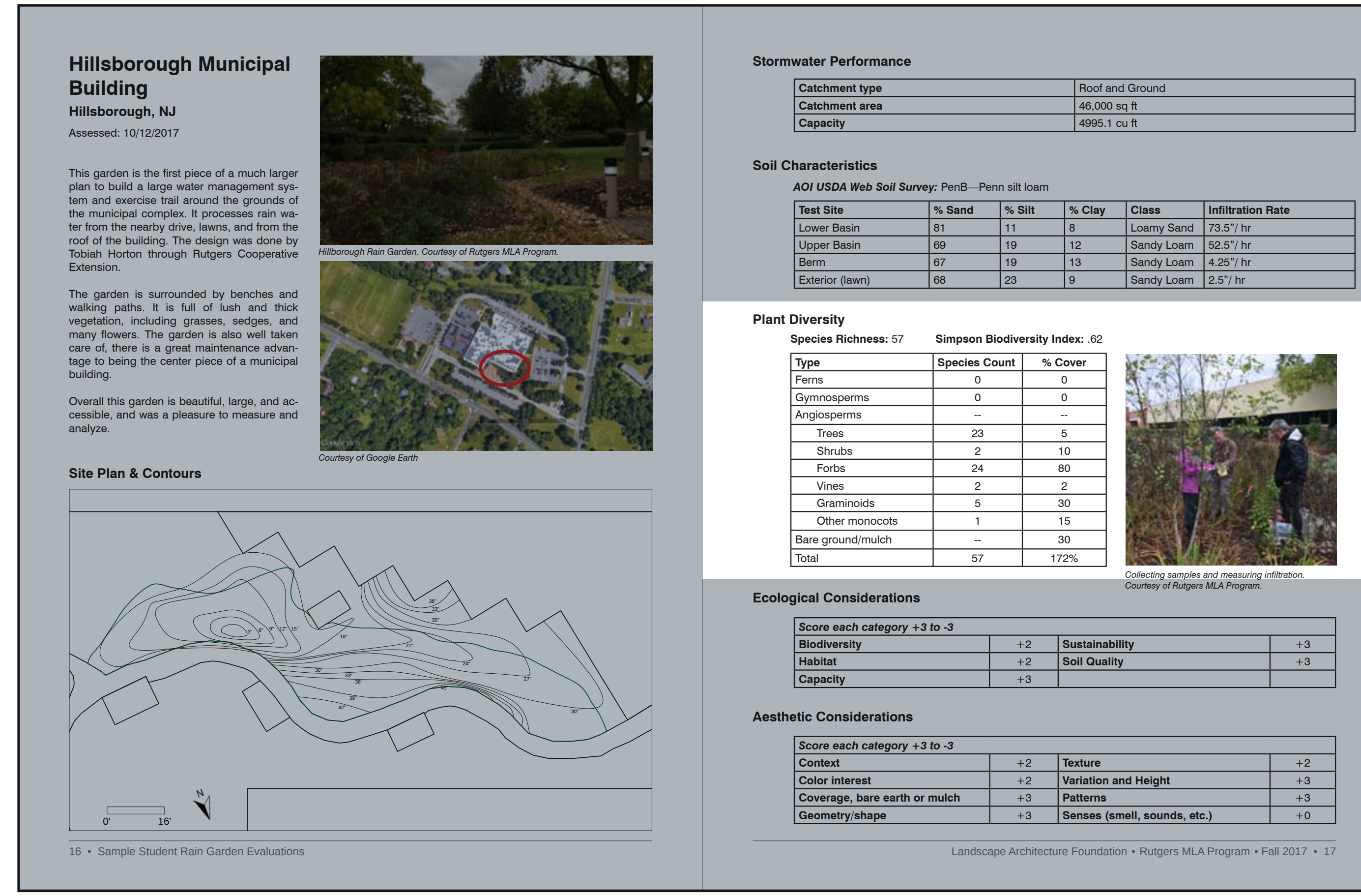
Naturally, to support greater biodiversity, a garden needs to be dense as well as diverse. We visually assessed the proportion of garden area covered by each category of plant. A garden that had good coverage in a number of different plant categories would be considered successful, while a garden with coverage from only one category or fewer categories would be less biodiverse and deemed not as successful.

### *Methods of Measurement: Species Count & Coverage*

At each site, students survey the rain garden and, using hand shears, take small samples from each plant species present. The samples are laid out on-site and examined to remove duplicates. The students tally the number of species in each classification and record the total in the **Species Count** column. The total number of species noted on-site is used as the **Species Richness** value of the first biodiversity metric.

**Plant Cover** is determined by observation alone, and therefore is one of the more subjective variables recorded. Students observe the garden as a whole and for each plant classification and make a determination of percentage of cover. To help remedy personal subjectivity, individual students may make their own evaluations and then confer to agree upon an average coverage percentage for each tally. Since plants of different types may layer over one another, or for example a ‘tree’ may layer over ‘bare ground,’ the **Plant Cover Total** should always exceed 100%, may often be near 200%, and in mature systems may exceed 300%.

The second biodiversity metric, the **Simpson Biodiversity Index,** reflects the probability that two species chosen at random from a community would belong to the same species. In our application, it is calculated using observed coverage scores for each category, where $D = \sum n_1(n_1-1) / N (N-1)$. Since D is a measure of species dominance, then calculate 1 - D to arrive at value that better reflects an intuitive representation of diversity. The value will always be between 0 and 1, with results closer to 1 reflecting greater biodiversity.



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| Vines | 2 | 2 |
| Graminoids | 5 | 30 |
| Other monocots | 1 | 15 |
| Bare ground/mulch | -- | 30 |
| Total | 57 | 172% |

*Collecting samples and measuring infiltration. Courtesy of Rutgers MLA Program.*

**Ecological Considerations**

| *Score each category +3 to -3* | | | |
|---|---|---|---|
| **Biodiversity** | +2 | **Sustainability** | +3 |
| **Habitat** | +2 | **Soil Quality** | +3 |
| **Capacity** | +3 | | |

**Aesthetic Considerations**

| *Score each category +3 to -3* | | | |
|---|---|---|---|
| **Context** | +2 | **Texture** | +2 |
| **Color interest** | +2 | **Variation and Height** | +3 |
| **Coverage, bare earth or mulch** | +3 | **Patterns** | +3 |
| **Geometry/shape** | +3 | **Senses (smell, sounds, etc.)** | +0 |

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# Ecological Considerations

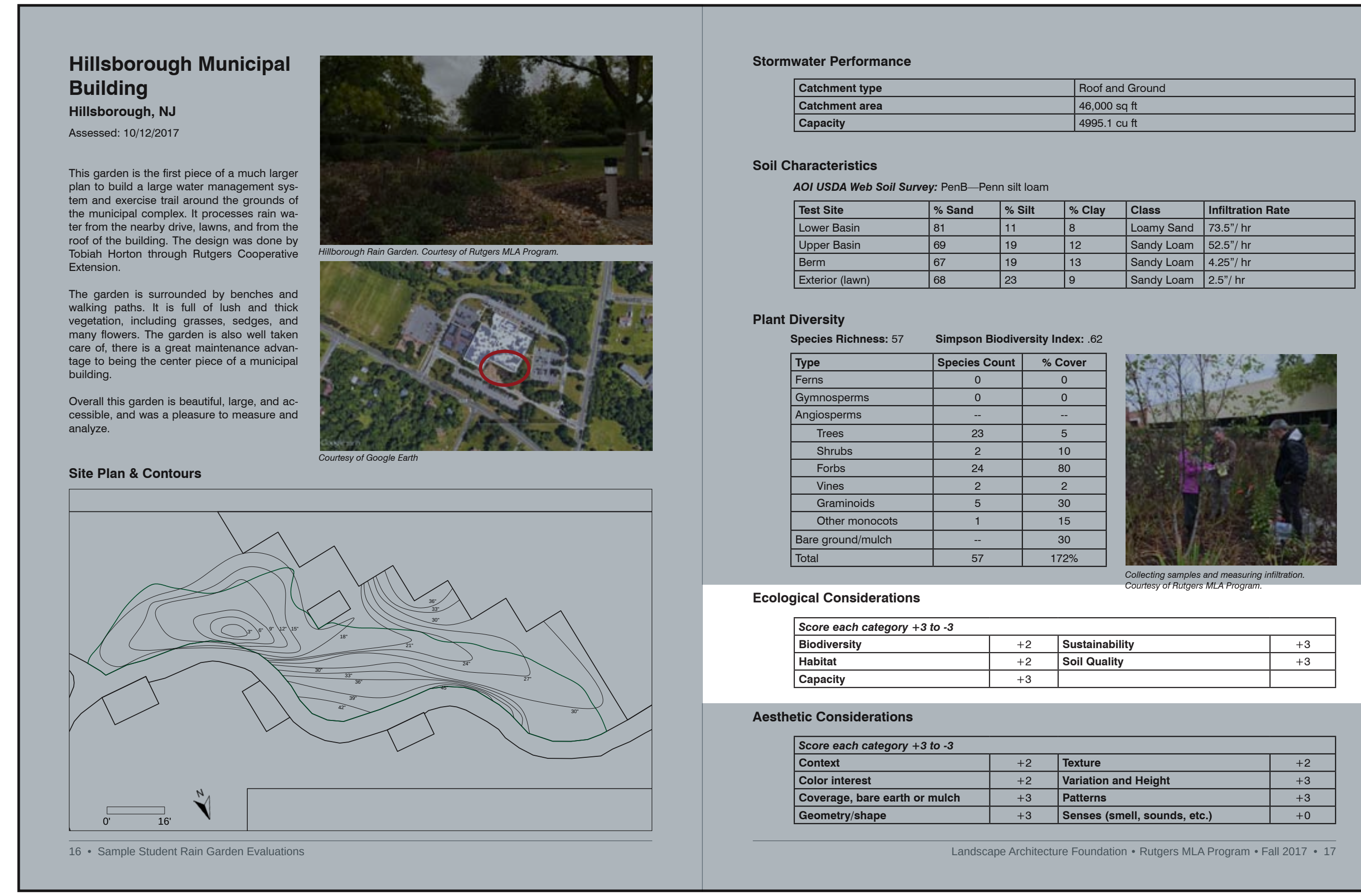
As discussed, the ecological benefits of rain garden design begin with collecting and managing stormwater run-off. As a part of this process, active measures such as soil amendment, or on-going organic processes such as the accumulation of organic materials and active root growth on the site, encourage greater soil permeability, better water infiltration and serves to rehabilitate compacted and damaged soils due to construction or foot traffic.

The ecological benefits of well-designed rain gardens go far beyond only stormwater management. Planting design can re-introduce biodiversity in an area that is otherwise lacking. These plantings can also provide habitat and food sources for a great number of wildlife species that include insects, birds and small mammals.

While we have used an existing biodiversity index to score the plant life present on site, we wanted to create another system by which we could use additional observations to determine ecological benefit.

***Methods of Measurement: Ecological Scoring***

We have created five broad Ecological Considerations categories: **Biodiversity, Habitat, Capacity, Sustainability** and **Soil Quality**. At the end of this guide there is a ***Rain Garden Assessment, Ecological & Aesthetic Considerations Checklist*** worksheet that includes questions one may ask themselves to help determine whether a rain garden exhibits these positive qualities or is fundamentally lacking in some ways. The questions are meant to be straight-forward and simple to understand, so that the assessment may be done by anyone, even those without a deeper understanding of ecology. Based upon the on-site



## Hillsborough Municipal Building

**Hillsborough, NJ**

Assessed: 10/12/2017

This garden is the first piece of a much larger plan to build a large water management system and exercise trail around the grounds of the municipal complex. It processes rain water from the nearby drive, lawns, and from the roof of the building. The design was done by Tobiah Horton through Rutgers Cooperative Extension.

The garden is surrounded by benches and walking paths. It is full of lush and thick vegetation, including grasses, sedges, and many flowers. The garden is also well taken care of, there is a great maintenance advantage to being the center piece of a municipal building.

Overall this garden is beautiful, large, and accessible, and was a pleasure to measure and analyze.

*Hillborough Rain Garden. Courtesy of Rutgers MLA Program.*

*Courtesy of Google Earth*

**Site Plan & Contours**

**Stormwater Performance**

| | |
|---|---|
| **Catchment type** | Roof and Ground |
| **Catchment area** | 46,000 sq ft |
| **Capacity** | 4995.1 cu ft |

**Soil Characteristics**

***AOI USDA Web Soil Survey:*** PenB—Penn silt loam

| Test Site | % Sand | % Silt | % Clay | Class | Infiltration Rate |
|---|---|---|---|---|---|
| Lower Basin | 81 | 11 | 8 | Loamy Sand | 73.5"/ hr |
| Upper Basin | 69 | 19 | 12 | Sandy Loam | 52.5"/ hr |
| Berm | 67 | 19 | 13 | Sandy Loam | 4.25"/ hr |
| Exterior (lawn) | 68 | 23 | 9 | Sandy Loam | 2.5"/ hr |

**Plant Diversity**

**Species Richness:** 57 **Simpson Biodiversity Index:** .62

| Type | Species Count | % Cover |
|---|---|---|
| Ferns | 0 | 0 |
| Gymnosperms | 0 | 0 |
| Angiosperms | -- | -- |
| Trees | 23 | 5 |
| Shrubs | 2 | 10 |
| Forbs | 24 | 80 |
| Vines | 2 | 2 |
| Graminoids | 5 | 30 |
| Other monocots | 1 | 15 |
| Bare ground/mulch | -- | 30 |
| Total | 57 | 172% |

*Collecting samples and measuring infiltration. Courtesy of Rutgers MLA Program.*

**Ecological Considerations**

| *Score each category +3 to -3* | | | |
|---|---|---|---|
| **Biodiversity** | +2 | **Sustainability** | +3 |
| **Habitat** | +2 | **Soil Quality** | +3 |
| **Capacity** | +3 | | |

**Aesthetic Considerations**

| *Score each category +3 to -3* | | | |
|---|---|---|---|
| **Context** | +2 | **Texture** | +2 |
| **Color interest** | +2 | **Variation and Height** | +3 |
| **Coverage, bare earth or mulch** | +3 | **Patterns** | +3 |
| **Geometry/shape** | +3 | **Senses (smell, sounds, etc.)** | +0 |

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rain garden observations, each Ecological Considerations category should be given a score from -3 to +3. We hope that this scoring approach will allow a reviewer to quickly assess the overall perceived ecological health of a site.

# Aesthetic Considerations

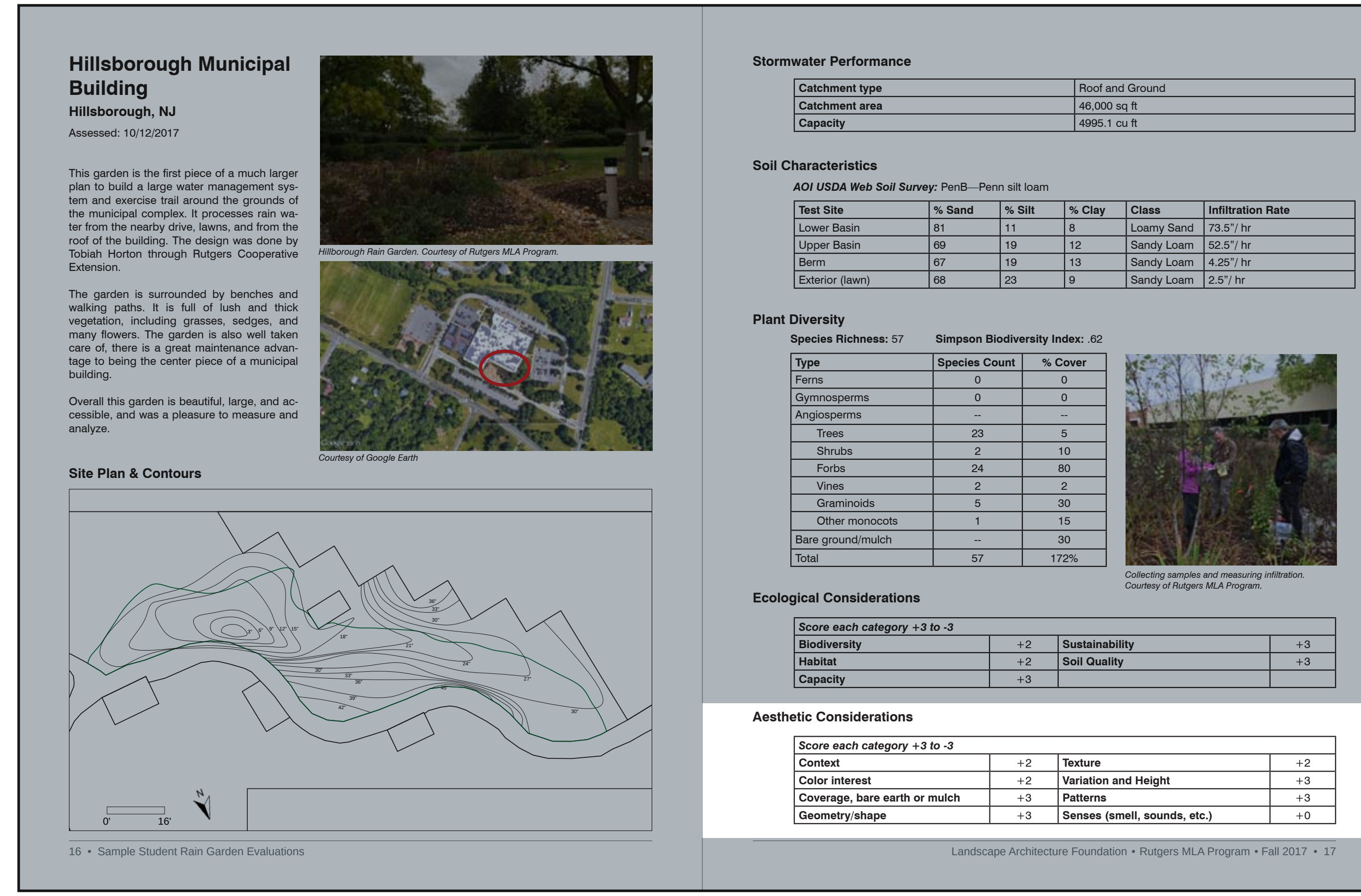
While water and biodiversity are the reasons why people build rain gardens, it is people who are building them. If people find them attractive, they may want more. If they are found to be messy, ugly eyesores, they will be disdained. Therefore, we chose to make an aesthetic assessment along with our other assessments. While more subjective than the other assessments, it is also important.

As it is subjective by nature, it was more challenging to create a reliable method of assessment. While other aspects are quantifiable and measurable, this one depends far more on the opinion of the person making the assessment. To reduce the variability of this assessment and to give it some structure, we broke it down into different categories that could be assessed on a numerical scale. While still a subjective assessment, this allowed us to quantify aesthetics on a rubric and make comparisons between the different gardens analyzed.

### *Methods of Measurement: Aesthetic Scoring*

The Aesthetic Considerations are divided into eight categories: **Context, Color Interest, Coverage, Geometry/Shape, Texture, Variation & Height, Patterns and Senses**. Again, at the end of this guide there is a ***Rain Garden Assessment, Ecological & Aesthetic Considerations Checklist*** worksheet that will help one conducting an assessment determine the positive, neutral or negative score for each category. The questions are meant to be thought-starters and do not constitute an entirely comprehensive exploration of each category. As each viewer will apply their own perspective as to what qualities are aesthetically pleasing and noting that each site is contextually unique, the assessor should apply their own best judgment





## Hillsborough Municipal Building

**Hillsborough, NJ**

Assessed: 10/12/2017

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The garden is surrounded by benches and walking paths. It is full of lush and thick vegetation, including grasses, sedges, and many flowers. The garden is also well taken care of, there is a great maintenance advantage to being the center piece of a municipal building.

Overall this garden is beautiful, large, and accessible, and was a pleasure to measure and analyze.

*Hillborough Rain Garden. Courtesy of Rutgers MLA Program.*

*Courtesy of Google Earth*

**Site Plan & Contours**



16 • Sample Student Rain Garden Evaluations

**Stormwater Performance**

| | |
|---|---|
| **Catchment type** | Roof and Ground |
| **Catchment area** | 46,000 sq ft |
| **Capacity** | 4995.1 cu ft |

**Soil Characteristics**

***AOI USDA Web Soil Survey:*** PenB—Penn silt loam

| Test Site | % Sand | % Silt | % Clay | Class | Infiltration Rate |
|---|---|---|---|---|---|
| Lower Basin | 81 | 11 | 8 | Loamy Sand | 73.5"/ hr |
| Upper Basin | 69 | 19 | 12 | Sandy Loam | 52.5"/ hr |
| Berm | 67 | 19 | 13 | Sandy Loam | 4.25"/ hr |
| Exterior (lawn) | 68 | 23 | 9 | Sandy Loam | 2.5"/ hr |

**Plant Diversity**

**Species Richness:** 57 **Simpson Biodiversity Index:** .62

| Type | Species Count | % Cover |
|---|---|---|
| Ferns | 0 | 0 |
| Gymnosperms | 0 | 0 |
| Angiosperms | -- | -- |
| Trees | 23 | 5 |
| Shrubs | 2 | 10 |
| Forbs | 24 | 80 |
| Vines | 2 | 2 |
| Graminoids | 5 | 30 |
| Other monocots | 1 | 15 |
| Bare ground/mulch | -- | 30 |
| Total | 57 | 172% |

*Collecting samples and measuring infiltration. Courtesy of Rutgers MLA Program.*

**Ecological Considerations**

| *Score each category +3 to -3* | | | |
|---|---|---|---|
| **Biodiversity** | +2 | **Sustainability** | +3 |
| **Habitat** | +2 | **Soil Quality** | +3 |
| **Capacity** | +3 | | |

**Aesthetic Considerations**

| *Score each category +3 to -3* | | | |
|---|---|---|---|
| **Context** | +2 | **Texture** | +2 |
| **Color interest** | +2 | **Variation and Height** | +3 |
| **Coverage, bare earth or mulch** | +3 | **Patterns** | +3 |
| **Geometry/shape** | +3 | **Senses (smell, sounds, etc.)** | +0 |

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when scoring each site. Based upon their observations each Aesthetic Considerations category should be given a score from -3 to +3.

