West Windsor Community Park Rain Garden Final Report

An Internship Project for the 2021 Rutgers Environmental Stewards Program

Steffen Parratt

July 2022

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Report Summary

This report describes Steffen Parratt's internship project for completion of the 2021 *Rutgers Environmental Stewards program.* This project was to build a rain garden in West Windsor's Community Park, at the request of the Township's Environmental Commission. This report, and related resources, can be found on the project website. A news story about this rain garden appeared on our Township's website.

This report is intended to serve three purposes:

- A final deliverable for project approval by my host organization,
- An archival reference for the Township of West Windsor, and
- An educational document for community members and fellow Rutgers students.

Project Goal

To create a rain garden in Community Park to collect water that is eroding an embankment and flowing over a pedestrian walkway. This will also serve as an educational demonstration of rain gardens and native pollinator plants. It will be a visually attractive addition to our park.

Problem Description

Figure 1 is a photograph of a section of Community Park. The dark square is the skatepark, and the path wrapping around it is an asphalt pedestrian walkway. The skatepark was built on a bed of porous gravel. Water exits from under the western corner of the skatepark, shown by the large white dot. The water follows the white arrows, flowing down the embankment, crossing the pedestrian path, following the second arrow to the low point in the shadow of a tree.

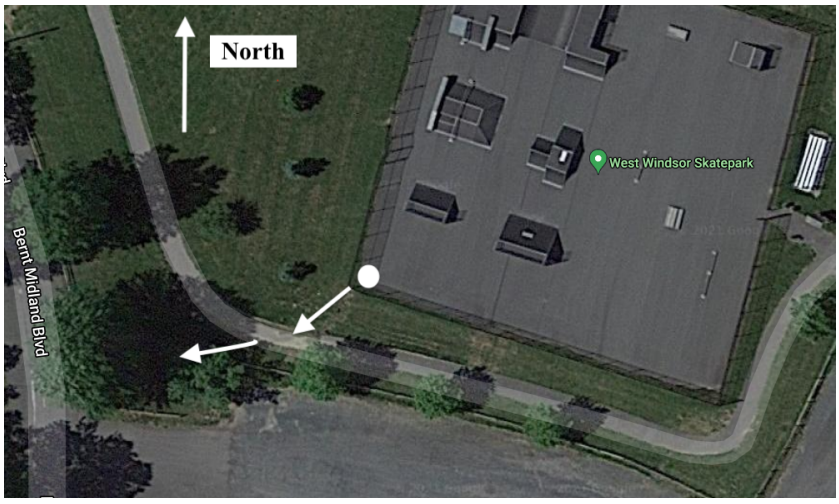


Figure 1: Satellite photograph of the skatepark

The left-hand photograph of Figure 2 shows the skatepark corner from the pedestrian walkway. Although it had not rained for more than a week when this photograph was taken, the water continues to seep out from under the park, eroding the surrounding lawn. In the foreground of the photograph are ruts left by mowing equipment passing over the muddy lawn.

Figure 2: Erosion caused by water exiting porous material under the skatepark

The right-hand photograph of Figure 2 shows the view from the corner of the skatepark: the water flows down the eroded embankment, crosses the pedestrian walkway, and collects in the low area just past the sign posted along the path. When this area overflows, the water drains to the existing stormwater management basin for this section of the park, as shown in Figure 3.

Figure 3: Existing stormwater management basin

In the colder months of the year, the water flowing over the walkway sometimes freezes on the asphalt and becomes a slipping danger for pedestrians. To solve the problems of erosion, mud, and ice patches, the Township proposed creating a rain garden at the corner of the skatepark to collect and infiltrate this water.

Problem Solution

We solved the Township's water flow problem by constructing the rain garden shown in Figure 4. It is approximately 55 feet in length, 25 feet in width at its widest, and is filled with 17 species of native pollinator plants.

We have observed the garden almost daily since its construction, and there is no longer any water crossing the pedestrian path.