## RAIN GARDEN ASSESSMENT ECOLOGICAL & AESTHETIC CONSIDERATIONS CHECKLIST

Site Location: Date:

**Score each category from +3 to -3. Consider questions below each category to inform your score.**

| Ecological Considerations | | Aesthetic Considerations | |
|---|---|---|---|
| **Biodiversity** | | **Context** | |
| Are there a significant number of plant species present? | | Is the garden suited to its surroundings? | |
| Are the species of different habits? (ferns, grasses, forbs, woody) | | Does design work with nearby buidings? | |
| Are there multiple flowering species? | | Do the plants fit in the greater plant community? | |
| Are there multiple woody species? | | | |
| Are there multiple grasses or other monocot species? | | **Color Interest** | |
| | | Is color a tasteful part of the design? | |
| **Habitat** | | Do the colors work well together? | |
| Are there obvious signs of insects? (visible or leaf damage) | | If only green, is there pleasing variation? | |
| Are there signs of butterflies or moths? (visible or chrysalis ) | | | |
| Are there signs of bees, wasps or other pollinators? | | **Coverage, Bare earth or mulch** | |
| Are there signs of birds? | | Does the garden appear appropriately "full"? | |
| Are there signs of small mammals or other animals? (amphibians) | | Is there little or no bare earth visible? | |
| | | Are unplanted areas well-tended? | |
| **Capacity** | | | |
| Is there an obvious, significant depth to the retention area? | | **Geometry use / shape** | |
| Is the area of capture depth significantly broad? | | Does the shape of the garden suit the larger site? | |
| Is there a berm around the retention area? | | Is the overall garden shape pleasing? | |
| Is garden of significant size to handle catchment areas? | | Are any other geometric factors (e.g. hardscaping) used well? | |
| Is there an overflow catchment system in place (drain, basin)? | | | |
| | | **Texture** | |
| **Sustainability** | | Is there a good use of texture in the overall design? | |
| Is there no standing water? | | Do the textures of the hardscaping work with plantings? | |
| Does water quickly drain from basin point during infiltration test? | | Is their pleasing variation in foliage texture? | |
| Does the area receive full or part sun conditions? | | | |
| Does the garden receive runoff that is free of sediments? | | **Variation and Height** | |
| Are plants healthy, dense and free of invasive weeds? | | Are there a variety of plant species? | |
| | | Are there woody structural elements for winter interest? | |
| **Soil Quality** | | Is their a pleasing variation in plant height? | |
| Is soil texture suited to drain well? | | | |
| Is soil loose and pourous with no obvious compaction? | | **Patterns** | |
| Visible presence of orgnaic material? | | Are there pleasing massings of plantings? | |
| Presence of black soils? | | Is there a good use of repetition and rhythm? | |
| Lack of grey, green or mottled soils? | | | |
| | | | |
| | | **Senses (smells, sounds, etc)** | |
| Other notes: | | Are there pleasant smells present? | |
| | | Do you notice pleasing sounds (water, foliage rustle)? | |
| | | Are your senses peaked in any other ways? | |
| | | | |



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and Biological Sciences

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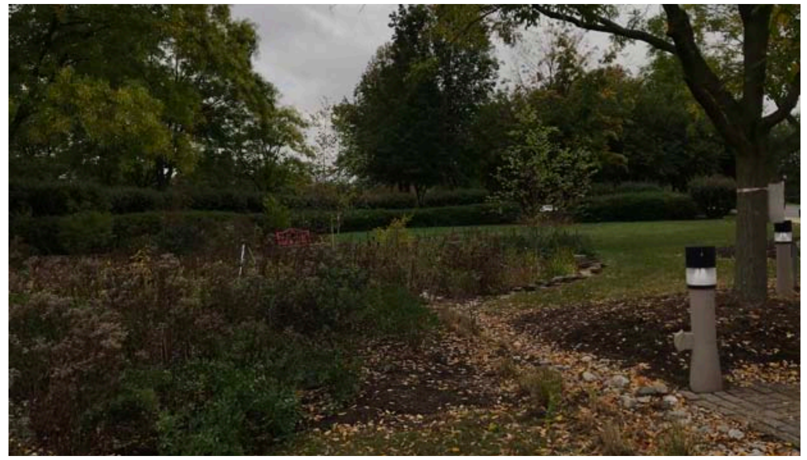
# Sample Student Rain Garden Evaluations

Landscape Architecture Foundation
Rutgers MLA Program • Fall 2017

# Hillsborough Municipal Building

### Hillsborough, NJ

Assessed: 10/12/2017


*Hillborough Rain Garden. Courtesy of Rutgers MLA Program.*


*Courtesy of Google Earth*

This garden is the first piece of a much larger plan to build a large water management system and exercise trail around the grounds of the municipal complex. It processes rain water from the nearby drive, lawns, and from the roof of the building. The design was done by Tobiah Horton through Rutgers Cooperative Extension.

The garden is surrounded by benches and walking paths. It is full of lush and thick vegetation, including grasses, sedges, and many flowers. The garden is also well taken care of, there is a great maintenance advantage to being the center piece of a municipal building.

Overall this garden is beautiful, large, and accessible, and was a pleasure to measure and analyze.

## Site Plan & Contours




## Stormwater Performance

| | |
|---|---|
| **Catchment type** | Roof and Ground |
| **Catchment area** | 46,000 sq ft |
| **Capacity** | 4995.1 cu ft |

## Soil Characteristics

***AOI USDA Web Soil Survey:*** PenB—Penn silt loam

| Test Site | % Sand | % Silt | % Clay | Class | Infiltration Rate |
|---|---|---|---|---|---|
| Lower Basin | 81 | 11 | 8 | Loamy Sand | 73.5"/ hr |
| Upper Basin | 69 | 19 | 12 | Sandy Loam | 52.5"/ hr |
| Berm | 67 | 19 | 13 | Sandy Loam | 4.25"/ hr |
| Exterior (lawn) | 68 | 23 | 9 | Sandy Loam | 2.5"/ hr |

## Plant Diversity

**Species Richness:** 37 **Simpson Biodiversity Index:** .62

| Type | Species Count | % Cover |
|---|---|---|
| Ferns | 0 | 0 |
| Gymnosperms | 0 | 0 |
| Angiosperms | -- | -- |
| Trees | 3 | 5 |
| Shrubs | 2 | 10 |
| Forbs | 24 | 80 |
| Vines | 2 | 2 |
| Graminoids | 5 | 30 |
| Other monocots | 1 | 15 |
| Bare ground/mulch | -- | 30 |
| Total | 37 | 172% |


*Collecting samples and measuring infiltration. Courtesy of Rutgers MLA Program.*

## Ecological Considerations

| *Score each category +3 to -3* | | | |
|---|---|---|---|
| **Biodiversity** | +2 | **Sustainability** | +3 |
| **Habitat** | +2 | **Soil Quality** | +3 |
| **Capacity** | +3 | | |

## Aesthetic Considerations

| *Score each category +3 to -3* | | | |
|---|---|---|---|
| **Context** | +2 | **Texture** | +2 |
| **Color interest** | +2 | **Variation and Height** | +3 |
| **Coverage, bare earth or mulch** | +3 | **Patterns** | +3 |
| **Geometry/shape** | +3 | **Senses (smell, sounds, etc.)** | +0 |

# Jonathan Dayton High School

### Springfield, NJ

Assessed: 10/19/2017

Located directly in front of and running the entire length of the high school, this large rain garden was designed to capture runoff from roof and other ground source areas of the site.

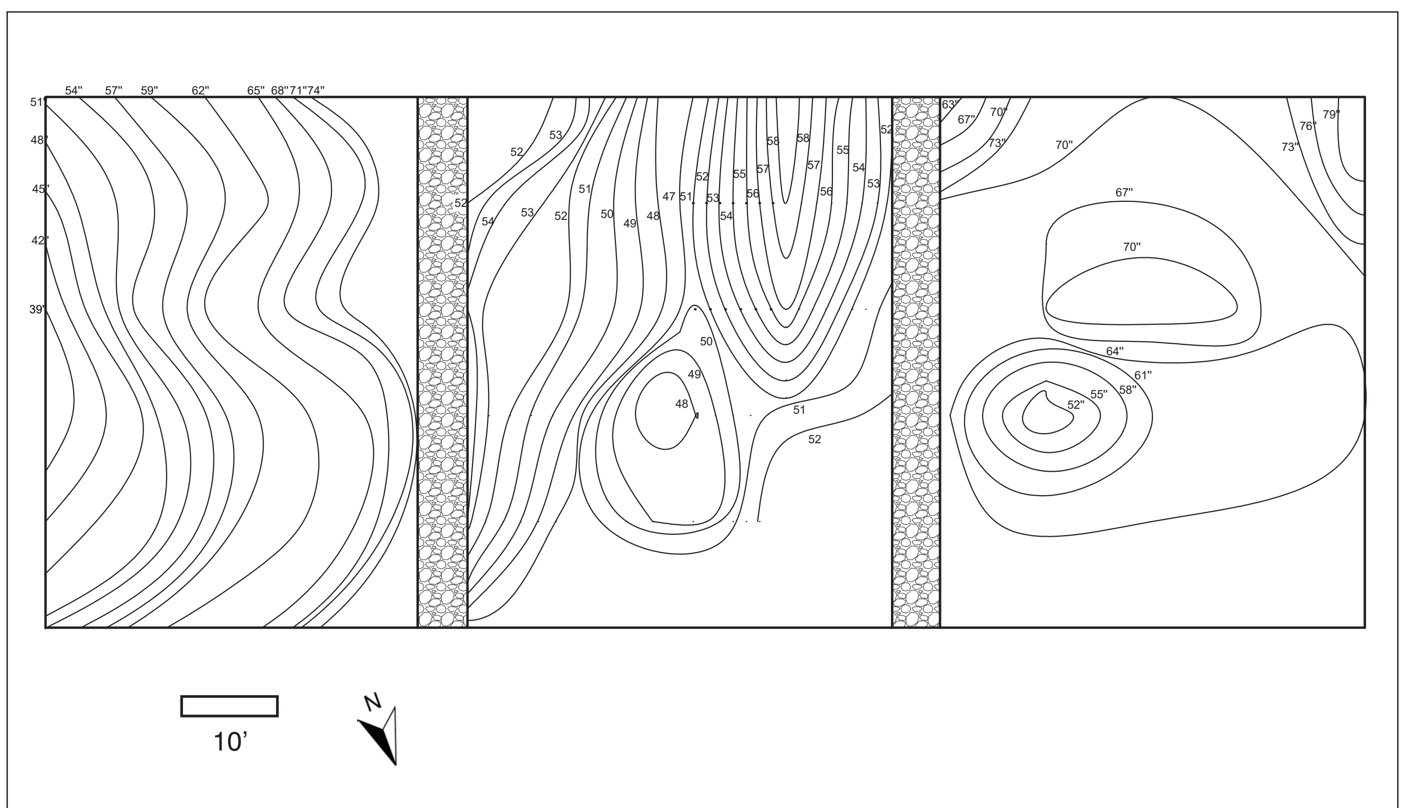
The garden is well-designed and has a multitude of different native species present significantly providing biodiversity in the urbanized suburb of Springfield, NJ. Even in later October, the use of the site as habitat for birds, butterflies and small mammals was readily evident.

The garden is thriving with little evidence of undesirable volunteer species while exhibiting excellent coverage and biodiversity.

*Dayton High School Rain Garden. Courtesy of Rutgers MLA Program.*

*Courtesy of Google Maps*

## Site Plan & Contours






## Stormwater Performance

| | |
|---|---|
| **Catchment type** | Roof and Ground |
| **Catchment area** | 24,954 sq ft |
| **Capacity** | 697 cu ft |

## Soil Characteristics

***AOI USDA Web Soil Survey:*** DuuA—Dunellen-Urban land complex

| Test Site | % Sand | % Silt | % Clay | Class | Infiltration Rate |
|---|---|---|---|---|---|
| Lower Basin | 80 | 12 | 7 | Loamy Sand | 150"/ hr |
| Upper Basin | 68 | 22 | 10 | Sandy Loam | 105"/ hr |
| Berm | 85 | 9 | 6 | Sandy Loam | 18"/ hr |
| Exterior (lawn) | 59 | 31 | 10 | Sandy Loam | 6.6"/ hr |

## Plant Diversity

**Species Richness:** 51 **Simpson Biodiversity Index:** .71

| Type | Species Count | % Cover |
|---|---|---|
| Ferns | 1 | 1 |
| Gymnosperms | 1 | 3 |
| Angiosperms | -- | -- |
| Trees | 6 | 10 |
| Shrubs | 6 | 15 |
| Forbs | 29 | 70 |
| Vines | 1 | 1 |
| Graminoids | 6 | 30 |
| Other monocots | 1 | 20 |
| Bare ground/mulch | -- | 25 |
| Total | 51 | 175% |

*Multi-layered section of the large rain garden. Courtesy of Rutgers MLA Program.*

## Ecological Considerations

| *Score each category +3 to -3* | | | |
|---|---|---|---|
| **Biodiversity** | +3 | **Sustainability** | +2 |
| **Habitat** | +3 | **Soil Quality** | +3 |
| **Capacity** | +1 | | |

## Aesthetic Considerations

| *Score each category +3 to -3* | | | |
|---|---|---|---|
| **Context** | +0 | **Texture** | +1 |
| **Color interest** | +2 | **Variation and Height** | +1 |
| **Coverage, bare earth or mulch** | +3 | **Patterns** | +1 |
| **Geometry/shape** | +2 | **Senses (smell, sounds, etc.)** | +3 |

# Cook-Douglas Lecture Hall Rain Garden

### New Brunswick, NJ

Assessed: 9/14/2017

This rain garden is located adjacent to Cook-Douglas Lecture Hall, a long-term 'temporary' structure on the Rutgers New Brunswick Campus.

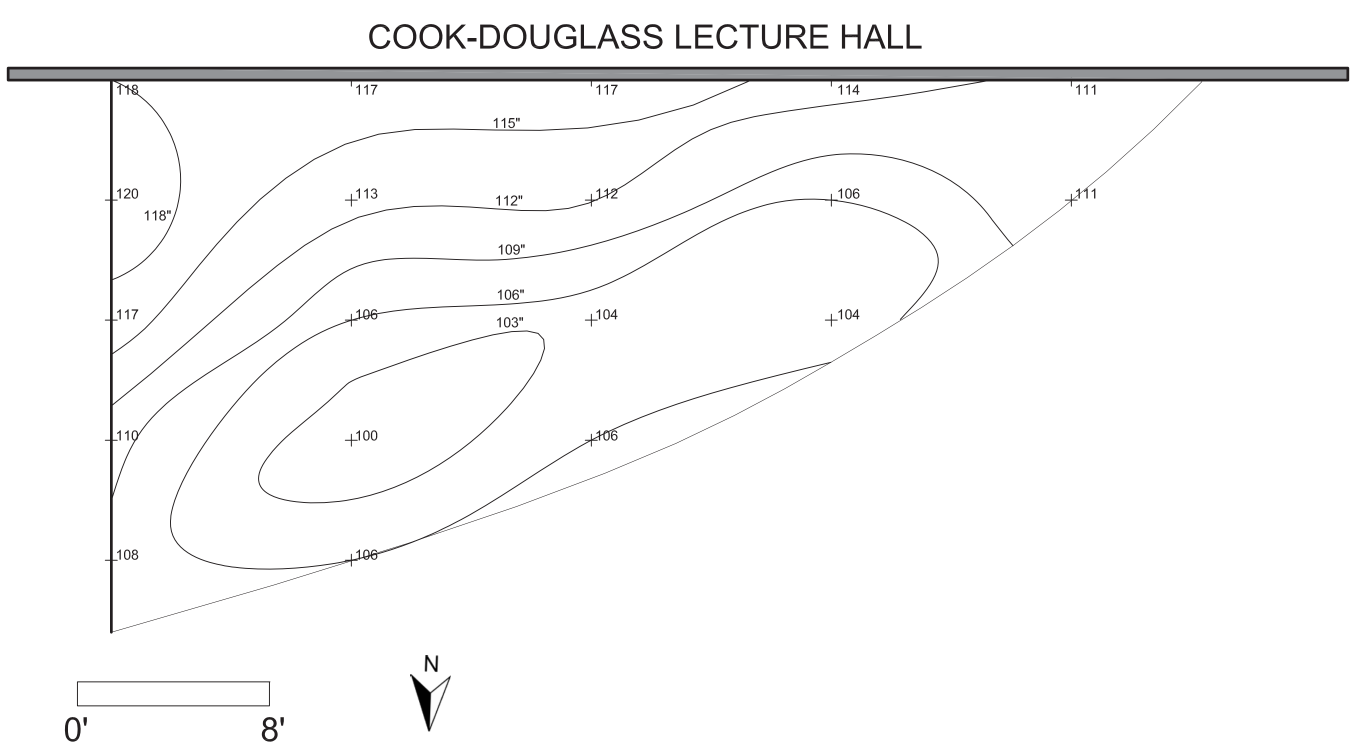
Positioned on the north facing side of the building it receives little sunlight. It is fed runoff from downspouts that account for approximately one-quarter of the building's coverage. Additionally, soil sampling reveals that the site's soil were likely never amended or replaced as the basin soils are largely clay and prone to allowing for standing water for extended periods of time.

Overall, this rain garden is not successfully managing stormwater, and as a result, is also not successfully supporting plant life or providing additional ecological value.

*CDL Rain Garden. Courtesy of Rutgers MLA Program.*

*Courtesy of Google Maps*

## Site Plan & Contours






## Stormwater Performance

| | |
|---|---|
| **Catchment type** | Roof |
| **Catchment area** | 2,710 sq ft |
| **Capacity** | 34.33 cu ft |

## Soil Characteristics

***AOI USDA Web Soil Survey:*** DuuA—Dunellen-Urban land complex

| Test Site | % Sand | % Silt | % Clay | Class | Infiltration Rate |
|---|---|---|---|---|---|
| Lower Basin | 48 | 49 | 4 | Sandy Loam | 0"/hr (Standing Water) |
| Upper Basin | 62 | 34 | 4 | Sandy Loam | .5"/ hr |
| Berm | 78 | 13 | 9 | Sandy Loam | .75"/ hr |
| Exterior (lawn) | 66 | 27 | 7 | Sandy Loam | .75"/ hr |

## Plant Diversity

**Species Richness:** 29 **Simpson Biodiversity Index:** .76

| Type | Species Count | % Cover |
|---|---|---|
| Ferns | 0 | 0 |
| Gymnosperms | 0 | 0 |
| Angiosperms | -- | -- |
| Trees | 2 | 20 |
| Shrubs | 2 | 15 |
| Forbs | 15 | 25 |
| Vines | 2 | 2 |
| Graminoids | 8 | 15 |
| Other monocots | 0 | 0 |
| Bare ground/mulch | -- | 80 |
| Total | 29 | 157% |

*A few planted grasses remain, otherwise volunteers dominate the rain garden.*

## Ecological Considerations

| *Score each category +3 to -3* | | | |
|---|---|---|---|
| **Biodiversity** | +3 | **Sustainability** | +2 |
| **Habitat** | +3 | **Soil Quality** | +3 |
| **Capacity** | +1 | | |

## Aesthetic Considerations

| *Score each category +3 to -3* | | | |
|---|---|---|---|
| **Context** | -1 | **Texture** | -3 |
| **Color interest** | -2 | **Variation and Height** | 0 |
| **Coverage, bare earth or mulch** | -3 | **Patterns** | -2 |
| **Geometry/shape** | -2 | **Senses (smell, sounds, etc.)** | -3 |

# Blake Hall Rain Garden

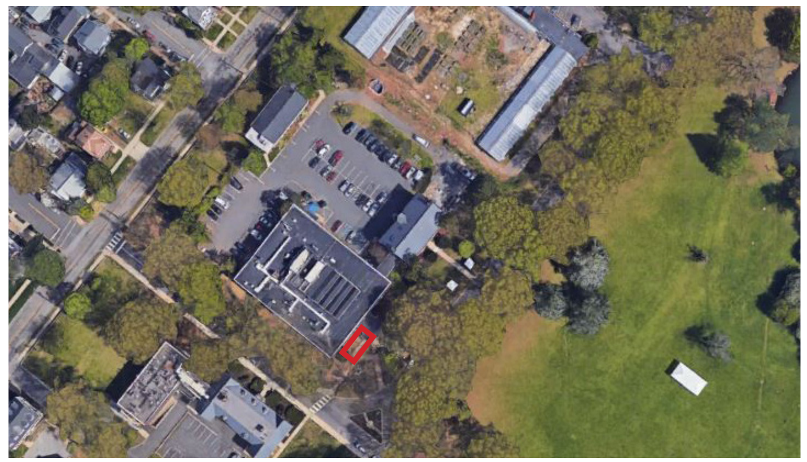
### New Bruswick, NJ

Assessed: 9/7/2017

The small rain garden outside of the Rutgers Landscape Architecture Department. It was dominated by irises and vairous shrubs. The plant material was frequently supplemented with plants leftover from other projects, and so its appearance was a bit haphazard. There were not a lot of showy plants, so for much of the year it was not particularly interesting. After rain events it would slowly infiltrate the rain water so that all standing water would be gone within 1-2 days.

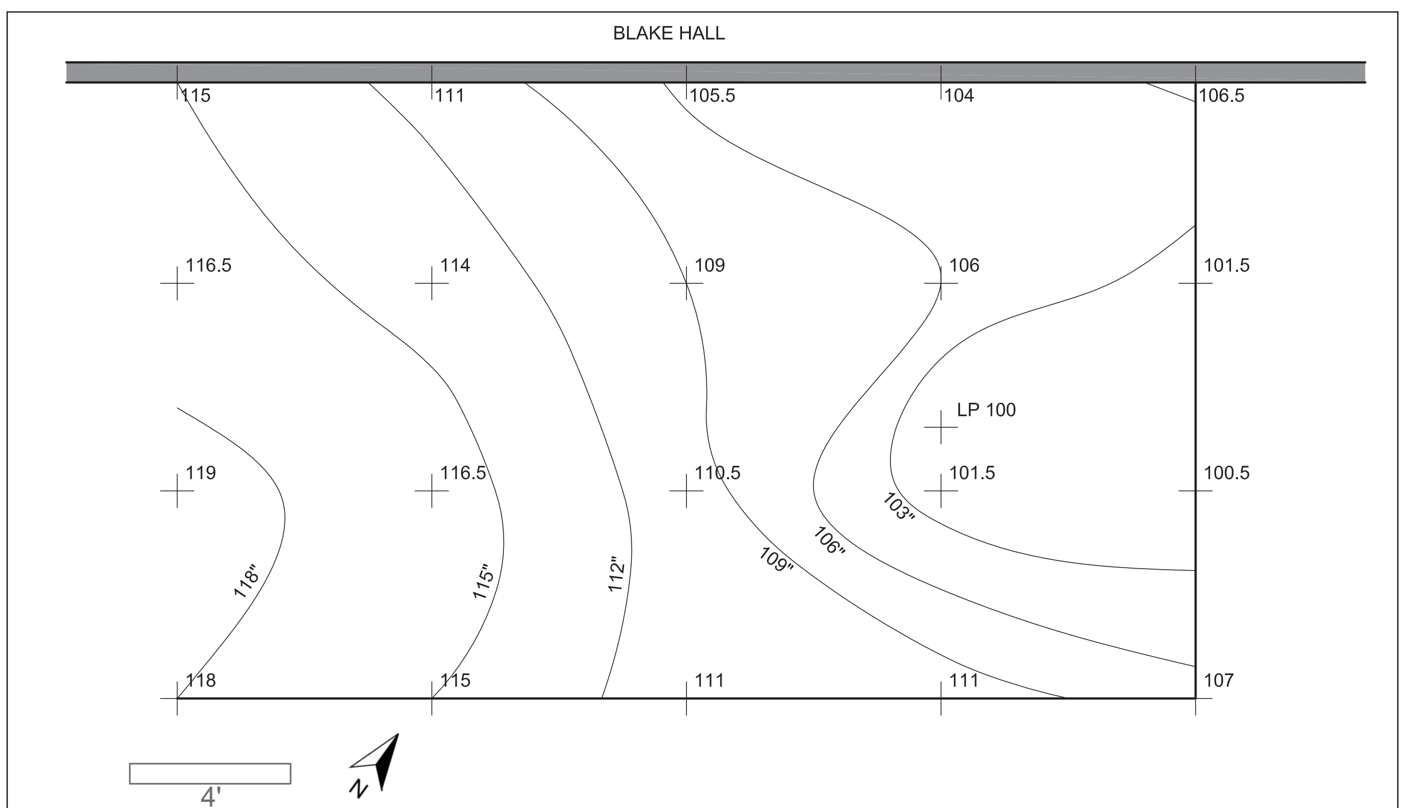
The garden was completely renovated this fall, and so certain metrics are left blank because they were not collected before the renovation.

*Students assessing Blake Rain Garden. Courtesy of Rutgers MLA Program.*



*Courtesy of Google Maps*

## Site Plan & Contours




## Stormwater Performance

| | |
|---|---|
| **Catchment type** | Roof |
| **Catchment area** | 324.5 sq ft |
| **Capacity** | 228 cu ft |

## Soil Characteristics

***AOI USDA Web Soil Survey:*** NkbP Nixon-Urban land complex

| Test Site | % Sand | % Silt | % Clay | Class | Infiltration Rate |
|---|---|---|---|---|---|
| Lower Basin | na | na | na | na | 78.75"/ hr |
| Upper Basin | na | na | na | na | 2.5"/ hr |
| Berm | na | na | na | na | na |
| Exterior (lawn) | na | na | na | na | 22.5"/ hr |

## Plant Diversity

**Species Richness:** 47 **Simpson Biodiversity Index:** .70

| Type | Species Count | % Cover |
|---|---|---|
| Ferns | 3 | 3 |
| Gymnosperms | 0 | 0 |
| Angiosperms | -- | -- |
| Trees | 2 | 20 |
| Shrubs | 8 | 20 |
| Forbs | 28 | 60 |
| Vines | 0 | 0 |
| Graminoids | 3 | 10 |
| Other monocots | 3 | 15 |
| Bare ground/mulch | -- | 25 |
| Total | 47 | 153% |

*Testing infiltration rates among the Itea virginica. Courtesy of Rutgers MLA Program.*

## Ecological Considerations

| *Score each category +3 to -3* | | | |
|---|---|---|---|
| **Biodiversity** | +2 | **Sustainability** | +1 |
| **Habitat** | +0 | **Soil Quality** | +1 |
| **Capacity** | +1 | | |

## Aesthetic Considerations

| *Score each category +3 to -3* | | | |
|---|---|---|---|
| **Context** | +0 | **Texture** | -2 |
| **Color interest** | -2 | **Variation and Height** | +1 |
| **Coverage, bare earth or mulch** | +1 | **Patterns** | +0 |
| **Geometry/shape** | +3 | **Senses (smell, sounds, etc.)** | -1 |

# Arthur L. Johnson High School

## Clark, NJ

Assessed: 10/5/2017

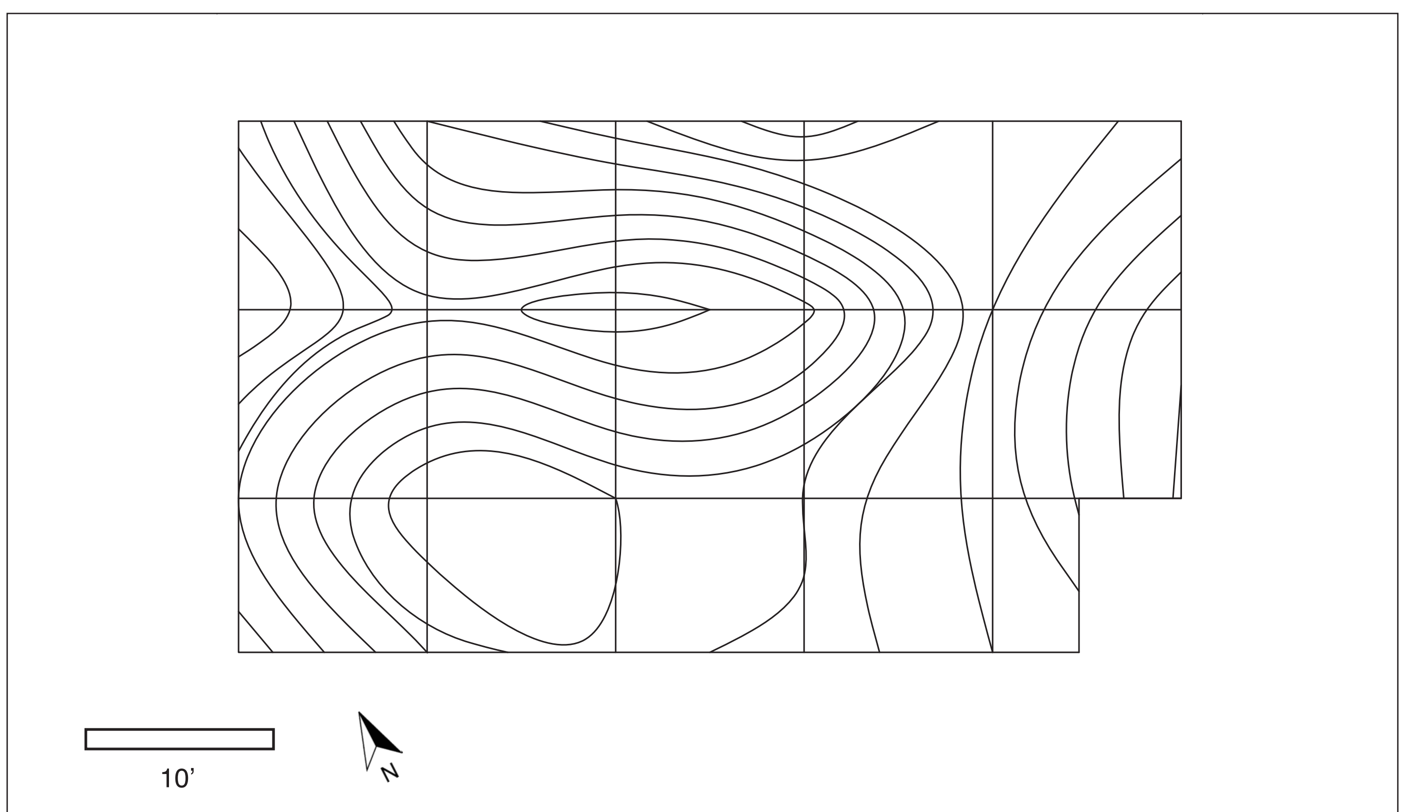
The rain garden was developed in a partnership between the Clark Department of Public Works, the Arthur L. Johnson High School and the Rutgers Cooperative Extension as an overflow area for a Sustainable Car Wash frequently run by students. The site was designed so that rinse water from the car wash would run from a parking lot directly into the garden. Unfortunately, the catchment area also includes a substantial portion of the Public Works parking area which is paved only with stone dust. This creates a substantial amount of erosion deposition at the inlet of the garden.

While a good effort and a structurally successful design, the blocking deposition and the introduction of several undesirable invasive species means the garden needs a considerable amount of maintenance to improve its ongoing performance.

*Clark High School Rain Garden. Courtesy of Rutgers MLA Program.*

*Courtesy of Bing Maps*

### Site Plan & Contours




### Stormwater Performance

| | |
|---|---|
| **Catchment type** | Ground |
| **Catchment area** | 34,000 sq ft |
| **Capacity** | 1,125 cu ft |

### Soil Characteristics

***AOI USDA Web Soil Survey:*** HatB—Haledon-Urban land-Hasbrouck complex

| Test Site | % Sand | % Silt | % Clay | Class | Infiltration Rate |
|---|---|---|---|---|---|
| Lower Basin | 67 | 23 | 10 | Sandy Loam | 19.5"/ hr |
| Upper Basin | na | na | na | na | na |
| Berm | 45 | 45 | 10 | Loam | 21"/ hr |
| Exterior (lawn) | 67 | 15 | 19 | Sandy Loam | 4.5"/ hr |

### Plant Diversity

**Species Richness:** 22 **Simpson Biodiversity Index:** .63

| Type | Species Count | % Cover |
|---|---|---|
| Ferns | 0 | 0 |
| Gymnosperms | 0 | 0 |
| Angiosperms | -- | -- |
| Trees | 3 | 10 |
| Shrubs | 2 | 12 |
| Forbs | 11 | 85 |
| Vines | 0 | 0 |
| Graminoids | 5 | 60 |
| Other monocots | 1 | 5 |
| Bare ground/mulch | -- | 20 |
| Total | 22 | 192% |

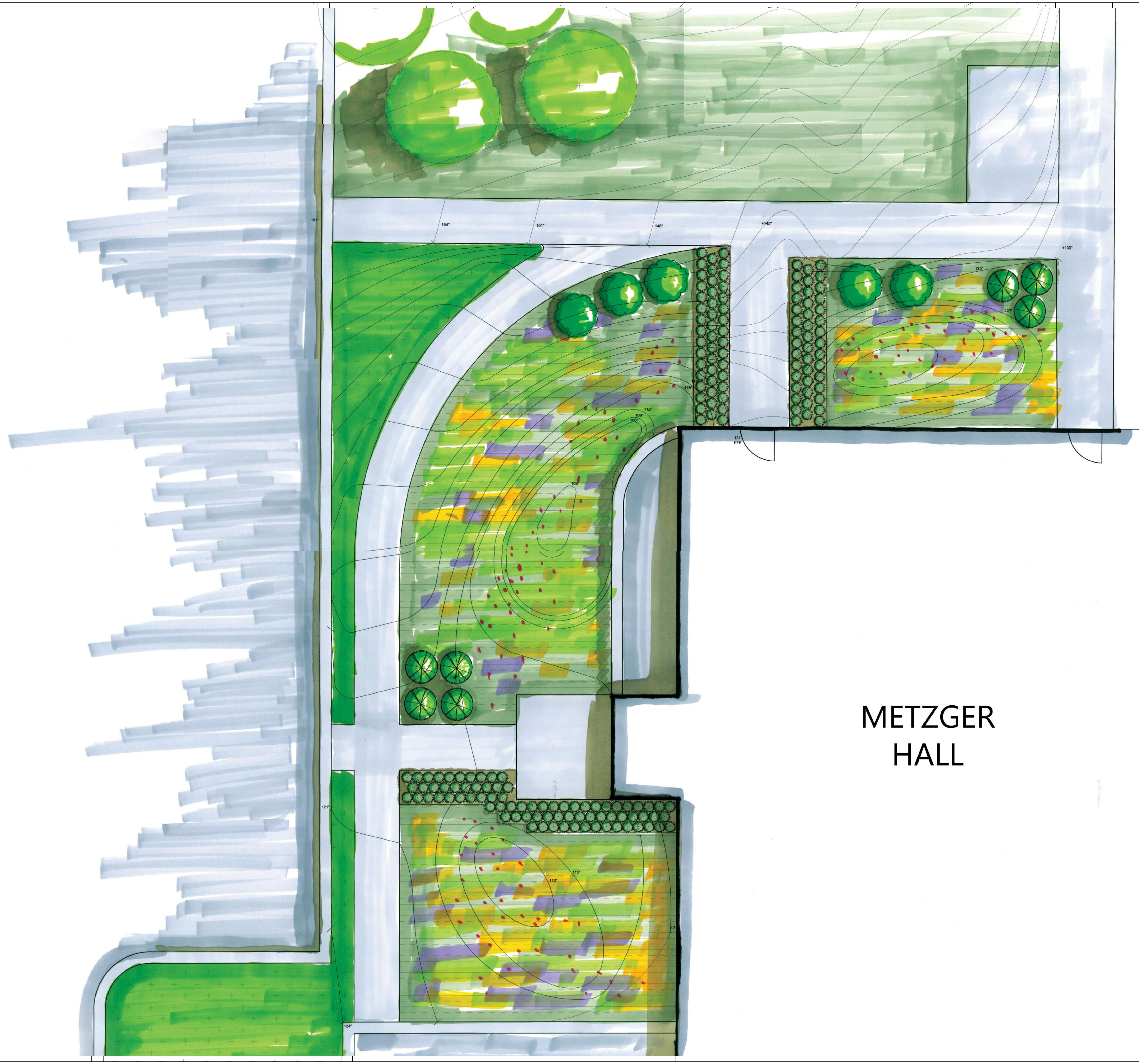
*Late season seed heads provide food souces. Courtesy of Rutgers MLA Program.*

### Ecological Considerations

| *Score each category +3 to -3* | | | |
|---|---|---|---|
| **Biodiversity** | -1 | **Sustainability** | -1 |
| **Habitat** | +1 | **Soil Quality** | +2 |
| **Capacity** | -1 | | |

### Aesthetic Considerations

| *Score each category +3 to -3* | | | |
|---|---|---|---|
| **Context** | -1 | **Texture** | +1 |
| **Color interest** | +0 | **Variation and Height** | +1 |
| **Coverage, bare earth or mulch** | +2 | **Patterns** | +1 |
| **Geometry/shape** | +0 | **Senses (smell, sounds, etc.)** | -1 |




RUTGERS

MARK HOOPES DESIGN
RAIN GARDENS
PLANTING PLANS
WATER MANAGEMENT

93 LIPMAN DRIVE
NEW BRUNSWICK, NJ

LANDSCAPE ARCHITECT
NJ LICENSE NO XXXXXXXXXXXX

DATE: 12/05/2017

TRUE
NORTH

PROJECT
NORTH

DEPT. OF
LANDSCAPE ARCHITECTURE
NEW BRUNSWICK, NJ

PROJECT TITLE

METZGER HALL
RAIN GARDEN

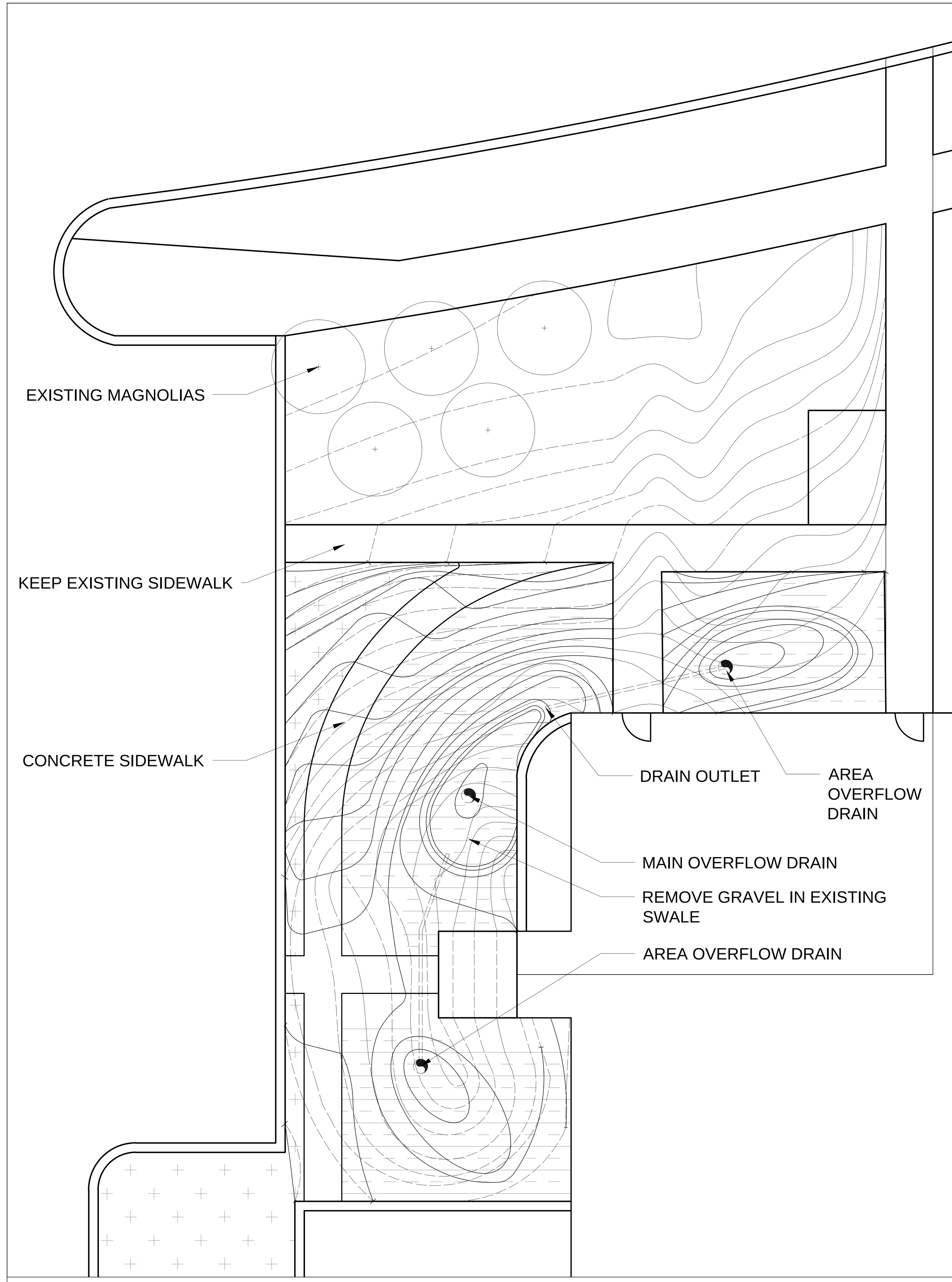
DRAWING TITLE

LANDSCAPE
SITE PLAN

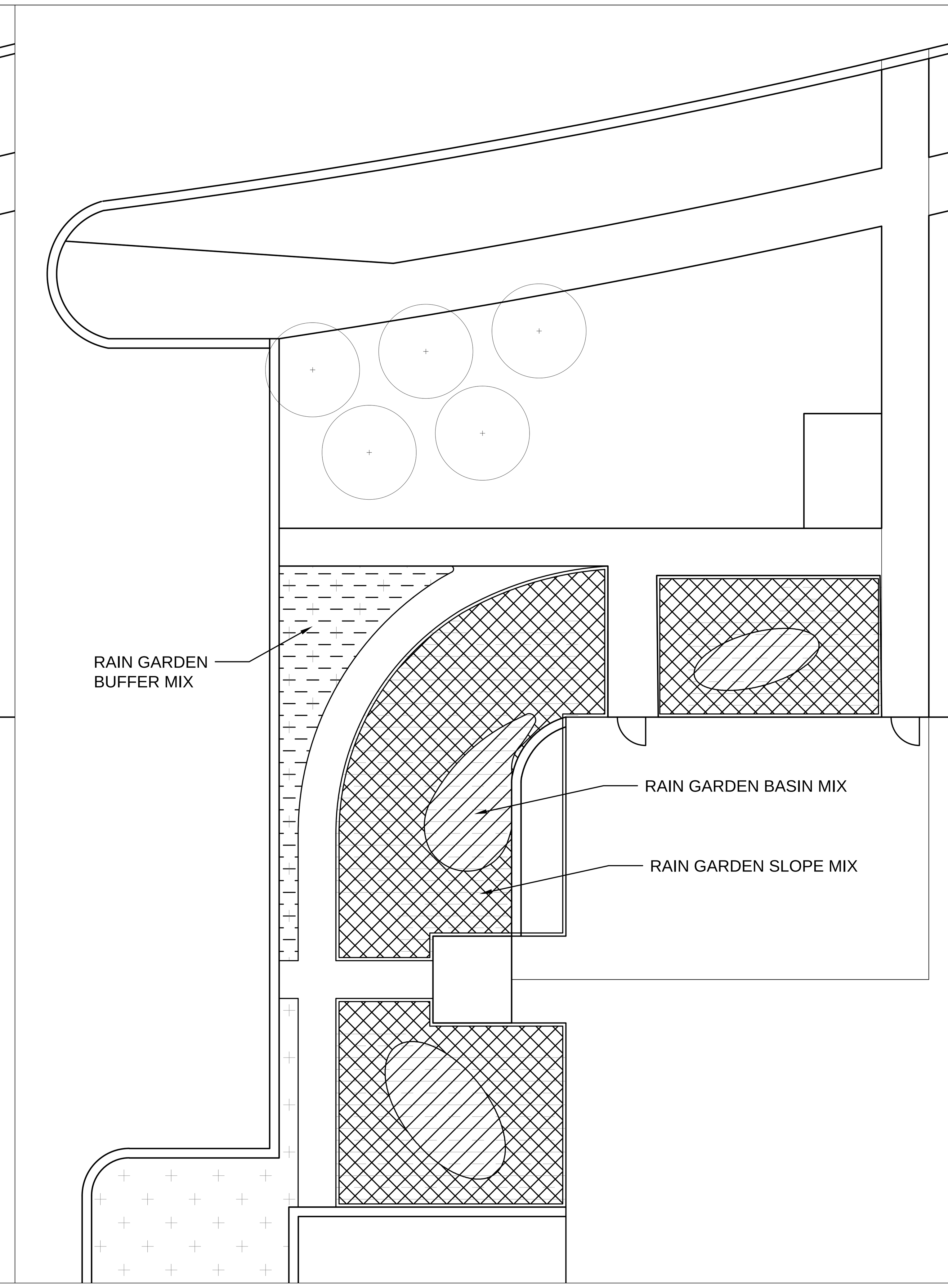
| | | |
|---|---|---|
| BLDG NO. XXXX | DSR NO. XXXX | DRAWN BY MH |
| SCALE AS NOTED | DATE 12/05/2017 | CHECKED BY MH |