Figure 4: Community Park Rain Garden

Project Details

This project was conducted in five discrete phases, which are described in the following pages:

- Design
- Hydrology
- Horticulture
- Education
- Maintenance

Timeline

- Design -- Summer 2021
    - Measured the site elevations, designed the garden, created a work plan, and received utility and town approvals to dig in the area
- Hydrology -- Fall 2021
    - Conducted infiltration tests, excavated the garden, created a berm, installed fencing to ensure the site was safe for park visitors
    - Tested the performance of the garden through late fall, winter, and early spring. Modified the garden design to improve performance
    - Experimented in auguring sand wicks
    - Observed moisture content to inform plant selection
- Horticulture -- Spring 2022
    - Filled garden basin with rocks, coarse sand, compost, soil, and mulch
    - Finalized plant layout, researched nurseries, ordered plants, planted, and nurtured
- Education -- Summer 2022
    - Completed educational materials (including this report)
    - Posted signage at the garden
    - Created a website for the garden
    - Published a news story on our town website, and publicized with an email blast
    - Share our success story with the Rutgers Environmental Stewards program
- Maintenance -- ongoing
    - Visit the garden almost daily: weed, water (as necessary), remove dead plants, pick up litter, trim edges (as necessary), inspect for insect infestations, etc.

Design

The objective of this phase was to create a design for the proposed rain garden, and to receive approval by my host organization contact. This section describes the physical dimensions of the rain garden, its elevations and grades, materials, garden layout, and native plants. I used the *Rain Garden Manual of New Jersey* as a reference for designing the garden.

Site Selection

The first step in designing a rain garden is to choose its location. This was pre-determined by the problem that was presented to me -- the garden was to be located where it could capture the groundwater flowing from underneath the skatepark.

Sizing the Garden

Determining the appropriate size and depth for this rain garden was ambiguous. Typically, a rain garden is sized by measuring the area of an associated impermeable surface, such as a driveway, parking lot, or roof that sources the water flow to the garden. After determining the infiltration characteristics of the site soil, there are calculations to determine the appropriate size and depth of the garden, so that runoff water does not overflow into a stormwater drain.

In this case the rain garden is required to capture water seeping out from under the skatepark. There is a constant flow of groundwater, but it is a relatively low volume compared to rainwater running off an impermeable surface. There is also surface runoff from the neighboring field and skatepark.

It is not clear how to calculate this amount of runoff in this case, as this is not a typical hard surface scenario. Also, it is not a significant problem if the garden does not capture all storm runoff, as any water that would overflow the garden would merely cross the sidewalk and settle in the depression on the other side of the walkway, and then overflow to the edge of the park, as it does today. My thought process was to design a garden that aesthetically fit the area, run percolation tests, and observe how the garden performed in actual rainstorms before doing any planting. If it couldn't handle a medium-size storm, I would consider deepening the garden.

Layout

The left-hand side sketch of Figure 5 shows a top view of the garden layout. Starting at the top right, "skate park" shows the corner of the skatepark corresponding to the earlier photographs. 21 feet away from the corner is the asphalt walkway. Following the walkway to the left, it reaches the widest part of the rain garden. This shows a berm that is 10 feet wide, rising 1.5 feet high along its ridge, and then descending into the garden. The horizontal lines along the bottom of the figure are a front view showing the elevation of the path and the future berm relative to the elevation of the skatepark. On the right side of the diagram, the walkway is approximately 2 feet below the elevation of the skatepark and drops to 3 feet below the skatepark elevation as we move to the left.