DRAWING NUMBER

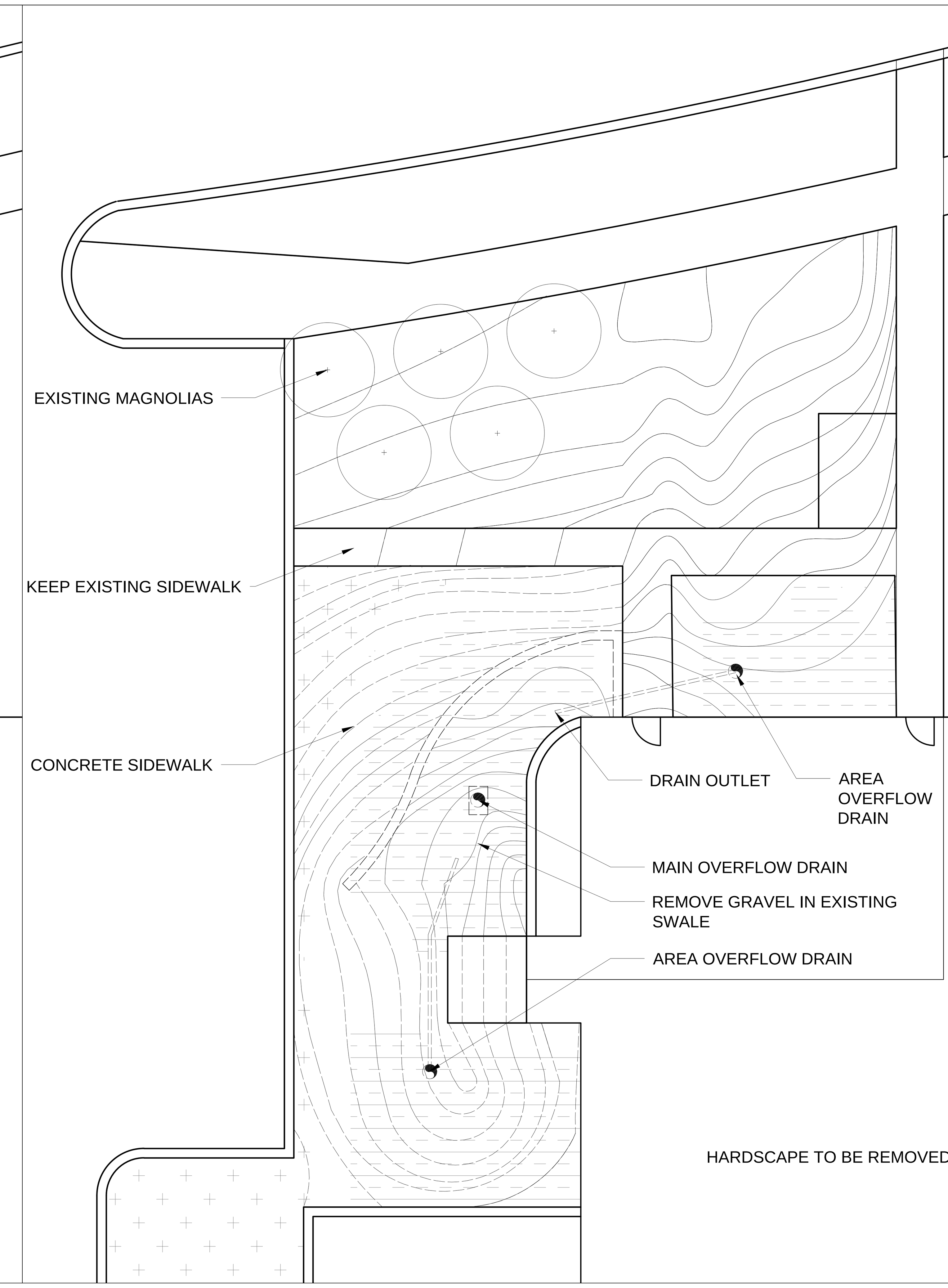
COVER




3 GRADING PLAN
1"=10'




2 SOILS PLAN
1"=10'




1 EXISTING CONDITIONS AND REMOVALS
1"=10'

### PROJECT DESCRIPTION

A RAIN GARDEN WILL BE CONSTRUCTED AT THIS LOCATION TO HELP FURTHER THE GOALS OF RUTGERS UNIVERSITY, TO HELP MANAGE STORM WATER ON THE SITE, AND TO ENHANCE THE EXPERIENCE OF SITE USERS. THIS PROJECT WILL BRIDGE THE GAP BETWEEN THE LARGE-SCALE CAMPUS MASTER PLAN , LOCAL WATER MANAGEMENT ISSUES, THE EXPERIENCES OF THE STUDENT, AND THE MAINTENANCE CAPABILITIES OF RUTGERS STAFF. TO DO THIS THE SPACE MUST BE FUNCTIONAL AND BEAUTIFUL.

THE RUTGERS MASTER PLAN CALLS FOR BEST MANAGEMENT PRACTICES SUCH AS MANAGING STORM WATER ON SITE, PLANTING OF NATIVE PLANT COMMUNITIES, AND USE OF MORE EFFICIENT OR RECYCLED MATERIALS. THIS OPEN SPACE SHOULD EMBODY THESE PRINCIPLES THROUGH THE INCORPORATION OF LOW MAINTENANCE NATIVE PLANTINGS, A FUNCTIONAL SITE PLAN AND USER EXPERIENCE, AND PLANTINGS THAT ARE AESTHETICALLY PLEASING.

### GENERAL NOTES

1. VERIFY LOCATIONS OF EXISTING UNDERGROUND UTILITIES PRIOR TO EXCAVATION. REPAIR ANY DAMAGE TO EXISTING UTILITIES, PIPES, OR RELATED FACILITIES AT CONTRACTOR'S EXPENSE AND IN A MANNER APPROVED BY LANDSCAPE ARCHITECT.
2. NOTIFY LANDSCAPE ARCHITECT OF ANY DISCREPANCIES IN THE LAYOUT OF WORK PRIOR TO EXECUTION OF ANY WORK.
3. LANDSCAPE ARCHITECT SHALL BE NOTIFIED 48 HOURS IN ADVANCE OF ANY SITE INSPECTIONS.
4. FOR HORIZONTAL LAYOUT, REFER TO LAYOUT PLAN. FOR VERTICAL LAYOUT, REFER TO GRADING PLAN.
5. THERE SHALL BE REQUIRED OBSERVATIONS BY LANDSCAPE ARCHITECT OR OWNERS REPRESENTATIVE PRIOR TO EXECUTION OF ANY WORK, INCLUDING AFTER STAKING, PRIOR TO POURING CONCRETE AND PRIOR TO ROUGH GRADING.
6. ALL STORMWATER FROM THE SITE AND FLOWING ONTO THE SITE SHOULD FLOW INTO THE PROPOSED DETENTION BASIN, BIO-SWALES, AND RAIN GARDENS.
7. ANY BUILDINGS WITHIN 10 FEET OF A RAIN GARDEN MUST HAVE WATER PROOFING APPLIED TO THE FOUNDATION.

**REQUIRED REVIEWS**

THERE SHALL BE REQUIRED REVIEWS BY LANDSCAPE ARCHITECT OR OWNER'S AGENT AT THE FOLLOWING STAGES OF CONSTRUCTION. REQUEST REVIEWS 72 HOURS IN ADVANCE.

1. PROJECT STARTUP & BUILDING/UTILTIY PROTECTION FENCING
2. LANDSCAPE EXCAVATION TO SUBGRADE AND PRIOR TO SOIL PLACEMENT & SOIL AMENDING
3. ALL CONCRETE WORK
4. PAVER LAYOUT
5. AT COMPLETION OF SOIL PREPARATIONS AND FINISH PLANT BED GRADES
6. PLANT LAYOUT, INCLUDING TREE PLACEMENT, GROUNDCOVER, PERENNIAL LAYOUT

**CONCRETE PREP**

1. ROCK SUBGRADE MUST BE PROPERLY WET DOWN PRIOR TO CONCRETE POUR.
2. IT IS RECOMMENDED THAT WET SANDING CONCRETE POURS OCCUR LATER IN THE EVENING AND ACID WASHING/ SEALING THE CONCRETE AS SOON AS POSSIBLE AFTERWARDS TO GREATLY REDUCE THE VULNERABILITY OF THE CONCRETE AS IT CURES OUT IN THE WARM WEATHER.
3. CONCRETE IS A RAW NATURAL MATERIAL AND IT IS IMPOSSIBLE TO DETERMINE WHERE THE CRACKS WILL OCCUR. BY POURING OVER A PROPERLY PREPARED SUBGRADE, REINFORCING WITH REBAR, POURING 3500 PSI CONCRETE AND SCORING CONCRETE IN SQUARE SECTIONS CHANCES OF RANDOM CRACKING ARE REDUCED. HOWEVER, IT WILL STILL CRACK WHERE IT NATURALLY WANTS TO.

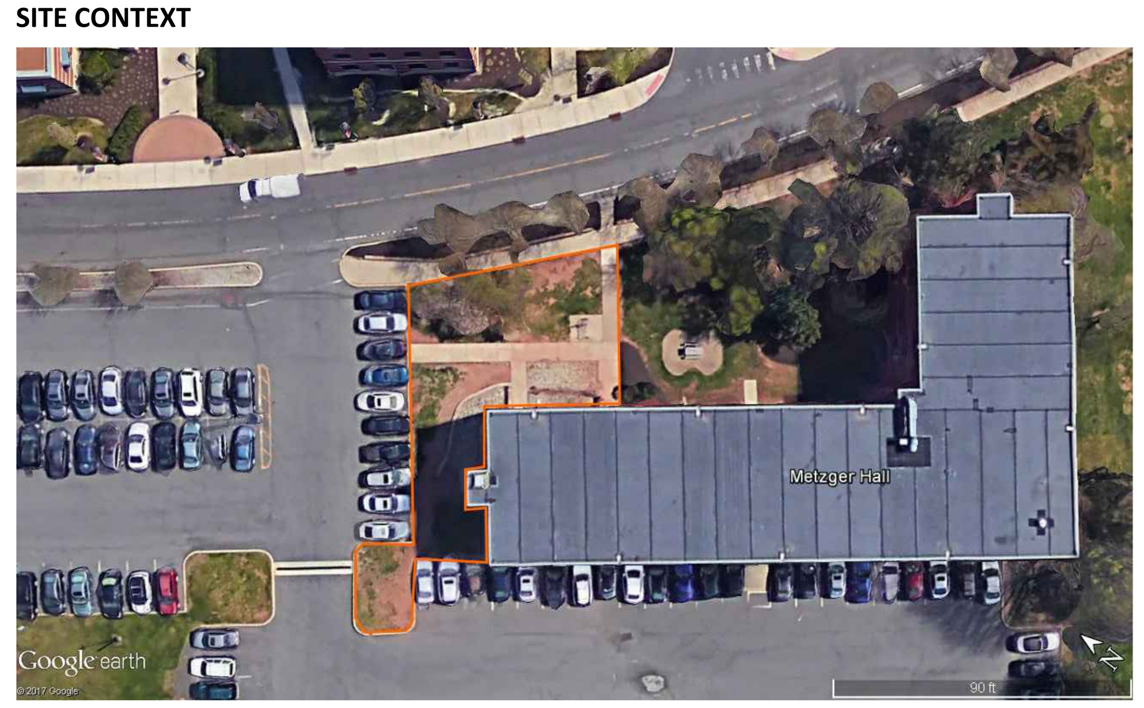
**BUILDING AND UTILITY PROTECTION NOTES**

1. CONTRACTOR TO PROTECT AND PRESERVE ALL BUILDINGS AND UTILITIES FROM HARM BY THE WORK OR INDIVIDUALS OR EQUIPMENT INVOLVED IN EXECUTING THE WORK.
2. PROVIDE PROTECTIVE FENCING AROUND ALL UTILITIES AND WHERE EQUIPMENT MAY ENCOUNTER BUILDINGS. ALL WORK WITHIN 1 FOOT OF BUILDINGS AND UTILITIES MUST BE DONE BY HAND.
3. LANDSCAPE ARCHITECT IS NOT RESPONSIBLE FOR DAMAGE DONE TO BUILDINGS OR UTILITIES.

### SYMBOLS & ABBREVIATION IDENTIFICATION

| | | | | | |
|---|---|---|---|---|---|
| | DRAIN PIPE | T.O.W. | TOP OF WALL | | PROPOSED TREE |
| | EXISTING TOPOGRAPHY | B.O.W. | BOTTOM OF WALL | | |
| 100' | PROPOSED TOPOGRAPHY | T.O.C. | TOP OF CURB | | PROPOSED SHRUB |
| | | B.O.C. | BOTTOM OF CURB | | |
| | | F.F.E. | FINISHED FLOOR ELEVATION | | |

### SITE CONTEXT




METZGER HALL IS A DORMITORY ON THE RUTGERS BUSCH CAMPUS IN PISCATAWAY, NJ. THE PART OF THE SITE INCLUDED IN THE PROJECT CURRENTLY USES HARDSCAPE FEATURES SUCH AS DRAINS, GRAVEL, RIVER ROCK, AND WALLS TO MANAGE THE STORM WATER. THERE IS A DESIRE PATH CUTTING THROUGH THE SITE, AND MOST OF THE SOIL IS HIGHLY COMPACTED.

THE SITE IS BORDERED ON THREE SIDES BY IMPERMEABLE SURFACES: A ROAD, A PARKING LOT, AND A BUILDING. WHILE THESE SURFACES DO NOT INFILTRATE WATER, MOST OF THESE ALSO DO NOT SHED WATER ONTO THE SITE. ONLY A SMALL PORTION OF THE BUILDING ROOF AND THE NEARBY SIDEWALKS DRAIN ONTO THIS SITE. BECAUSE THIS SITE IS SO SMALL, THIS GIVES THE OPPORTUNITY TO MANAGE ALL THE WATER DRAINING ONTO IT WITHOUT THE SYSTEM BECOMING OVERWHELMED.

THE SITE IS ON THE NORTH SIDE OF THE BUILDING, CAUSING THE SITE TO BE QUITE SHADY. THIS CREATES THE ADDITIONAL CHALLENGE OF FINDING PLANTS THAT ARE TOLERANT OF BOTH RAIN GARDEN CONDITIONS AND SHADY SITES. LUCKILY THE BUSCH CAMPUS RAIN GARDEN IS NEARBY. WHILE LARGER, THAT GARDEN HAS SIMILAR CONDITIONS TO THIS SITE, ESPECIALLY IN REGARDS TO SUNLIGHT. BY OBSERVING WHAT PLANTS AND STRATEGIES ARE SUCCESSFUL THERE, I CAN HAVE A BETTER IDEA OF WHAT WILL BE SUCCESSFUL ON THIS SITE

RAIN GARDEN MIX: ERNMX-180
SOURCE: ERNST SEED
RATE: .5 LBS PER 1000 SF

MIX COMPOSITION
31.7% SCHIZACHYRIUM SCOPARIUM
20.0% ELYMUS RIPARIUS
10.0% CAREX VULPINOIDEA
10.0% PANICUM RIGIDULUM
4.0% ECHINACEA PURPUREA
3.0% COREOPSIS LANCEOLATA
3.0% RUDBECKIA HIRTA
2.0% AGROSTIS PERENNANS
2.0% CAREX SCOPARIA
2.0% CHAMAECRISTA FASCICULATA
2.0% EUPATORIUM COELESTINUM
2.0% LIATRIS SPICATA
1.0% ASCLEPIAS INCARNATA,
1.0% ASTER LAEVIS
1.0% ASTER NOVAE-ANGLIAE
1.0% JUNCUS EFFUSUS
1.0% JUNCUS TENUIS
1.0% PENSTEMON DIGITALIS
0.5% BAPTISIA AUSTRALIS
0.5% MONARDA FISTULOSA
0.5% RUDBECKIA FULGIDA VAR. FULGIDA
0.5% SENNA HEBECARPA
0.3% SOLIDAGO JUNCEA

PLANTING SCHEDULE

| BOTANICAL NAME | COMMON NAME | SIZE |
|---|---|---|
| CAREX TESTACEA 'PRAIRIE FIRE' | PRAIRIE FIRE SEDGE | #2 |
| ARONIA ARBUTIFOLIA 'BRILLIANTISSIMA' | BRILLIANTISSIMA RED CHOKEBERRY | #3 (2-3') |
| MYRICA PENSYLVANICA | BAYBERRY | #3 (15-18") |

CREEPING RED FESCUE MIX: FESRUB-01
SOURCE: ERNST SEED
RATE: 3 LBS PER 1000 SF

MIX COMPOSITION
100% FESTUCA RUBRA

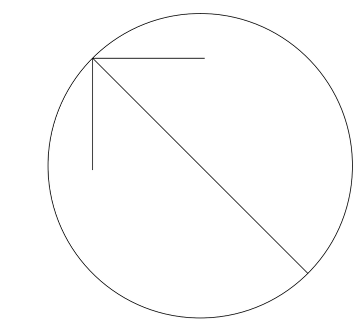
RUTGERS

MARK HOOPES DESIGN
RAIN GARDENS
PLANTING PLANS
WATER MANAGEMENT

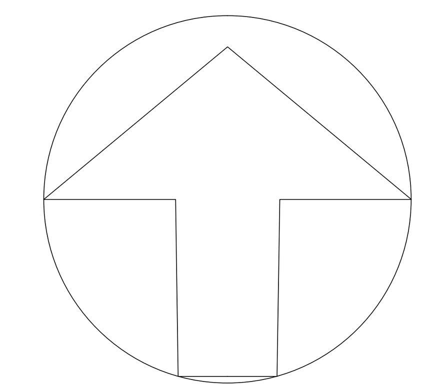
93 LIPMAN DRIVE
NEW BRUNSWICK, NJ

LANDSCAPE ARCHITECT
NJ LICENSE NO XXXXXXXXXXXX

DATE: 12/05/2017



TRUE NORTH



PROJECT NORTH

0 5' 10' 20'

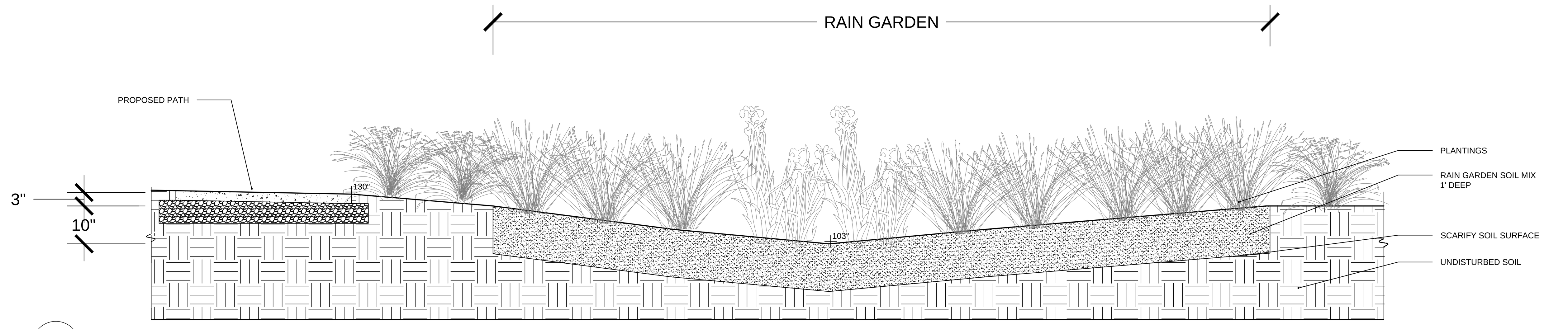
DEPT. OF LANDSCAPE ARCHITECTURE
NEW BRUNSWICK, NJ

PROJECT TITLE
METZGER HALL RAIN GARDEN

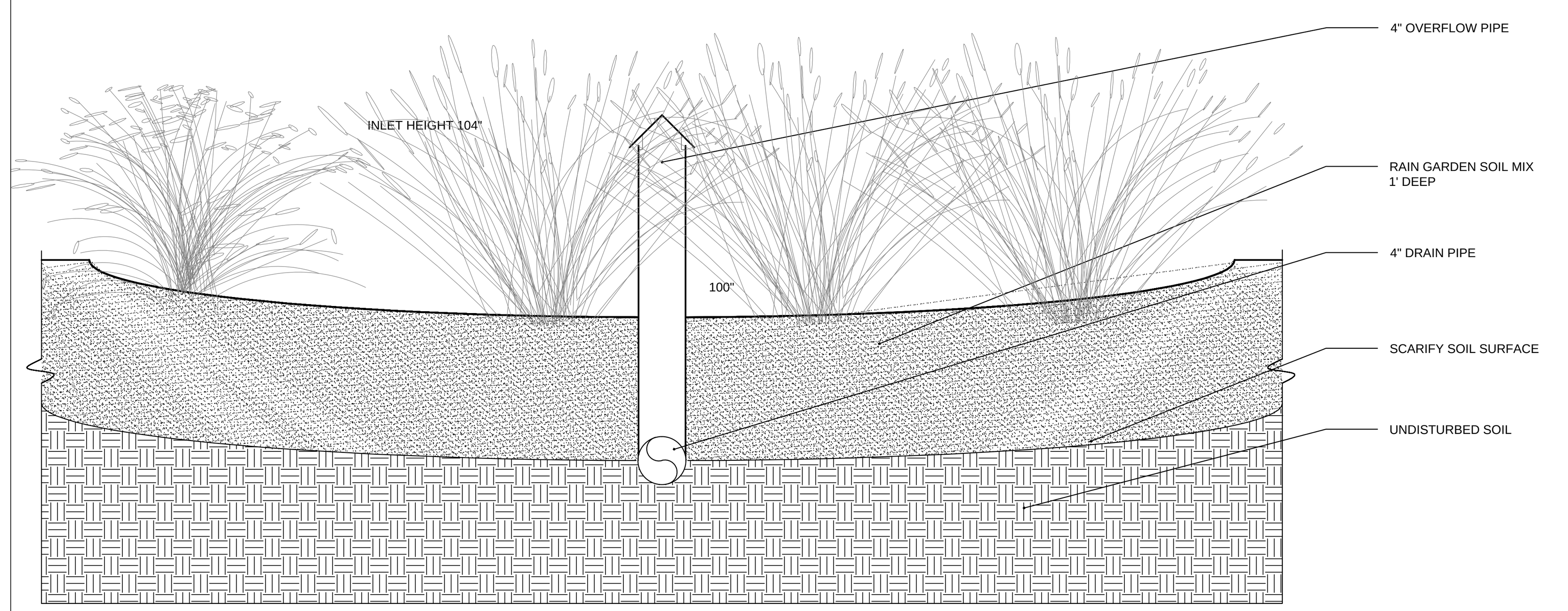
DRAWING TITLE
LANDSCAPE SITE PLAN

| | | |
|---|---|---|
| BLDG NO. XXXX | DSR NO. XXXX | DRAWN BY MH |
| SCALE AS NOTED | DATE 12/05/2017 | CHECKED BY MH |

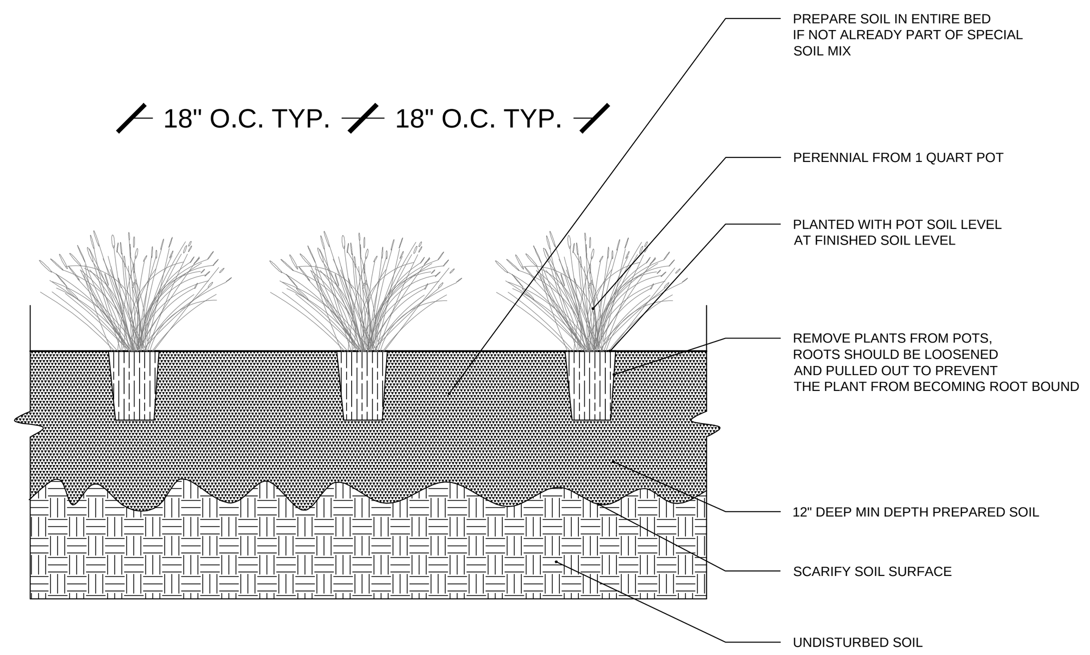
DRAWING NUMBER
LA-001



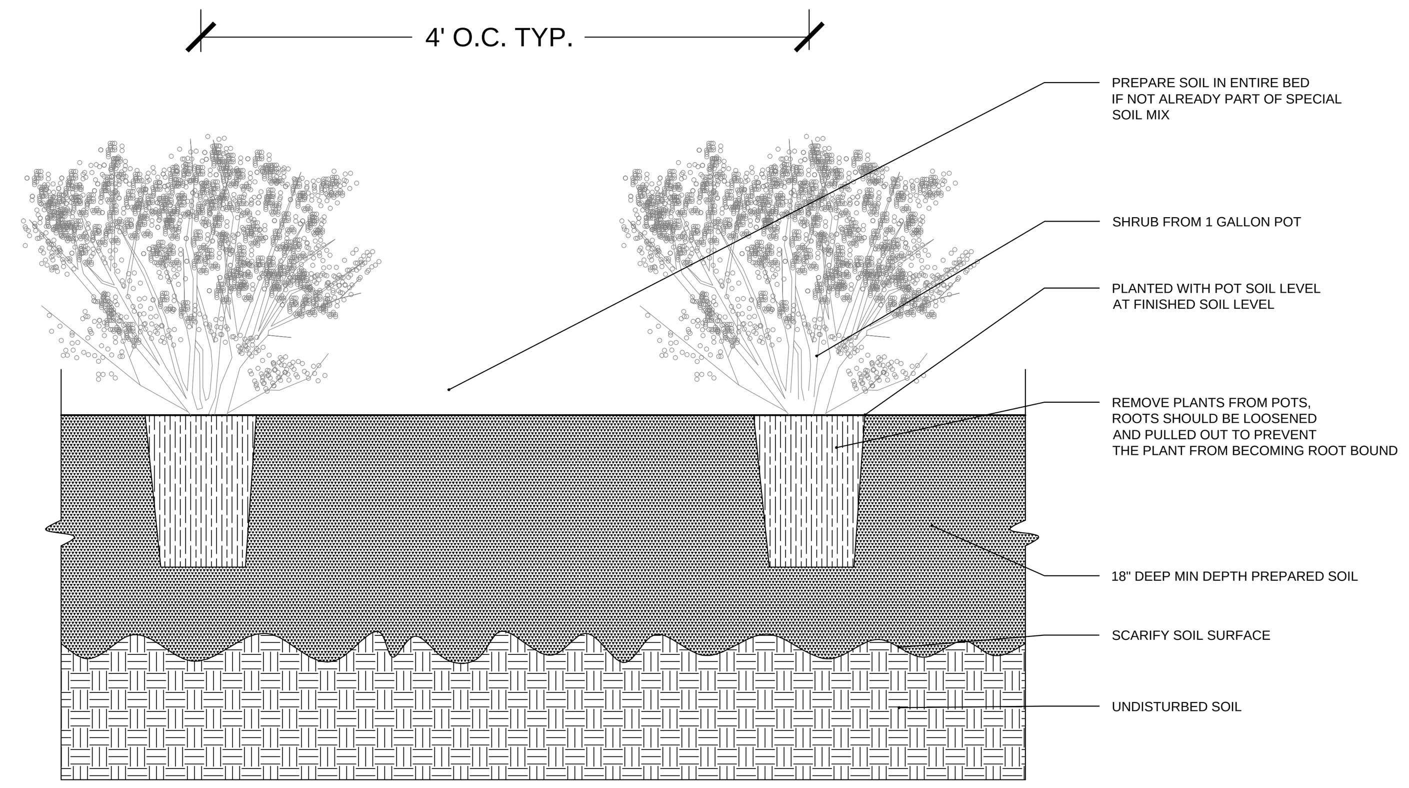

8 RAIN GARDEN AND PATH
1/2"=1'-00"



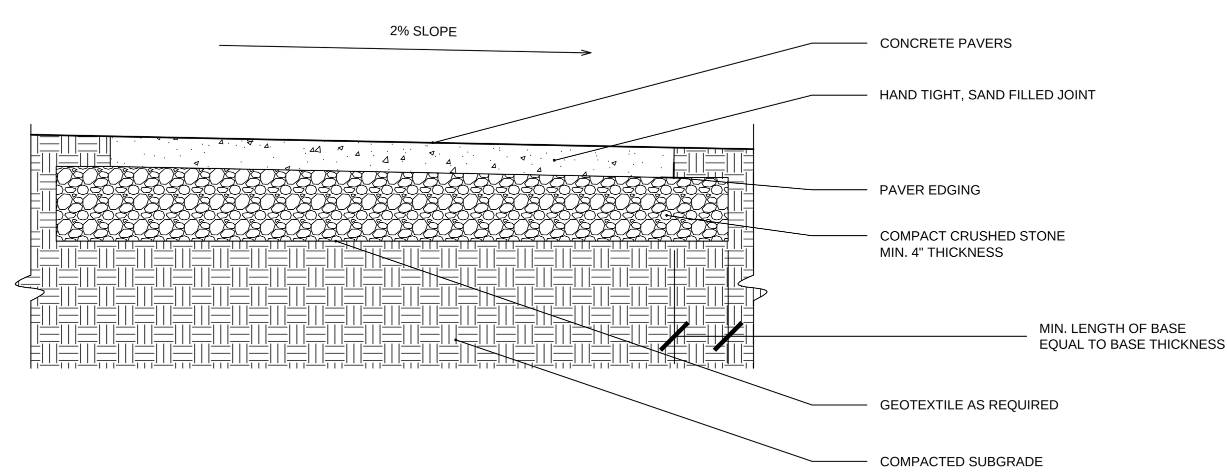

7 BIOSWALE
1"=1'-00"




4 TYPICAL PERENNIAL PLANTING
1"=1'-00"




6 TYPICALSHRUB PLANTING
1"=1'-00"

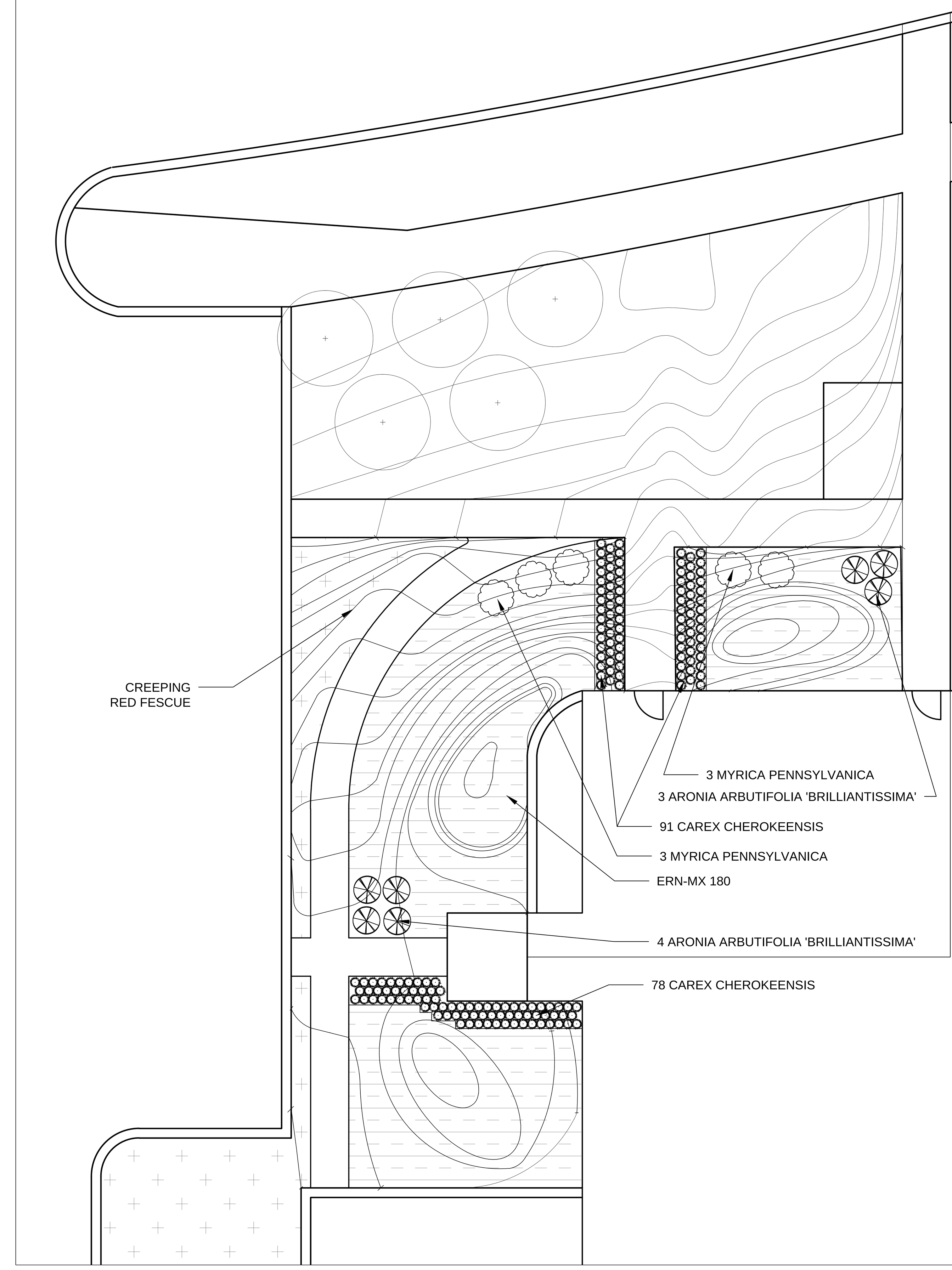



3 TYPICAL PATH SECTION
1"=1'-00"

| NATIONAL STORMWATER CALCULATOR REPORT | | |
|---|---|---|
| | | |
| GARDEN | 0% | 30% |
| LAWN | 62% | 26% |
| IMPERVIOUS | 38% | 44% |
| | | |
| AVERAGE ANNUAL RAINFALL | 49.3 IN | 49.3 IN |
| AVERAGE ANNUAL RUNOFF | 16.85 IN | .53 IN |
| INFILTRATION | 62% | 93% |
| EVAPORATION | 4% | 6% |
| RUNOFF | 34% | 1% |

5 STORMWATER CALCULATIONS

2 RAIN CATCHMENT AREA
NTS




1 PLANTING PLAN
1"=10'

RAIN GARDEN MIX: ERNMX-180
SOURCE: ERNST SEED
RATE: .5 LBS PER 1000 SF

MIX COMPOSITION
31.7% SCHIZACHYRIUM SCOPARIUM
20.0% ELYMUS RIPARIUS
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0.3% SOLIDAGO JUNCEA

| PLANTING SCHEDULE | | |
|---|---|---|
| BOTANICAL NAME | COMMON NAME | SIZE |
| CAREX TESTACEA 'PRAIRIE FIRE' | PRAIRIE FIRE SEDGE | #2 |
| ARONIA ARBUTIFOLIA 'BRILLIANTISSIMA' | BRILLIANTISSIMA RED CHOKEBERRY | #3 (2-3') |
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SOURCE: ERNST SEED
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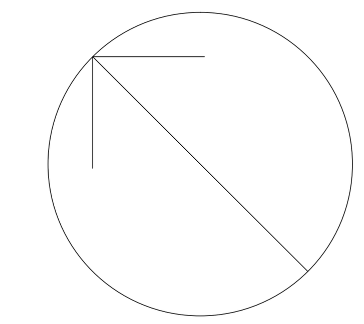
RUTGERS

MARK HOOPES DESIGN
RAIN GARDENS
PLANTING PLANS
WATER MANAGEMENT

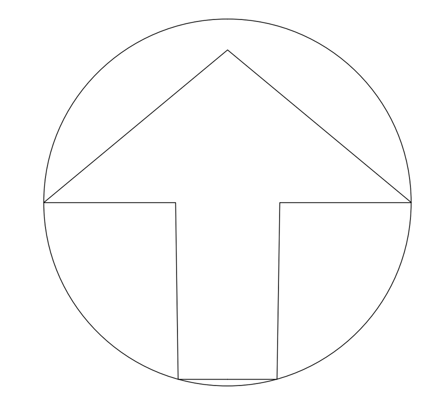
93 LIPMAN DRIVE
NEW BRUNSWICK, NJ

LANDSCAPE ARCHITECT
NJ LICENSE NO XXXXXXXXXXXX

DATE: 12/05/2017



TRUE
NORTH



PROJECT
NORTH

DEPT. OF
LANDSCAPE ARCHITECTURE
NEW BRUNSWICK, NJ

PROJECT TITLE
METZGER HALL
RAIN GARDEN

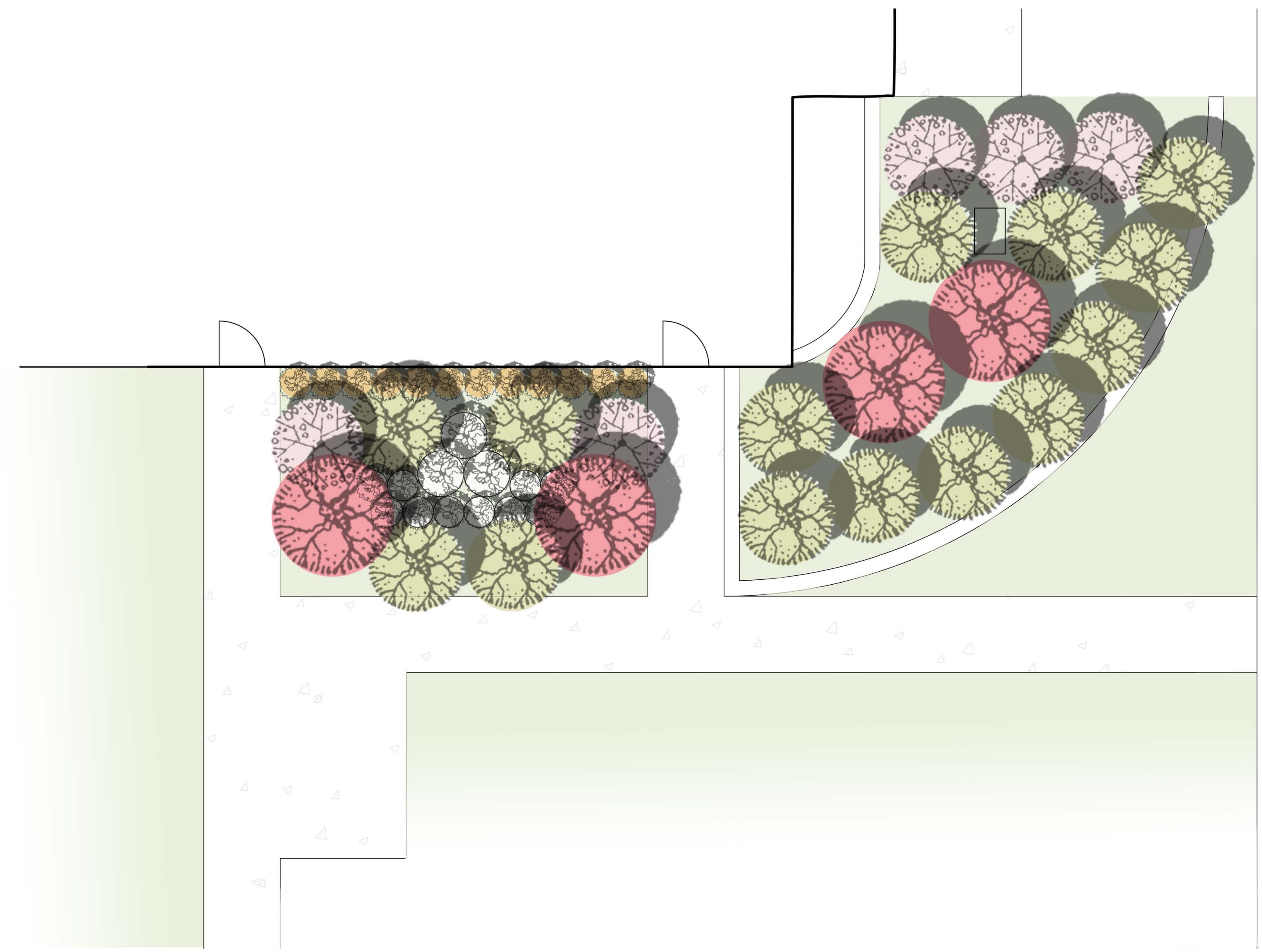
DRAWING TITLE
LANDSCAPE
SITE PLAN

| | | |
|---|---|---|
| BLDG NO. XXXX | DSR NO. XXXX | DRAWN BY MH |
| SCALE AS NOTED | DATE 12/05/2017 | CHECKED BY MH |

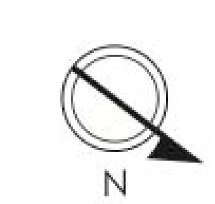
DRAWING NUMBER
LA-002

# METZGER RESIDENCE HALL
# RAIN GARDEN DESIGN

BUCSH CAMPUS, RUTGERS UNIVERSITY
New Brunswick, NJ 08901



**PLANTING DESIGN**
Submission Date: 12/07/2017
Submitted by: Bo Peng



## SITE DESCRIPTION

1. GRADING OF THE NORTHEAST LANDSCAPE SLOPES TOWARD THE BUILDING, GENERALLY TOWARD THE SOUTHEAST.

2. STORMWATER FROM THE BUILDING'S ROOD IS CAPTURED BY 5 DRAINAGE PIPE AND DRAINED TO THE LAWN AREA IN FRONT OF THE METZGER HALL.

3. LARGE RIVER ROCKS SERVE AS GROUNDCOVER ON THE POTENTIAL RAIN GARDEN AREA.

4. ACCORDING TO USDA SOIL SURVEY, THE SOIL ON-SITE IS KLINESVILLE-URBAN LAND COMPLEX SOILS.

5. THE INFILTRATION TESTS INDICATE THE SOIL ON-SITE IS RALETIVELY COMPACTED, ONLY MODERATE TO SLOW INFILTRATION RATES OF 1.5" PER HOUR.

6. EXISTING PLANTINGS INCLUDE 5 MAGNOLIA TREES, SEVERAL SHRUBS AND GRASSES NEAR THE BUILDING AND LAWN AREA.

## GENERAL NOTES

1. THE CATCHMENT AREAS OF THE RAIN GARDEN CONSIDERED FOR THE SITE INCLUDE THE NORTHEAST SIDE OF THE BUILDING ROOF, LAWN AREAS ON THE NORTHEAST SIDE OF THE BUILDING, THE IMPERVIOUS SURFACE AND THE EXISTING DRAINAGE AREA.

2. THE VOLUME OF THE CAPTURED STORMWATER ON SITE IS BASED ON A 2" RAIN FALL DEPTH PER DAY.

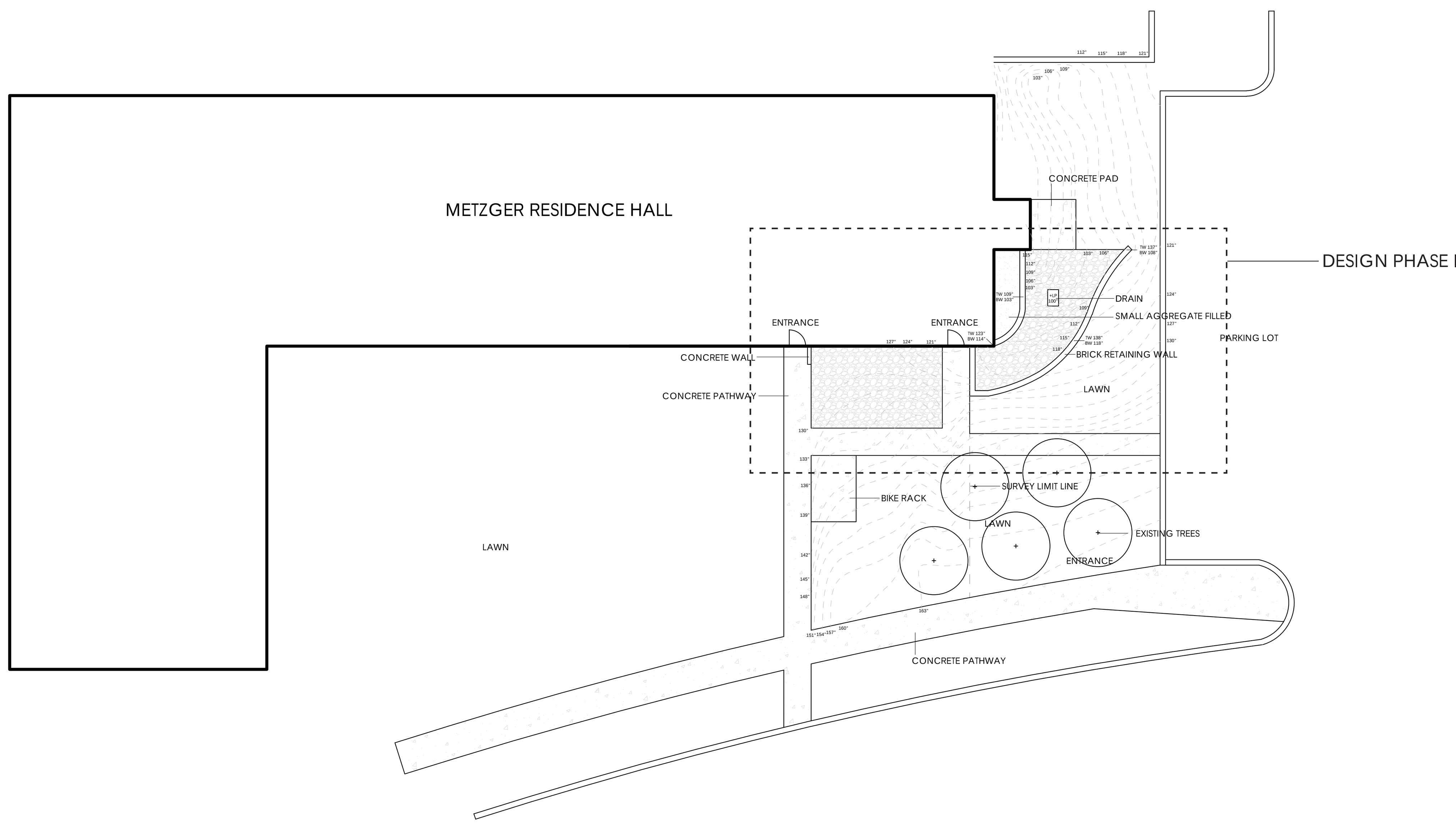
3. CONSIDERING THE EXISTING SOIL CONDITION, THE DEPTH OF RAIN GARDEN SHOULD BE 6". CALCULATIONS OF THE SIZE OF RAIN GARDEN ARE INCLUDED ON THIS SHEET.