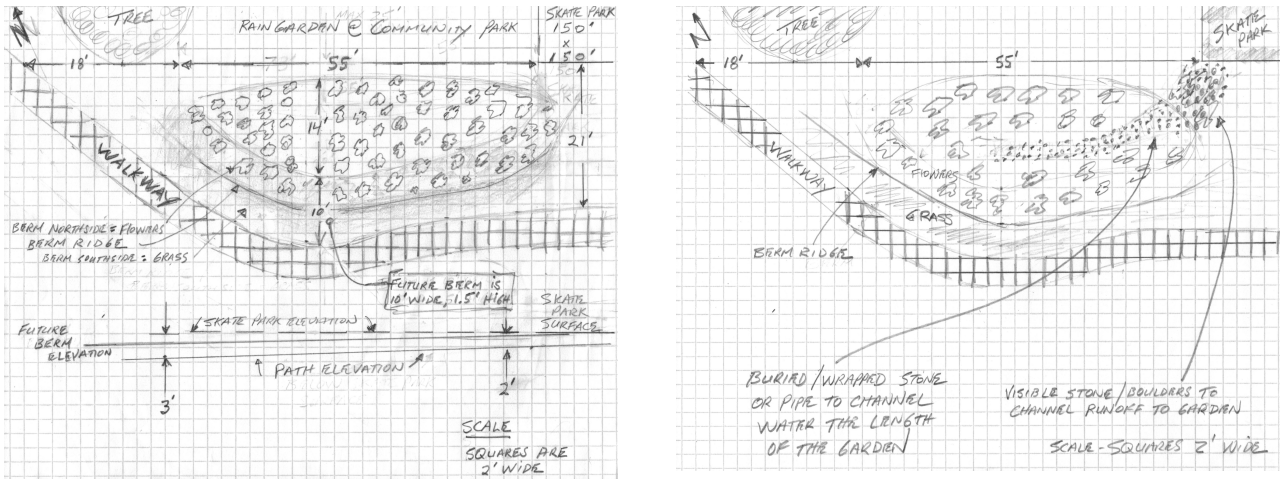


Figure 5: Garden layout

I was concerned that the groundwater would not flow into the garden, but, instead, continue to follow its current path and seep under the berm and run over the walkway. To ensure that the water flowed through the garden, I designed a deep trench from the water source into the basin of the garden, to be filled with rock or a pipe (eventually I chose to use coarse sand), to ensure the water flowed in the correct direction, as shown in the right-hand sketch of Figure 5.

Elevations

Figure 6 shows a depiction of the cross-section of the rain garden, the walkway is on the left and uphill is on the right, before and after excavation. Circle 1 shows that presently the area drops approximately 2 feet over the 25 feet from the top of the garden to the walkway. Circle 2 shows the excavated material being piled up onto the berm, which is 10 feet in width and reaches 1.5 feet in height. Circle 3 shows the excavated area being partially backfilled with porous and organic material. The berm slope is 3:1, which is recommended.

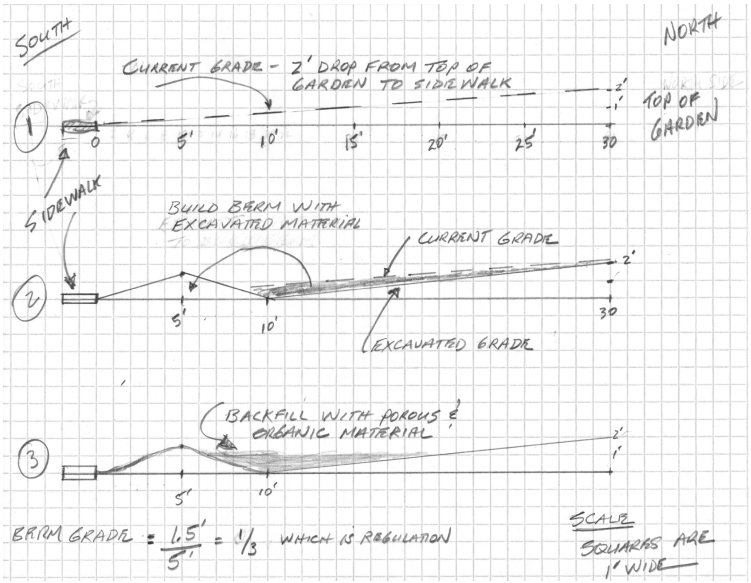


Figure 6: Elevations before / after excavation

Plants

The primary purpose of a rain garden is to capture water and infiltrate it into the ground. Plants assist in that function by having roots that reach down and loosen the soil. However, rain garden plants can fulfill other functions as well, such as creating an oasis of natural plants for birds, butterflies, bees, and other pollinators. Properly arranged, these plants also can provide a beautiful educational display for park visitors.

Types of Plants

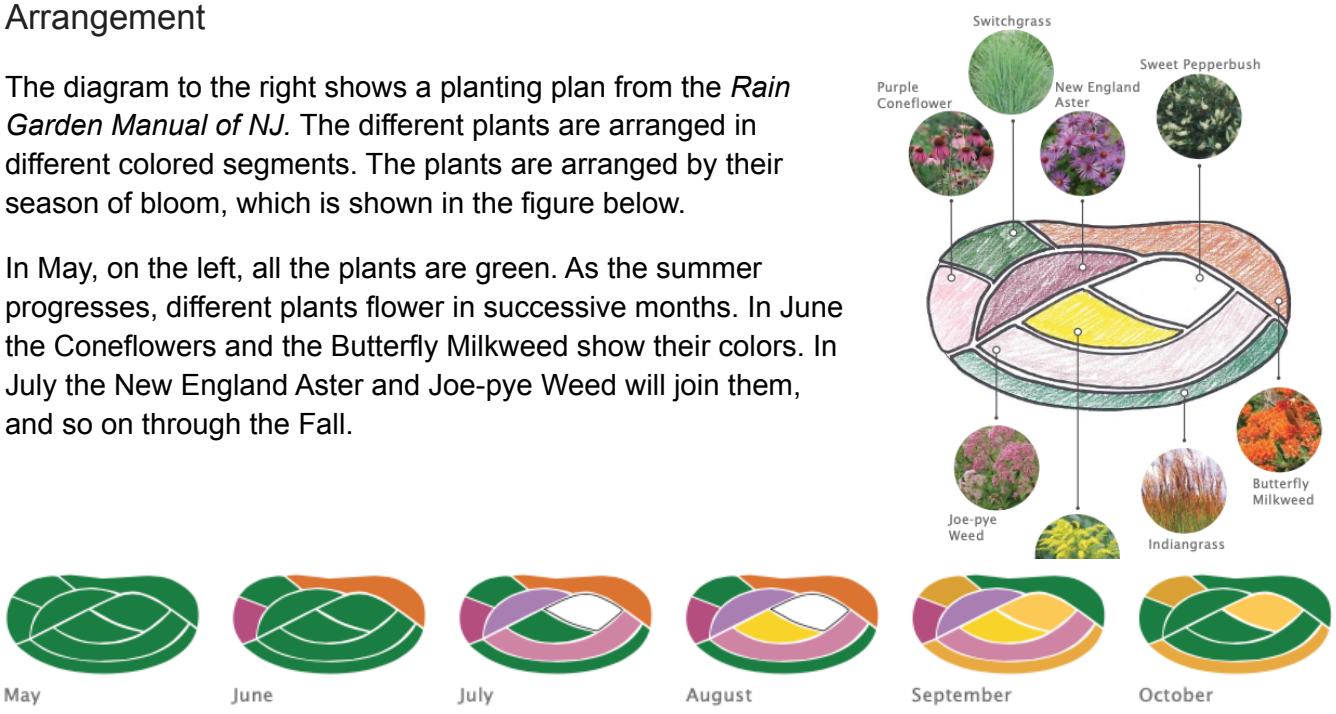
We chose plants that are:

- Native to the region
    - Favored by birds, bees, butterflies, and other pollinators
    - Ideally not overly favored by deer, as the garden does not have any fencing
- Tolerant of full sun and poorly drained clay soil
- Consistent and complementary to the nearby pollinator garden
    - The *Wild for West Windsor* group planted a pollinator garden near the rain garden and they shared their design, which we used as the foundation of the rain garden design. We used many of their same plant types, which provides visual coherence to visitors as they enter the park and pass by the two gardens.

Arrangement

The diagram to the right shows a planting plan from the *Rain Garden Manual of NJ.* The different plants are arranged in different colored segments. The plants are arranged by their season of bloom, which is shown in the figure below.

In May, on the left, all the plants are green. As the summer progresses, different plants flower in successive months. In June the Coneflowers and the Butterfly Milkweed show their colors. In July the New England Aster and Joe-pye Weed will join them, and so on through the Fall.



Example plant arrangement

Moisture

In addition to the season of bloom, an arrangement also needs to consider the moisture content of the soil and the presence of standing water. The page below from the same *Manual* shows the Wetland Status codes (e.g., OBL, FACW) for different levels of water content. Flowers need to be in locations that match their water tolerance.