4. CONSIDERING THE CATCHMENT AREA FOR THE SITE, SUGGESTED RAIN GARDEN SIZE AND AREA ARE SHOWN IN DIAGRAM ON SHEET L-001.

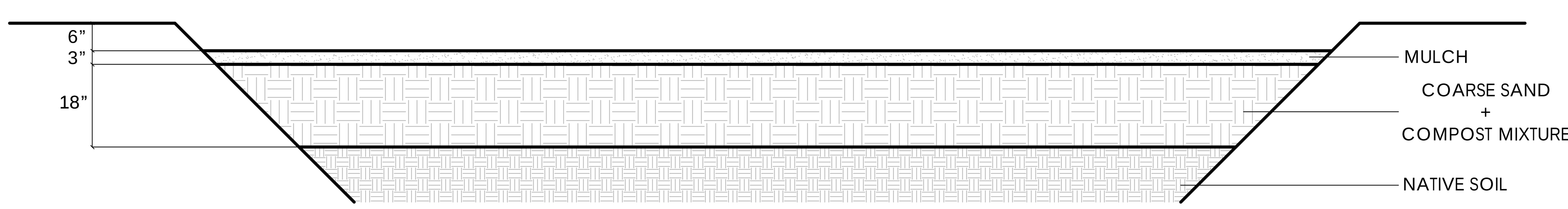
5. PRESERVE ALL EXISTING CONCRETE PAVING.

6. PRESERVE THE BRICK RETAINING WALL FROM DEMOLISHED WALLS TO REUSE IN NEW DESIGN RETAINING WALL.

7. CONSIDERING THE EXISTING SOIL CONDITION, ALL SOIL OF PLANTING AREAS SHOULD BE AMENDED. THE AMENDED PLANTING SOIL SHOULD BE 18" DEEP MINIMUM. CERTAIN DETAIL IS INCLUDED ON THIS SHEET.




1 L001 EXISTING CONDITION PLAN
SCALE: 1"=20'




2 L001 SOIL AMENDMENT
SCALE: 1/4"=1'-0"

| Catchment Area | Catchment Area sqft | Infiltration | Runoff | Rainfall Depth (ft) | Rain Garden Depth (ft) | Rain Garden Size sqft |
|---|---|---|---|---|---|---|
| Building Roof | 4875 | 0% | 100% | 0.167 | 0.5 | 1628.25 |
| Paved Area | 804 | 0% | 100% | 0.167 | 0.5 | 268.536 |
| Lawn | 8260 | 20% | 80% | 0.167 | 0.5 | 2758.84 |
| Total Area | | | | | | 4655.626 |

3 L001 CATCHMENT AREA CALCULATION


4 L001 CATCHMENT AREA DIAGRAM
NTS


5 L001 SUGGESTED RAIN GARDE AREA DIAGRAM
NTS

# LA


DEPARTMENT OF LANDSCAPE ARCHITECTURE
School of Environmental & Biological Sciences
Rutgers University
New Brunswick, New Jersey


COURSE

LANDSCAPE PLANTS II
16:550:548
JEAN MARIE HART-MAN

DRAWN BY

BO PENG

PROJECT

METZGER RESIDENCE HALL PLANTING DESIGN

LOCATION

RUTGERS UNIVERSITY BUCSH CAMPUS

SHEET TITLE

EXISTING CONDITION

DATE
12.07.2017

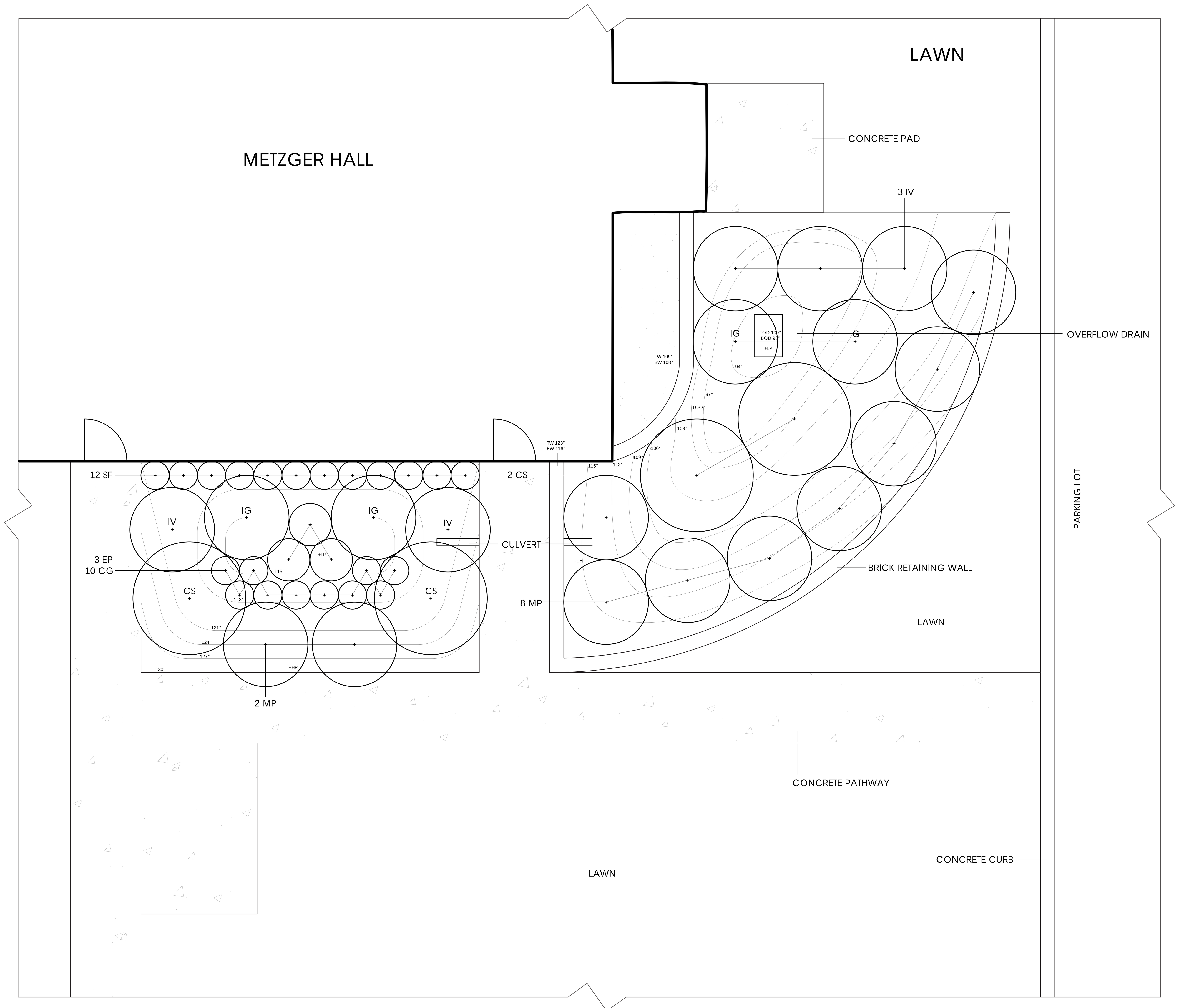
N

L-001

## PLANT SCHEDULE

| Qty. | Sym. | Botanical Name | Scientific Name | Plant Type | Height | Spread | Water Perference | Bloom Time | Bloom Color | Flower | Fruit | Foliage | Winter Interest | Stormwater Management | Erosion Control | Sun Perference | Attracts | Shade Tolerate | Deer Tolerate | Drought Tolerate | Other Tolerate |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | IG | Ilex glabra | Inkberry Holly | Evergreen Shrub | 5'-8' | 5'-8' | Medium - Wet | 5-6 | Greenish-white | Insignificant | Berries | Evergreen | | Base Area | Y | Full sun - Part shade | Birds | Y | Y | | Rabbit / Wet soil / Air pollution |
| 3 | EP | Eupatorium perfoliatum | American Boneset | Herb | 4'-6' | 3'-4' | Medium - Wet | 7-9 | White | Showy | | | | Base Area | | Full sun - Part shade | Butterflies | | Y | | Clay soil / Wet soil |
| 10 | CG | Chelone glabra | White Turtlehead | Herb | 2'-3' | 1.5'-2.5' | Medium - Wet | 8-10 | | Showy | | | | Base Area | Y | Part shade | Butterflies | Y | | | Wet soil |
| 5 | IV | Ilex verticillata | Winterberry Holly | Deciduous Shrub | 3'-12' | 3'-12' | Medium - Wet | 6-7 | Greenish-white | Insignificant | Showy | | Showy berries | Slope Area | Y | Full sun - Part shade | Birds | | | | Clay soil / Wet soil / Air pollution |
| 4 | CS | Cornus sericea | Red Twig Dogwood | Deciduous Shrub | 6'-9' | 7'-10' | Medium - Wet | 5-6 | White | Showy | Showy | Red - Orange | Stem color | Slope Area | Y | Full sun - Part shade | Birds / Butterflies | | Y | | Clay soil / Wet soil |
| 12 | SF | Solidago flexicaulis | Broad Leaf Goldenrod | Herb | 1'-3' | 1'-3' | Medium | 7-9 | Yellow | Showy | | | | Slope Area | | Full sun - Part shade | Butterflies | Y | Y | | Clay soil |
| 10 | MP | Myrica pensylvanica | Bayberry | Deciduous Shrub | 5'-10' | 5'-10' | Dry - Medium | 5 | Yellowish-green | Insignificant | Showy | | Semi-evergreen | Buffer Area | Y | Full sun - Part shade | Birds | | | Y | Wet soil |

1 L002 PLANT SCHEDULE




2 L002 PLANTING PLAN
SCALE: 1/4"=1'-0"


Ilex glabra


Eupatorium perfoliatum


Chelone glabra


Ilex verticillata


Cornus sericea


Solidago flexicaulis


Myrica pensylvanica

3 L002 PLANT PALETTE

# LA


DEPARTMENT OF LANDSCAPE ARCHITECTURE
School of Environmental & Biological Sciences
Rutgers University
New Brunswick, New Jersey


COURSE

LANDSCAPE PLANTS II
16:550:548
JEAN MARIE HART-
MAN

DRAWN BY

BO PENG

PROJECT

METZGER RESIDENCE HALL
PLANTING DESIGN

LOCATION

RUTGERS UNIVERSITY
BUCSH CAMPUS

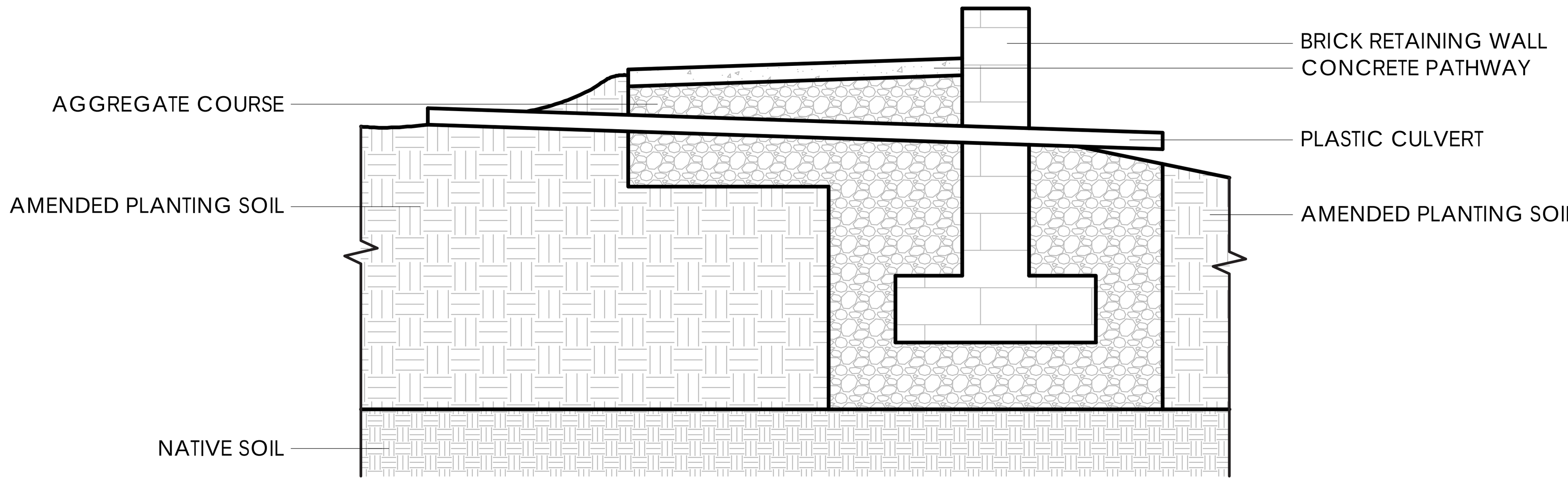
SHEET TITLE

PLANTING PLAN

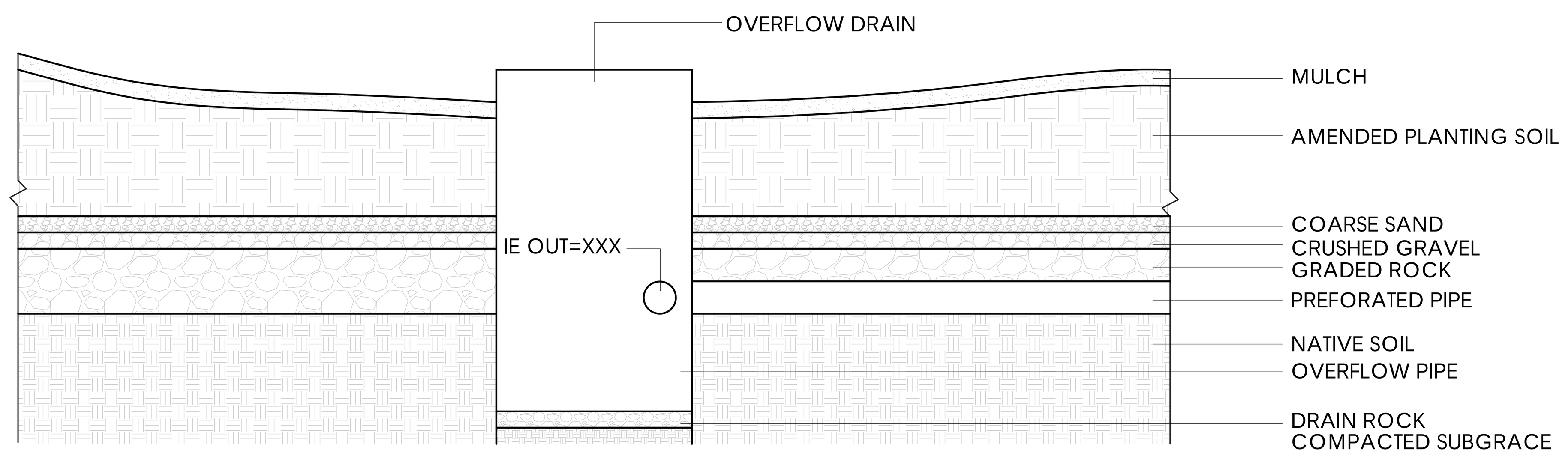
DATE
12.07.2017

N

L-002




1 L003 CULVERT & RETAINING WALL DETAIL
SCALE: 1/2"=1'-0"




2 L003 OVERFLOW DRAIN DETAIL
SCALE: 1/2"=1'-0"

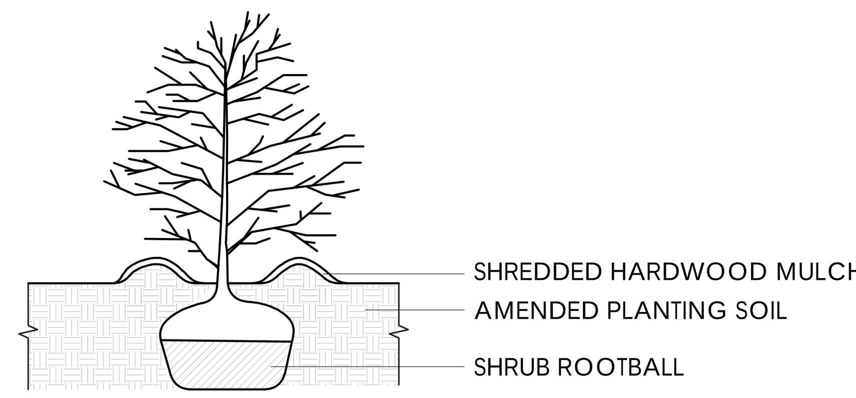
## SHRUB PLANTING DETAIL NOTES (TYP.)

1. FOR CONTAINER GROWN TREES FINGERS OR SMALL HAND TOOLS TO PULL THE ROOTS OUT OF THE OUTER LAYER OF POTTING SOIL, THEN CUT OR PULL APART ANY ROOT CIRCLING THE PERIMETER OF THE CONTAINER.

2. INCORPORATE COMMERCIALLY PREPARED MYCORRHIZAE SPORES AND FERTILIZER TABLETS IN THE SOIL IMMEDI-ATELY AROUND THE ROOT BALL AT RATE SPECIFIED BY THE MANUFACTURER.

3. PRIOR TO INSTALLATION CONFIRM THE SOILS WILL DRAIN PROPERLY. IF NECESSARY PROVIDE PROPER DRAINAGE.

4. THOROUGHLY SOAK THE ROOT BALL AND THE ADJACENT PREPARED SOIL SEVERAL TIMES DURING THE FIRST MONTH AND REGULARLY THROUGHOUT THE FOLLOWING TWO SUMMERS.




3 L003 SHRUB PLANTING DETAIL
SCALE: 1/2"=1'-0"

## PLANTING NOTES

1. THE LANDSCAPE CONTRACTOR WILL STAKE OUT PLANT LOCATIONS IN THE FIELD. THE LANDSCAPE DESIGNER AND OWNER RESERVE THE RIGHT TO OBSERVE THESE LOCATIONS PRIOR TO COMMENCING PLANT PIT EXCAVATION. THE CONTRACTOR WILL MAKE ADJUSTMENTS AS REQUIRED BY LANDSCAPE DEISGNER AND/OR OWNER.

2. NO SUBSTITUTIONS OF PLANT MATERIALS SHALL BE ALLOWED WITHOUT THE WRITTEN PERMISSION OF THE LANDSCAPE DESIGNER. THIS SHALL APPLY TO SUBSTITUTIONS OF SPECIES, SIZE AND QUANTITY.

3. ALL TREES AND SHRUBS SHALL BE OF HEALTHY VIGOROUS STOCK GROWN IN A RECOGNIZED NURSERY IN ACCORDANCE WITH GOOD HORTICULTURAL PRACTICE AND THE AMERICAN ASSOCIATION OF NURSERYMEN STANDARDS, FREE OF DISEASE AND DEFECTS.

4. PLANTS WITH UNDERSIZED OR BROKEN ROOT BALLS, EXCESSIVE CULLING AND/OR GIRDLING OF ROOTS, INJURY FROM ROUGH TREATMENT, OR DROUGHT STRESS WILL WITH UNDERSIZED OR BROKEN ROOT BALLS. EXCESSIVE CURLING AND/OR DROUGHT STRESS WILL BE REJECTED.

5. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO GUARANTEE THAT ROOT BALLS ARE PROPERLY SIZED. PLEASE BE AWARE THAT FOR PROPER SIZING, EXCESS ALIEN SOIL SHALL BE REMOVED PRIOR TO DIGGING, SEE DIAGRAM 1.A

6. ROOT BALLS SHALL BE KEPT MOIST AT ALL TIMES.

7. PLANTS SHALL BE COVERED DURING TRANSPORT TO PREVENT DESICCATION FROM WIND. IN WARM WEATHER PLANTS SHALL BE COVERED JUST PRIOR TO TRAVEL AND UNCOVERED IMMEDIATELY UPON REACHING DESTINATION TO AVOID HEAT BUILD UP UNDER THE TARP. PLANT MATERIAL SHALL NOT BE LEFT IN DIRECT SUNLIGHT OR ON HEAT ABSORPTION MATERIALS, SUCH AS BUT NOT LIMITED TO, ASPHALT AND/ OR METAL TRUCK BEDS TO PREVENT THE WILTING OF MATERIAL.

8. TREES SHALL BE MOVED BY THEIR ROOT BALL NOT THEIR TRUNK. TREES LARGER THAN 6" SHALL BE MOVED WITH PROPER STRAPPING SECURING ROOT BALL TO EQUIPMENT. WEAVE STRAPPING THROUGH THE LACING, NOT AROUND THE TRUNK. TREE TRUNK SHALL BE PROTECTED AT ALL TIME FROM COMPRESSION AND SEARING.