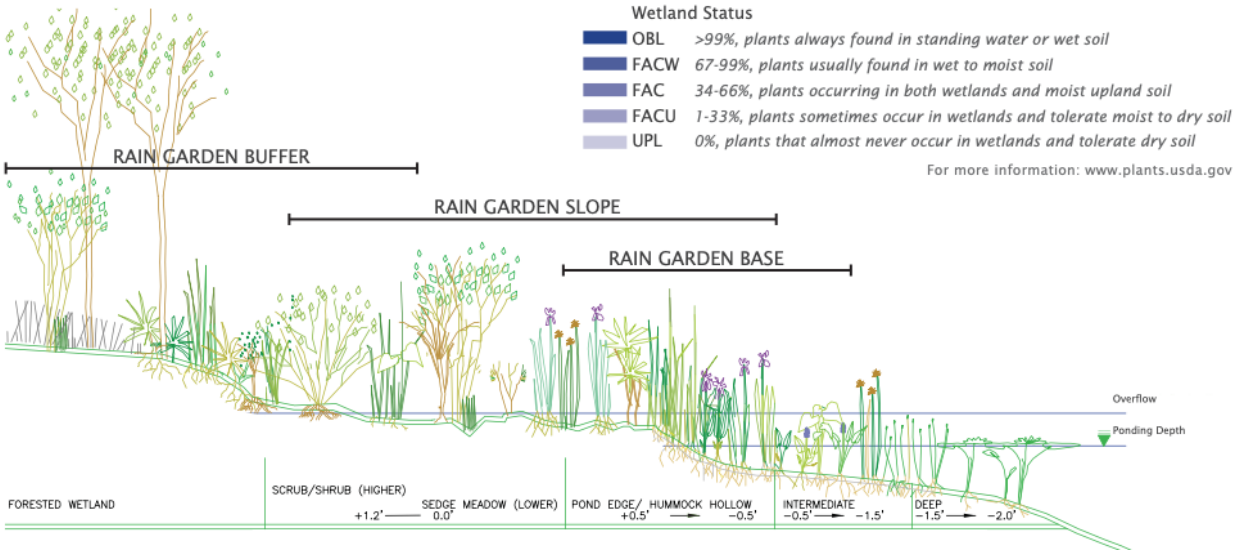


Figure 7: Wetness Status Classification

In addition to considering the blooming season, blooming color, and water levels, we also have to consider the directions from which the garden will be viewed, so that tall plants do not obscure the view of shorter plants. Finally, it is worth mentioning again that our rain garden is unusual in two respects that complicate the design.

First, rain gardens are typically located on flat surfaces and are designed to have flat floors. This garden is on an embankment, and so the rain garden is not flat. Water flows down the sloping embankment to the base. The slope will be well drained, and the base will be much wetter.

Second, rain gardens are typically fed by surface water, but this rain garden is mainly fed by water flowing underground. This water flows from the skatepark to the base. Consequently, some of the embankment slope area is wetter than the rest of the slope. After the garden was excavated, I observed the water flows and determined the impact on the selection of plants that we placed on the slope.

Figure 8 below shows the relevant constraints for our rain garden. The wetter base and dryer slope were mapped out, as well as the path that the water follows from the skatepark to the base. The diagram on the bottom of the page shows the viewing angles of the garden; there is no “back” to the garden where tall plants can be placed and “front” for the shorter plants. With all of these viewing directions, it makes more sense to place tall plants in the center of the garden, and shorter plants around the border.

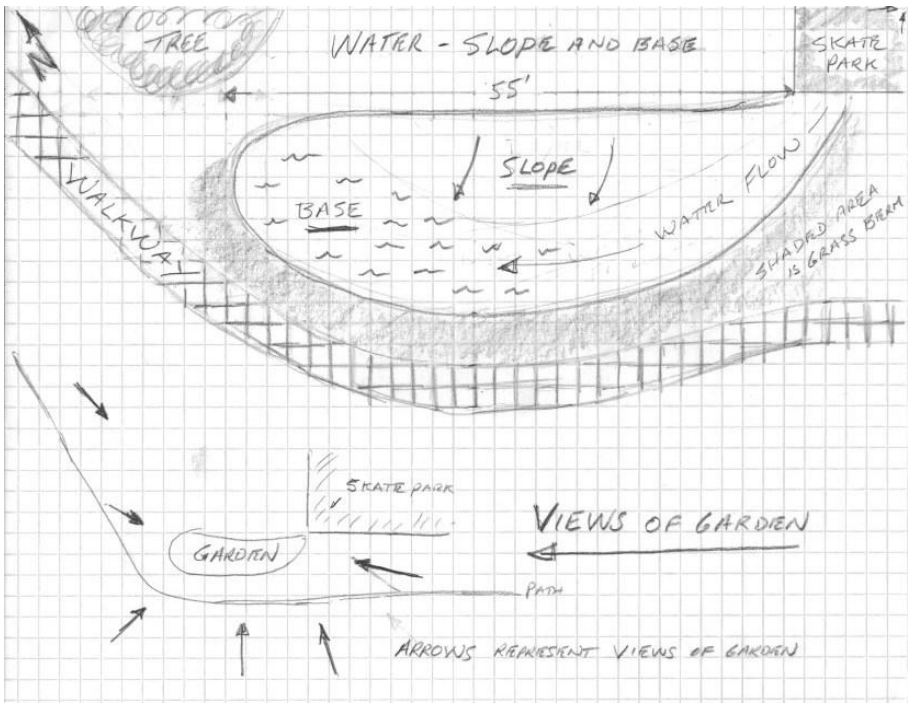


Figure 8: Water and viewing constraints for our garden

We can now segment our garden by water level and plant height, and create zones for different types of plants.

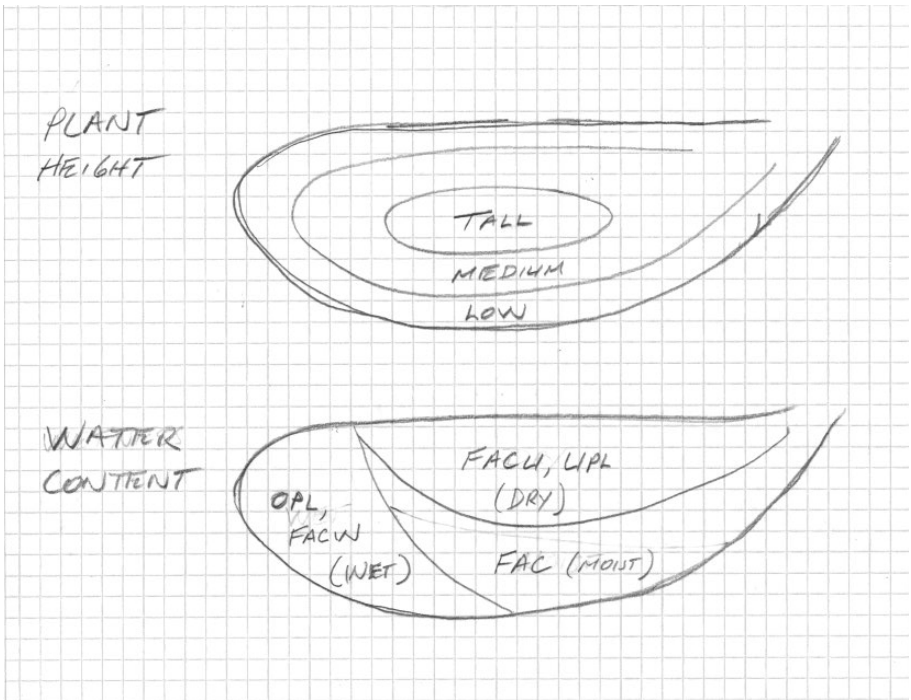


Figure 9: Creating height and water content zones

We then intersected these two diagrams to create planting zones, as shown in Figure 10.