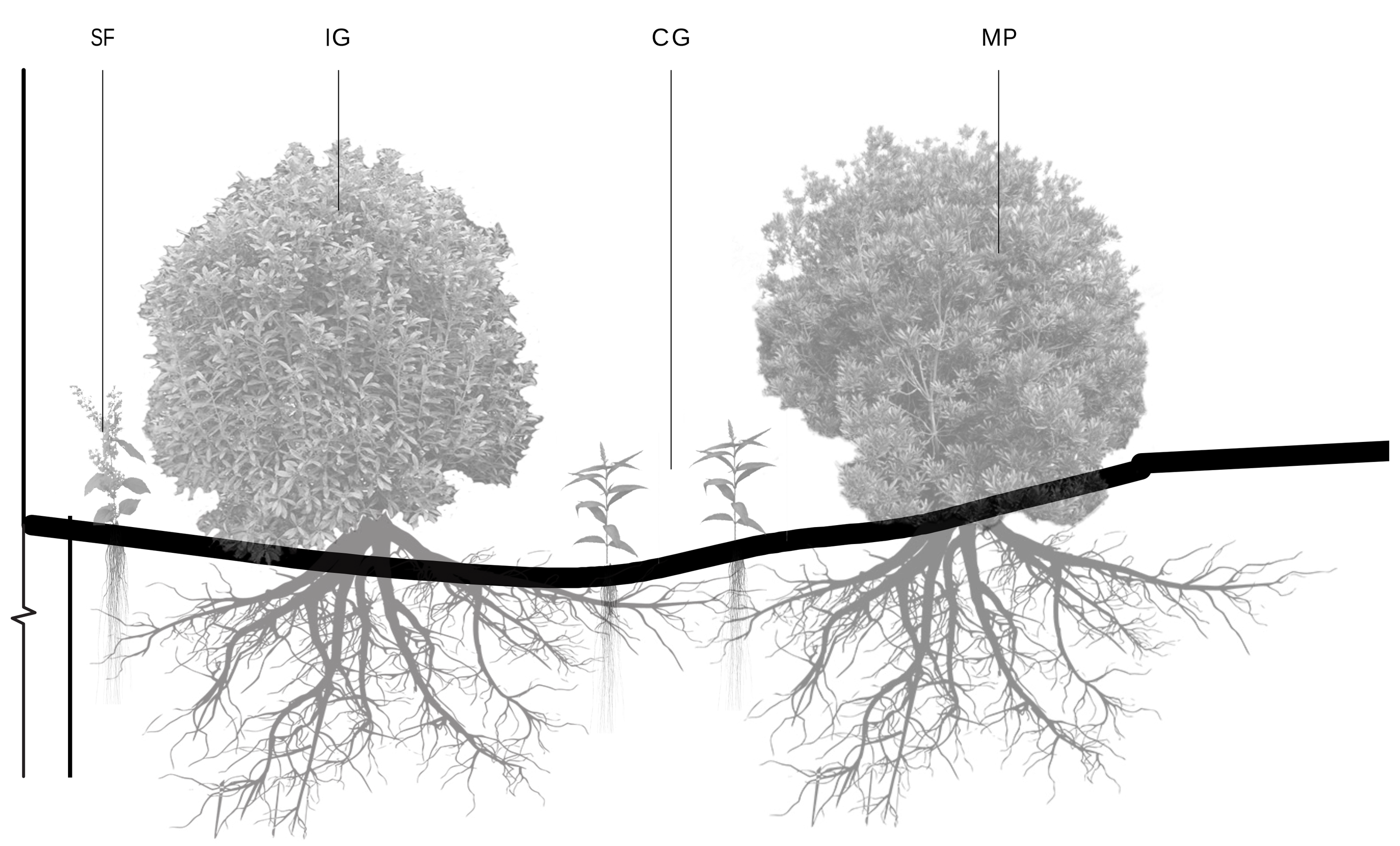
9. IF PLANTS ARE NOT PLANTED IMMEDIATELY ON SITE, PROPER CARE SHALL BE TAKEN:

A. PLACE IN PARTIAL SHADE WHEN POSSIBLE.

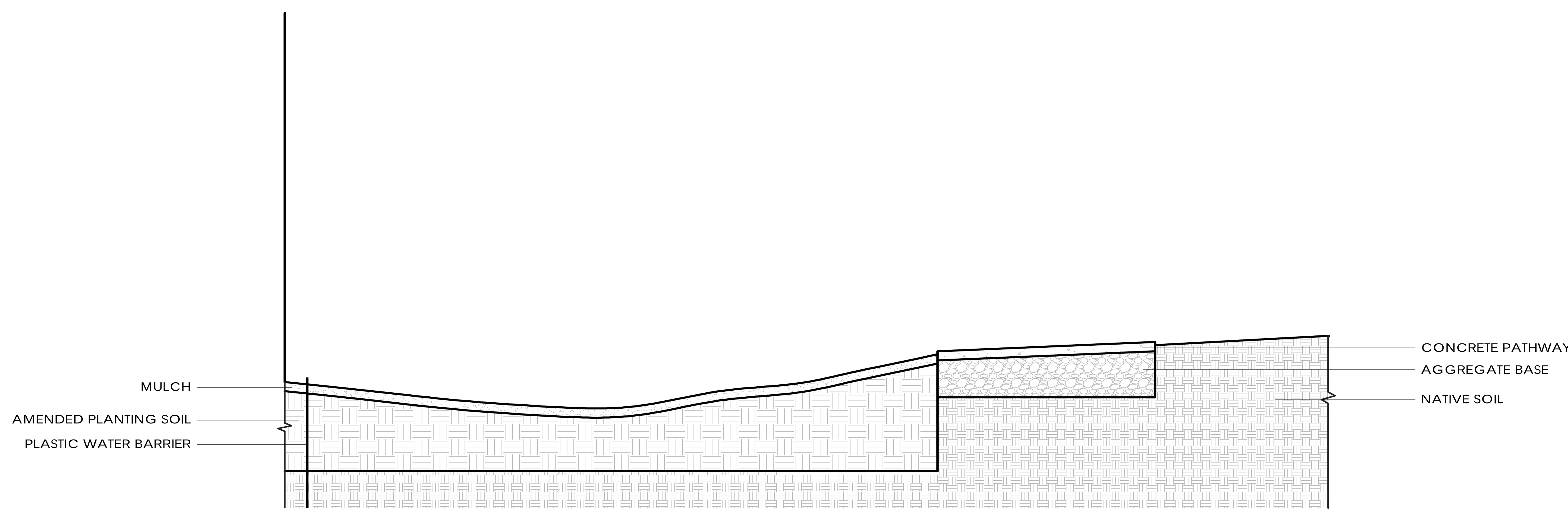
B. COVER ROOT BALL WITH MOISTENED MULCH OR AGED WOODCHIPS.

C. SUPPLY PROPER IRRIGATION AS NOT TO ALLOW THE ROOT BALL TO DRY OUT.

D. UNTIE PLANT MATERIAL AND ALLOW PROPER SPACING OF PLANTS FOR AIR CIRCULATION TO PREVENT DIS-EASE, WILTING, LEAF LOSS AND GENERAL HEATH OF PLANTS.




4 L003 RAIN GARDEN PLANTS SECTION
SCALE: 1/2"=1'-0"




5 L003 RAIN GARDEN SECTION
SCALE: 1/2"=1'-0"

# LA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METZGER RESIDENCE HALL
PLANTING DESIGN

LOCATION

RUTGERS UNIVERSITY
BUCSH CAMPUS

SHEET TITLE

DETAILS

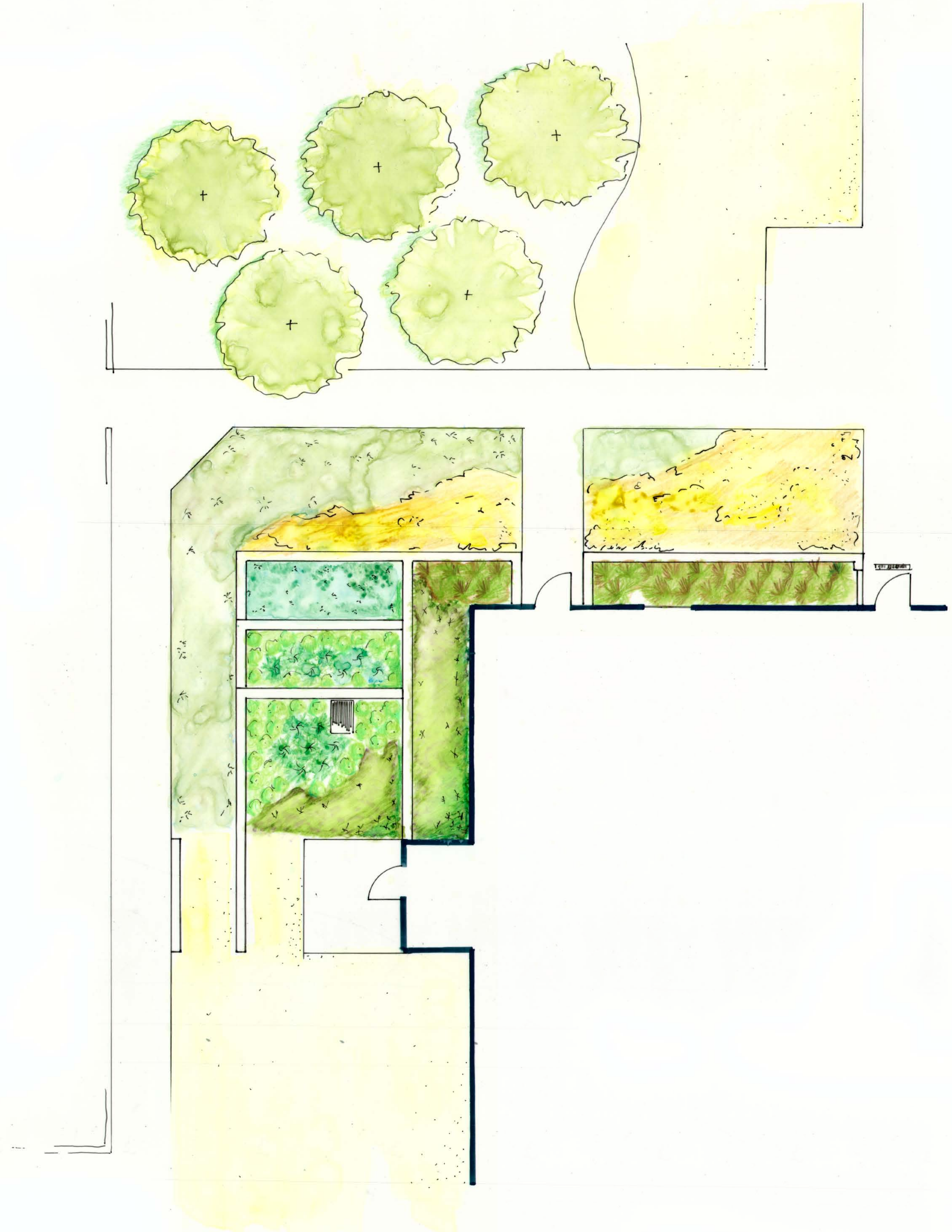
DATE
12.07.2017

N

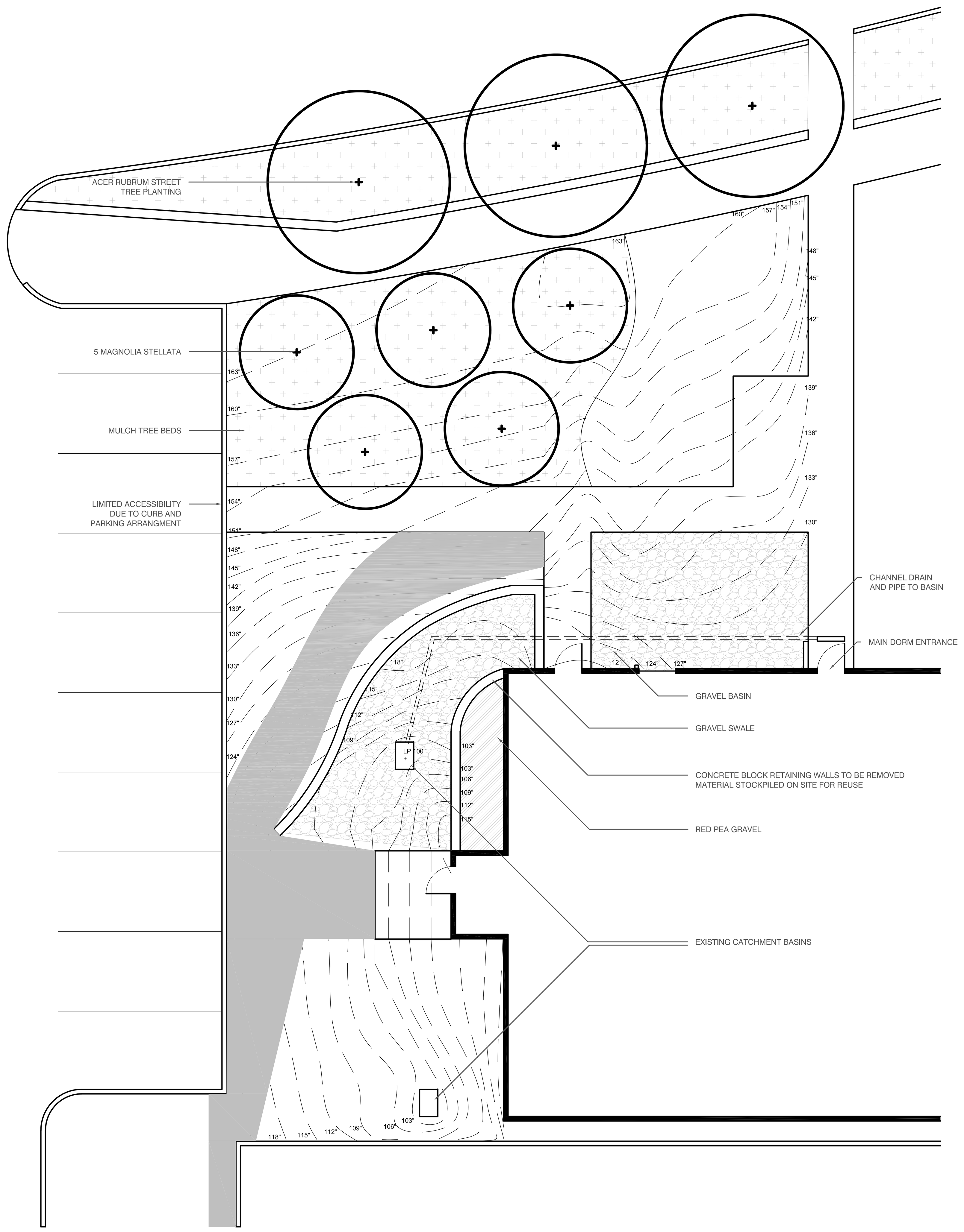
L-003

# METZGER HALL RAIN GARDEN

RUTGERS, THE STATE UNIVERSITY OF NJ

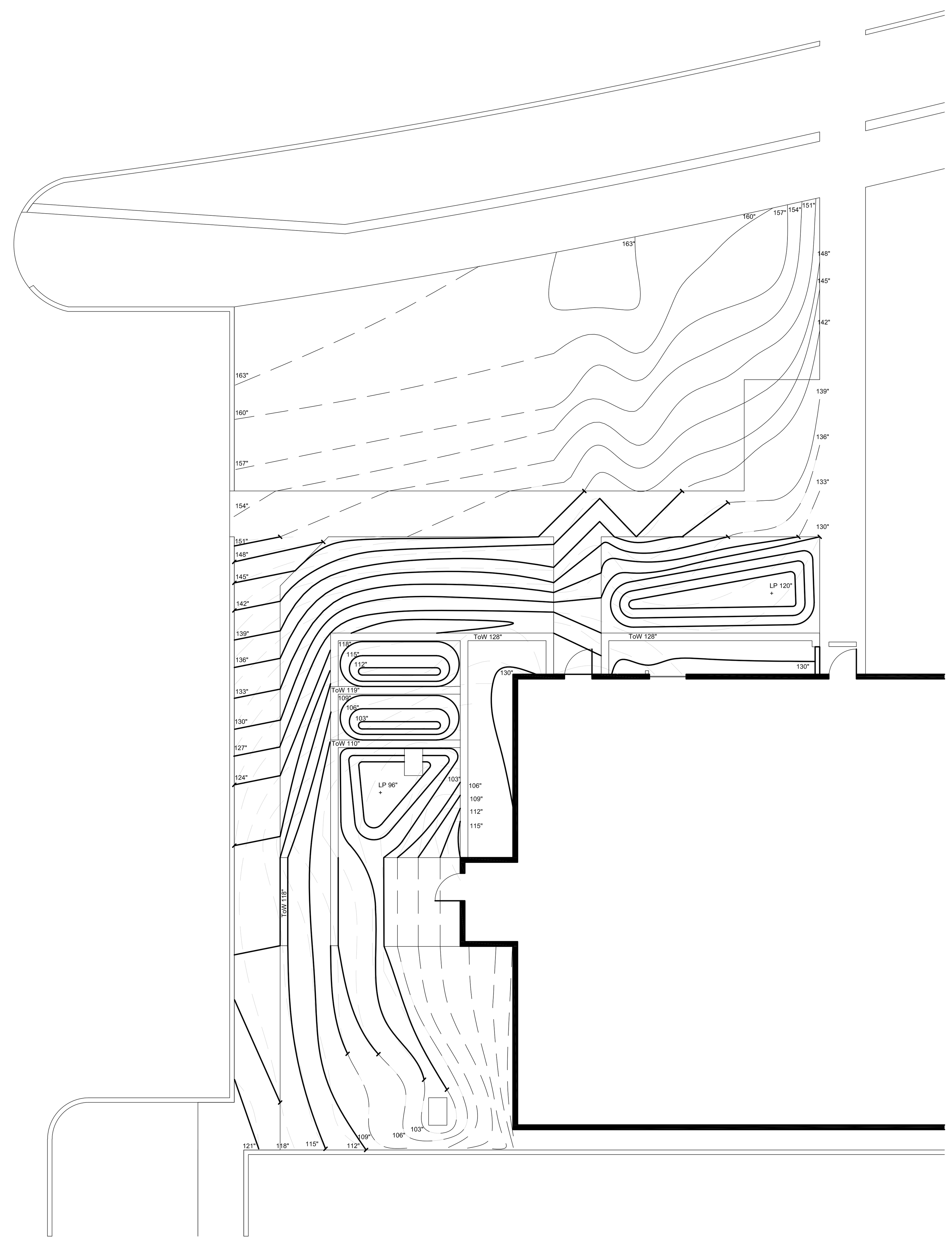


DESIGN: KARI WILLIAMS
FALL 2017



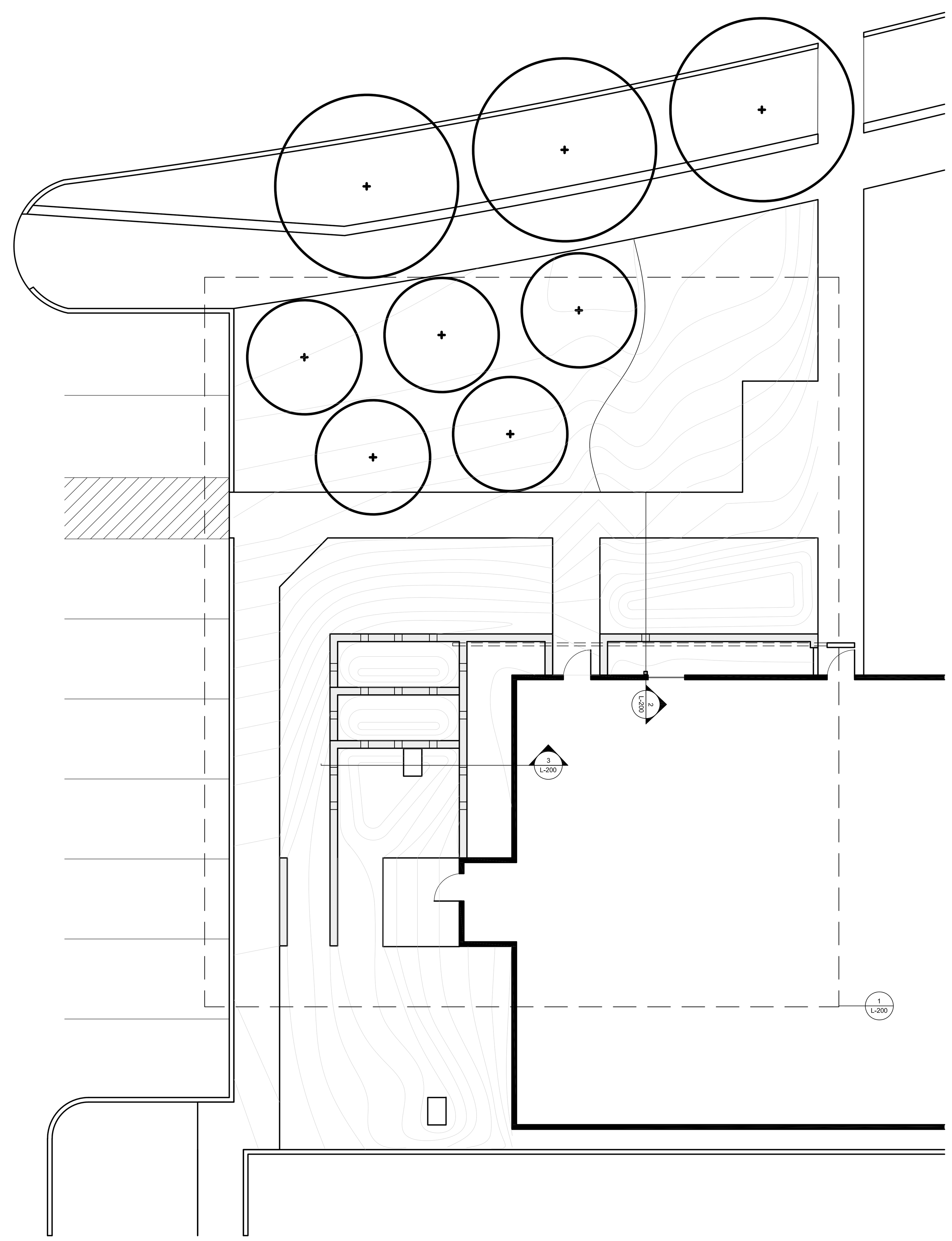

3 EXISTING CONDITIONS PLAN

1" = 10'



2 GRADING PLAN

1" = 10'



1 LAYOUT PLAN

1" = 10'

STORMWATER CALCULATIONS:

EXISTING CONDITIONS- 565 CUBIC FEET OF WATER TO STORM DRAIN. HIGH COMPACTION, SO ASSUMING MINIMAL INFILTRATION: 0% IN GRAVEL BASINS AND IMPERVIOUS SURFACES, 20% IN LAWN AREAS, 80% IN MULCHED AREAS.

DESIGNED CONDITIONS- DECREASED THE AMOUNT OF WATER FLOWING INTO THE SITE BY 217 CUBIC FEET THROUGH AMENDING COMPACTED AND IMPERVIOUS CONDITIONS. INCREASED WATER STORAGE CAPACITY BY AN ADDITIONAL 280 CUBIC FEET, AND INCREASED INFILTRATION RATES THROUGH THE ADDITION OF A RAINWATER SOIL MIX. 565-(217+280)=68. 68 CUBIC FEET OF RAINWATER WILL HAVE TO INFILTRATE OVER THE COURSE OF THE STORM OR WILL OVERFLOW INTO THE STORM DRAIN.