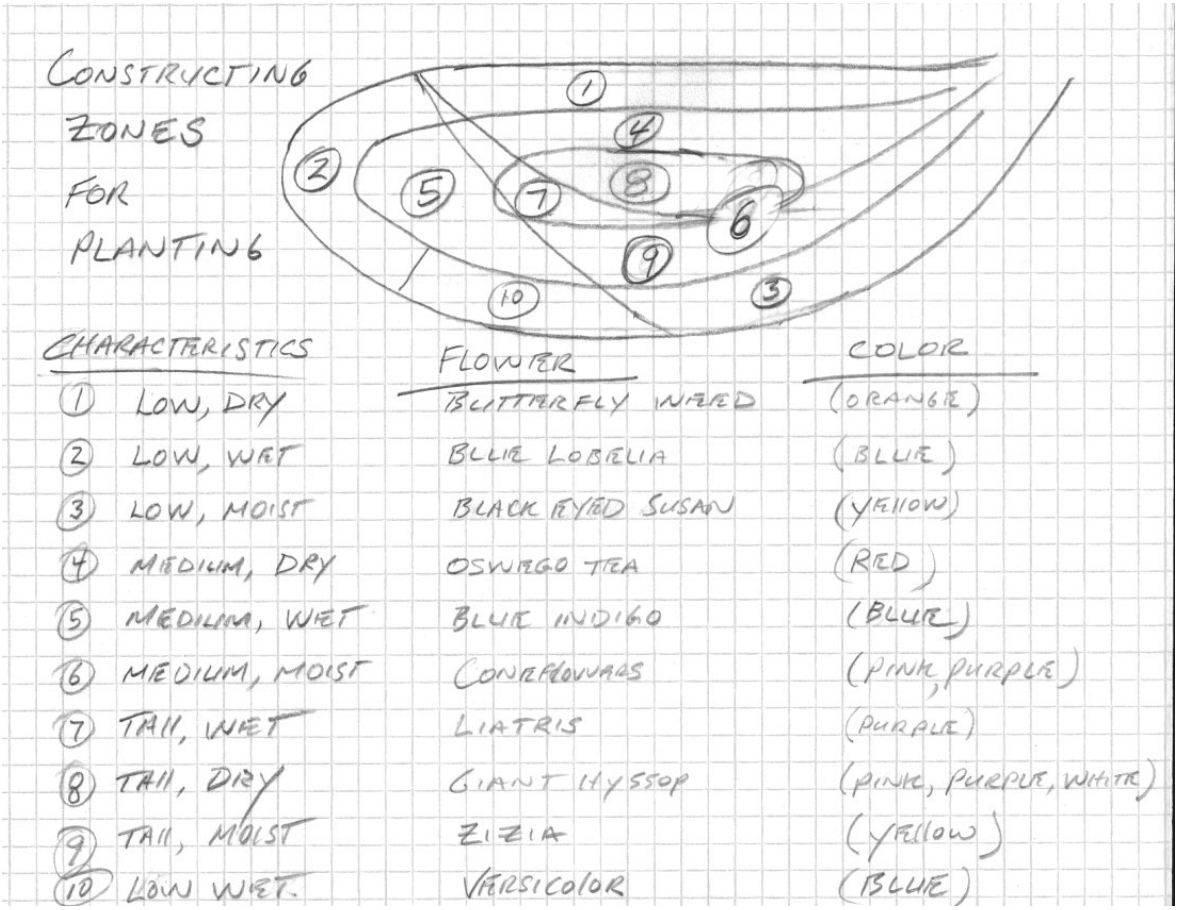


Figure 10: Planting zones

Based on each zone's characteristics, we chose flowers from the set provided by *Wild for West Windsor* (shown in Figure 11) to populate the garden.

zone	Scientific Name	Common Name	height	bloom	color	Optimal Sun	Soil - clay	deer resist	water
	Wild for West Windsor								
	Carex Pensylvanica	Sedge Grass	8 inches	late spring, early summer	green, purp, brown	partial shade	no	high	UPL
1	Asclepias Tuberosa	Butterfly Weed	1 to 2 feet	summer	orange	full	no	high	UPL
10	Iris Versicolor	Harlequin Blueflag	2 to 3 feet	May-August	blue, purple	full	yes	high	OBL
4	Monarda Didyma	Oswego Tea	2 to 4 feet	late spring, summer	red	full	yes	some	UPL, FAC
	Tradescantia Ohiensis	Ohio Spiderwort	2 to 4 feet	March - August	light blue	full	yes	some	FACW, UPL
2	Lobelia Siphilitica	Great Blue Lobelia	1 to 4 feet	July, Aug, Sept	blue	partial	yes	high	FACW+, OBL
3	Rudbeckia Fulgida	Black Eye Susan	3 feet	late spring to fall	yellow	full	yes	some	FACU-, FACU
5	Baptisia Australis	Wild Blue Indigo	3 to 4 feet	late spring to early summer	blue	full	yes	high	FACW+, OBL
7	Liatris	Dense Blazing Star	3 to 4 feet	summer	purple	full	yes	some	OBL
6	Echnacea purpurea	Purple Coneflowers	3 to 4 feet	summer	pink, purple	full	yes	some	FAC
9	Zizia Aurea	Golden Alexander	4 feet	spring to early summer	yellow	full	yes	some	FAC-, FAC+
8	Agastache scrophulariifolia	Purple Giant Hyssop	3 to 6 feet	late summer to fall	pink, purple, white	partial	no	high	FACU
	Helianthus maximiliani schrad	Maximilian Sunflowers	6 to 8 feet	Aug to Nov	yellow	full	yes	some	WELL DRAINED

Figure 11: Wild for West Windsor's plant list

Figure 12 below shows the colors of the resulting garden.