GENERAL NOTES:

1) EXISTING CONTOURS ARE AN ESTIMATION. THOSE NEAREST TO THE BUILDING AND IN FRONT OF THE ENTRANCE WERE MEASURED USING A STRING AND LINE. CONTOURS FURTHER FROM THE BUILDING WERE EXTRAPOLATED FROM PHOTOGRAPHY.

2) THE GENERAL CONTRACTOR SHALL CHECK AND VERIFY ALL DIMENSIONS AND GRADE CONDITIONS, (BOTH NEW AND EXISTING) REPORTING ANY DISCREPANCIES TO THE LANDSCAPE ARCHITECT PRIOR TO ORDERING MATERIALS OR PROCEEDING WITH ANY PHASE OF THE WORK.

3) PRESERVE ALL PRESSED CONCRETE BLOCKS FROM DEMOLISHED WALLS TO REUSE IN NEW DESIGN STRUCTURE

4) NO PLANT SUBSITUTIONS (SIZE, SPECIES OR VARIETY) SHALL BE MADE WITHOUT CONSULTATION WITH THE LANDSCAPE ARCHITECT.

5) UNDER NO CIRCUMSTANCES SHALL VEHICLES OR HEAVY MACHINERY OPERATE, NOR MATERIALS BE STORED, IN EXISTING MULCHED AREAS (TREE PLANTING AREAS).

6) THE VOLUME OF THIS GREEN INFRASTRUCTURE SYSTEM IS BASED UPON A 2" RAIN EVENT. CALCULATIONS ARE INCLUDED ON THIS SHEET. THE AREA CONSIDERED FOR THE CATCHMENT AREA IS MARKED ON THE EXISTING CONDITIONS PLAN ON THIS SHEET.

RUTGERS

Signature Line

BIRDTREE
Landscape Architecture

Rutgers Facilities

PROJECT NORTH

PLAN NORTH

PROJECT TITLE

# METZGER HALL RAIN GARDEN

ADDRESS

43 Bevier Rd
Piscataway Township, NJ
08854

DATE

December 6, 2017

DRAWN BY

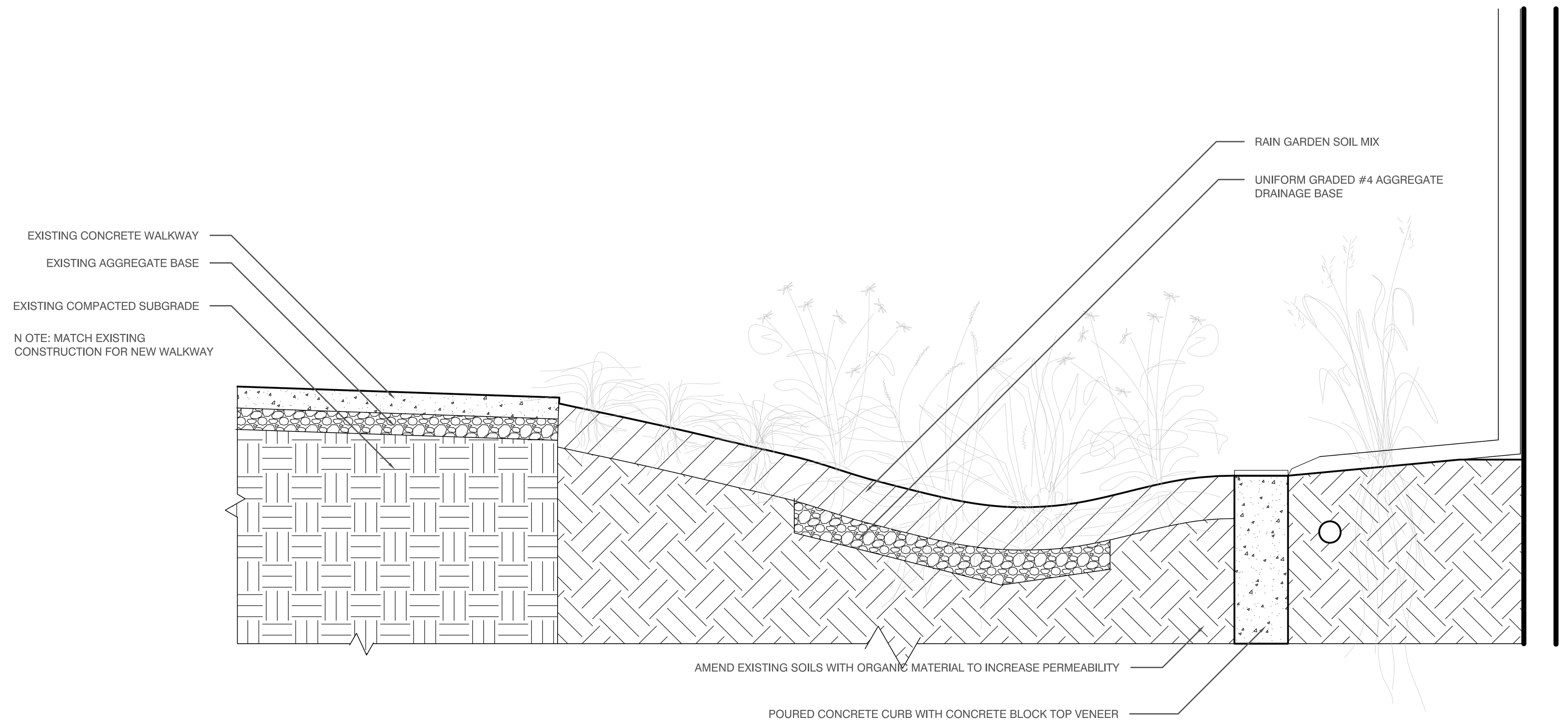
Kari Williams

SCALE

1" = 10'

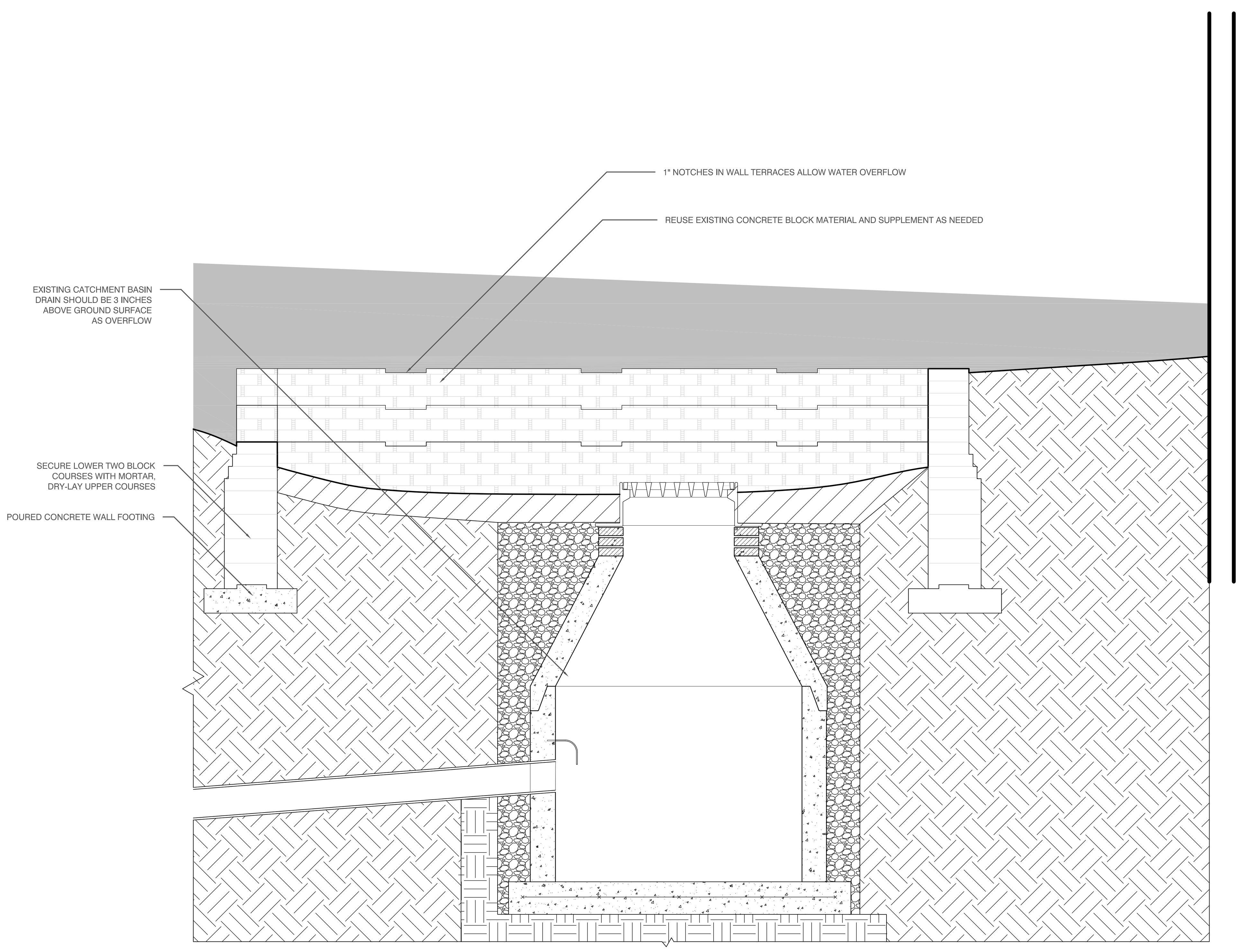
DRAWING NUMBER

LA-100



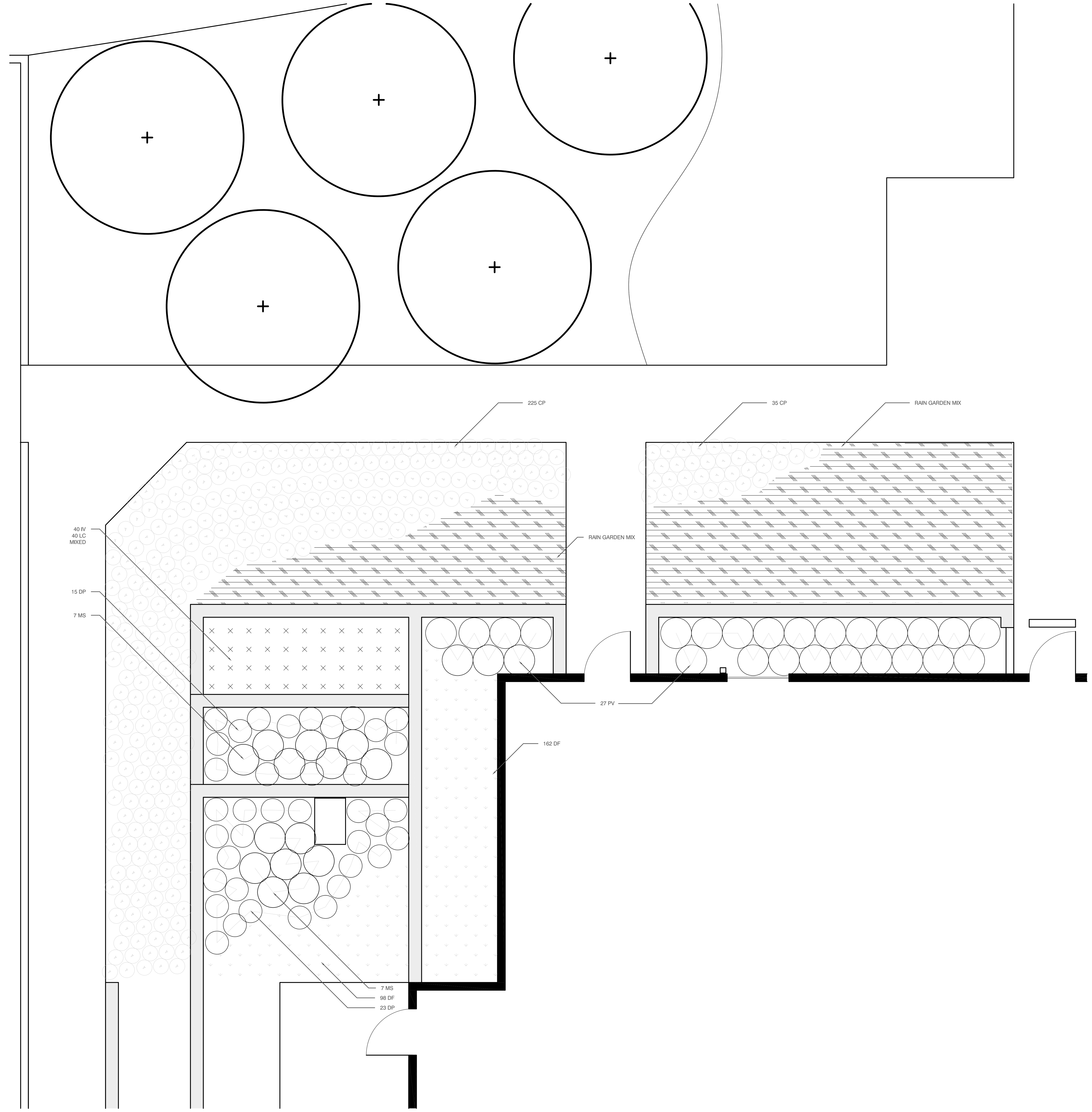

2 RAIN GARDEN DETAIL (WITH PLANTS)

$\frac{1}{2}$" = 1'




3 WALLS AND DRAINAGE SECTION-ELEVATION (SHOWN WITHOUT PLANTS)

$\frac{1}{2}$" = 1'




1 PLANTING PLAN

$\frac{1}{4}$" = 1'

PLANT SCHEDULE

| Code | Botanical Name | Common Name | Quantity | Size | Spacing |
|---|---|---|---|---|---|
| **Seed Mixture** | | | | | |
| Rain Garden Mix | Earnst Conservation Seeds | Rain Garden Mix - ERNMX-180 | | 3 oz seed | Spread liberally |
| **Grasses** | | | | | |
| DF | *Deschampsia flexuosa* | Wavy Hair Grass | 260 | Plugs | 10" |
| PV | *Panicum virgatum* | Switchgrass | 27 | 1/2 Gal. | 24" |
| CF | *Carex Pensylvanica* | Sedge | 360 | Plugs | 10" |
| **Flowering Perennials** | | | | | |
| IF | *Iris Versicolor* | Blue Flag Iris | 40 | Plugs | 12" |
| LC | *Lobelia cardinalis* | Cardinal Flower | 40 | Plugs | 12" |
| **Ferns** | | | | | |
| DP | *Dennstaedatia punctilobula* | Hay-scented fern | 38 Quart 18" | | |
| MS | *Matteuchia struthiopteris* | Ostrich Fern | 14 | 1/2 Gal. | 24" |

RUTGERS

Signature Line

BIRDTREE Landscape Architecture

Rutgers Facilities

PROJECT NORTH

PLAN NORTH

PROJECT TITLE

# METZGER HALL RAIN GARDEN

ADDRESS
43 Bevier Rd
Piscataway Township, NJ
08854

DATE
December 6, 2017

DRAWN BY
Kari Williams

SCALE
As noted

DRAWING NUMBER
LA-200

Rutgers School of Environmental and Biological Sciences

Department of Landscape Architecture
93 Lipman Drive, Blake Hall 113
New Brunswick, NJ 08901-8524
Phone: 848-932-9317
Fax: 732-932-1940

Advanced Plants • Fall 2017 • Prof. J.M. Hartman

## SYLLABUS

### Course Content and Structure for Advanced Plants

We will meet twice weekly. During each class, we will spend part of the time discussing reading assignments and field/greenhouse observations. The remainder of the class time will focus on projects related to plant identification, field studies, and planting design.

Introduction The principles of landscape performance will be introduced as a framework for the course. This approach focuses on evidence based evaluation of landscape design. We will use local gardens, especially rain gardens, to test and document landscape performance.

Section 1 We begin with methods of plant identification. The recognition method of plant identification, taught in Landscape Plants I, is an excellent way to get started and we will revisit it. Students will become familiar with common identification guides that use numerous organizations to help them identify plants (e.g. dichotomous keys, color guides, physiognomic groups).

In order to develop and use your plant identification skills, we will visit campus and nearby gardens to measure their composition and diversity. As we visit the gardens we will look at species coverage along gradients, study the soil conditions where they are growing, and (where possible) meet with someone who maintains the garden. These observations will be used to evaluate ecological function as a landscape performance category.

Section 2 We will focus on the interaction of plants with their environment. We will review the relationships between plant characteristics and adaptations to the environment. This section will include at least one greenhouse visit to look at adaptations of plants to arid, tropical, or wetland conditions.

In addition, we will continue to visit gardens and evaluate their fit with their surroundings. We will move from the campus setting to installations in surrounding communities. Are the gardens appropriate to their location? Do they communicate with visitors (through signs or events)? Are they attractors of pedestrians? These observations will be used to measure cultural and aesthetic performance of the gardens.

We will especially take time to meet with people who maintain the gardens and talk about efforts and costs and complaints they deal with. This will give us information related to costs and benefits that may be associated with landscape performance.

Section 3 In order to relate plant composition and diversity, garden characteristics, and design, a design assignment will require you to develop rain garden that will have high ecological performance as well as positive and measurable social and economic impacts. Some of the gardeners and property managers will be invited to review your work.

Department of Landscape Architecture
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## Course Materials and Communication

A sakai site has been established for announcements, exchange of reading materials, assignments, discussions, and questions. Please check it regularly and read the emails generated through this platform.

There are two required books both are very useful as well as inexpensive.
*Botany for Gardeners.* 2010. Brian Capon. ($10 to $15)
*How to Identify Plants.* 1957. H. D. Harrington ($6 to $10)

I will provide a small library of recommended books that you can use in my lab (room 130 Blake). Each of you will be expected to become familiar with them and to understand how to use them. Including these Recommended Books:
- *Newcomb's Wildflower Guide.* 1989. By Lawrence Newcomb.
- *Biology of Plants.* 2005. by Peter H. Raven, Ray F. Evert and Susan E. Eichhorn.
- *Botany Illustrated: Introduction to Plants, Major Groups, Flowering Plant Families.* 2006. J. Glimn-Lacy and P. B. Kaufman.
- *Bringing Nature Home: How Native Plants Sustain Wildlife in Our Gardens.* 2007. Douglas Tallamy.
- *Invasive Plants: Guide to Identification and the Impacts and Control of Common North American Species.* 2007. S.R. Kaufman and W. Kaufman.

Readings: Assigned and recommended readings will be mentioned during lectures. They will be available on the sakai site if they are not in your textbooks.

Learning Objectives: Each assignment is based on learning objectives. Some objectives involve strengthening or expanding skills introduced in another class. Other objectives involve the introduction and application of new knowledge and skills.

Course objectives and learning outcomes:
a) Apply plant diversity measures to rain gardens, in order quantify its ecological performance:
   Successful measurement and calculation of diversity.
   Proposal of design alteration to increase biodiversity.
   Clearly explain position on use of native versus introduced species in rain garden design.
b) Test rain gardens for soil characteristics, in order to evaluate its physical performance in water management:
   Characterize soil profile in rain gardens.
   Test porosity and infiltration rates in rain gardens.
   Propose improvements for soil health.
   Look for evidence of mosquito problems.
c) Evaluate the relationship between the appearance and function of the rain garden and its setting, or its cultural and aesthetic performance.
   Determine if cultural preferences have been addressed.
   Discuss maintenance and problems with caretakers of the gardens.
   Propose improvements that would better serve that site users.

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Student Background: This class covers a broad range of topics. There are a few assumptions made about your background knowledge such as the following:

1. you have taken college level biology
2. you have a working knowledge of the material taught in Landscape Plants 1
3. you are able to identify 20 or more common landscape plants
4. you have an interest in Planting Design.

If you do not meet these assumptions, you may need to do some extra reading or work a little harder. When topics are introduced and applied too quickly, please ask for help.

## COURSE SCHEDULE

| | |
|---|---|
| Sept. 7 | Introduction and rain garden in front of Blake Hall (plant id with Newcomb's) |
| Sept. 11 | The plant as an organism |
| Sept. 14 | Rain gardens around Cook Campus Center (plant id and diversity) |
| Sept. 18 | Plant anatomy and morphology review |
| Sept. 21 | Megan Barnes – "Landscape Performance" Rain Gardens by Environmental Sciences (plant id, diversity, soils) |
| Sept. 25 | Plant pollination biology, integrated pest management and expanding our view of ecological performance |
| Sept. 28 | Rain gardens on Busch and Livingston Campus (plant id, diversity, soils) |
| Oct. 2 | Diversity measurements and calculations, which are most useful? |
| Oct. 5 | Rain gardens in Manville (plant id, diversity, soils, setting observation and anal sis) |
| Oct. 9 | Soil structure and function review |
| Oct. 12 | Rain garden at Summit Library with Toby Horton (plant id, diversity, soils, setting observation and analysis, maintenance plan) |
| Oct. 16 | Soil performance measures |
| Oct. 19 | Rain gardens in local parks (plant id, diversity, soils, setting observation and analysis, and maintenance plans) |
| Oct. 23 | Ecological function measurement and calculation |
| Oct. 26 | Municipal Rain gardens (part 1) (plant id, diversity, soils, setting observation and analysis, and maintenance plan) |
| Oct. 30 | Measuring design function versus design goals |
| Nov. 2 | Municipal Rain gardens (part 2) (plant id, diversity, soils, setting observation and analysis, and maintenance plan) |

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| | |
|---|---|
| Nov. 6 | Essentials of rain garden evaluation |
| Nov. 9 | Design development |
| Nov. 13 | Design development |
| Nov. 16 | Site visit and documentation |
| Nov. 20 | Site plans and planting design standards |
| Nov. 21 | Site plans and planting design standards |
| Nov. 27 | Evaluating your design |
| Nov. 30 | Design development – technical drawings review |
| Dec. 4 | Design development |
| Dec. 7 | Final Presentation |

## ASSIGNMENT DUE DATES

| | |
|---|---|
| Sept. 14 | Initial species list in excel format (5 points) |
| Sept. 21 | updated species list with site richness and evenness (5 points) |
| Sept. 28 | soil description worksheet (5 points) |
| Oct. 5 | updated species list with recommended uses (5 points) |
| Oct. 12 | updated species list with both Shannon and Simpson's diversity index calculated (5 points) |
| Oct. 19 | updated soil performance worksheet with recommendations (10 points) |
| Oct. 26 | suggested rain garden species, based on your observations (10 points) |
| Nov. 9 | in class, Garden evaluations (10 points) |
| Nov. 16 | in class, design concept and program (10 points) |
| Nov. 30 | in class, technical drawings review (10 points) |
| Dec. 6 | noon, Final Drawings and Maintenance Plan (75 points) |