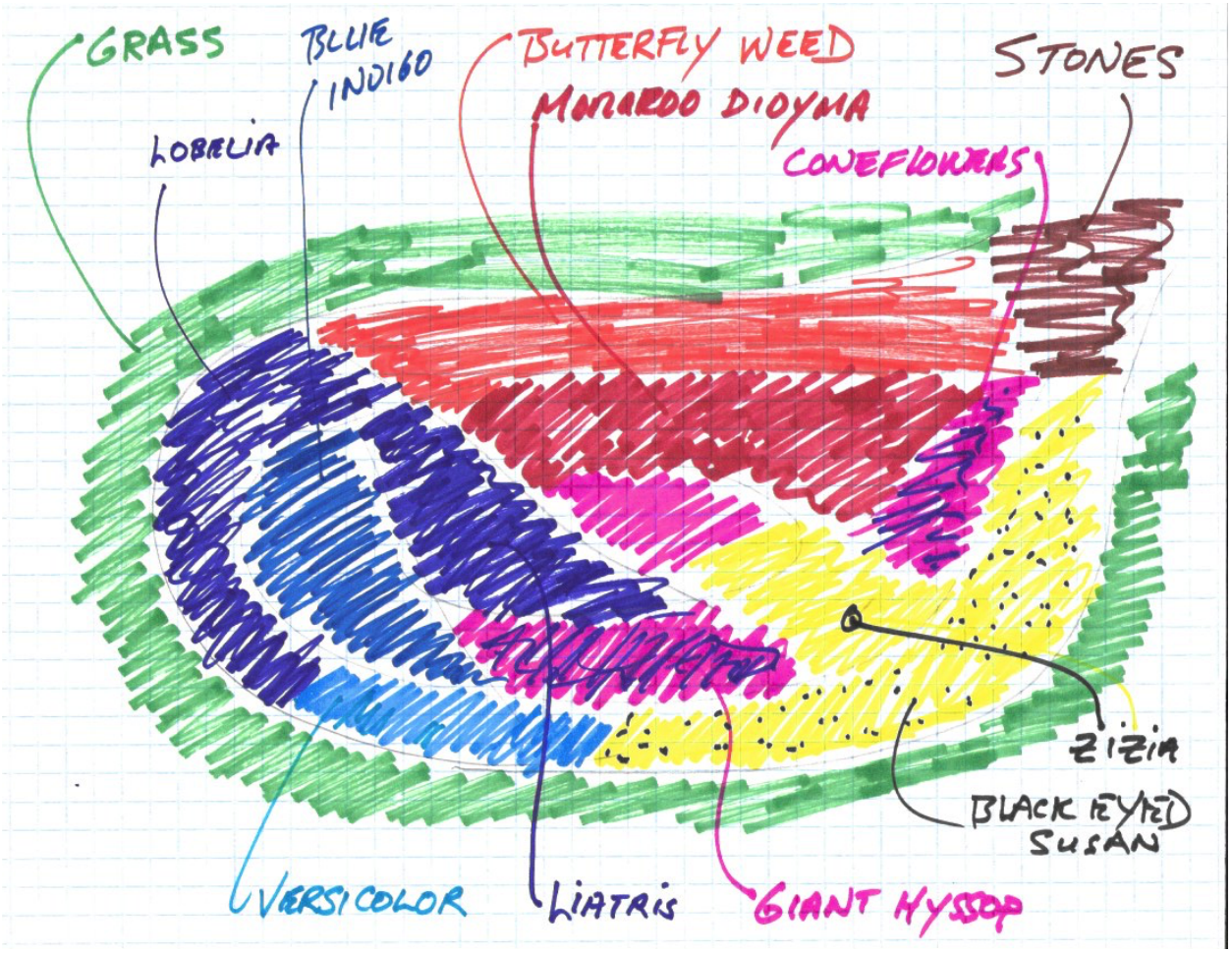


Figure 12: Rain Garden colors

Figure 12 shows my original design. Over the Winter and Spring I worked with an expert gardener in our community, Paula Bal, to revise and improve my design. This revised design is described in the Horticulture section.

Hydrology

This section focuses on channeling the water flow exiting underneath the skatepark so that it is contained by the rain garden, infiltrates into the ground, and does not cross over the walkway.

The first step in constructing a rain garden is to understand the porosity of the soil by infiltration tests. These tests require digging holes in the ground, which requires approval by the utility companies and the town.

Approvals to Dig

Digging in areas that might have utility lines requires a call to NJ's *One Call* service, which coordinates service visits to mark out any utilities in the vicinity of the area to be excavated. It turned out that the process worked differently than described in the *Rain Garden Manual of New Jersey*. The details of the *One Call* process, and their approval confirmation email, can be found in Appendix A.

Infiltration Tests

The required depth of a rain garden depends on the porosity of the underlying soil. Porous soils allow for shallow gardens because the water quickly drains into the ground. Less porous soils require either deeper gardens backfilled with porous soil, or even drainage holes to be drilled into the base of the garden.

An infiltration test requires digging a hole one foot deep and six inches wide. The hole is filled with water. When that water has completely drained, the hole is filled again with water and this time the water height is measured every hour until the hole is empty. It is advised to test the infiltration in several different locations, and to average the results.

The figure below shows the location of the 4 test holes, 9 feet apart, along the spine of the rain garden. Each hole is 6 inches wide and 12 inches deep.

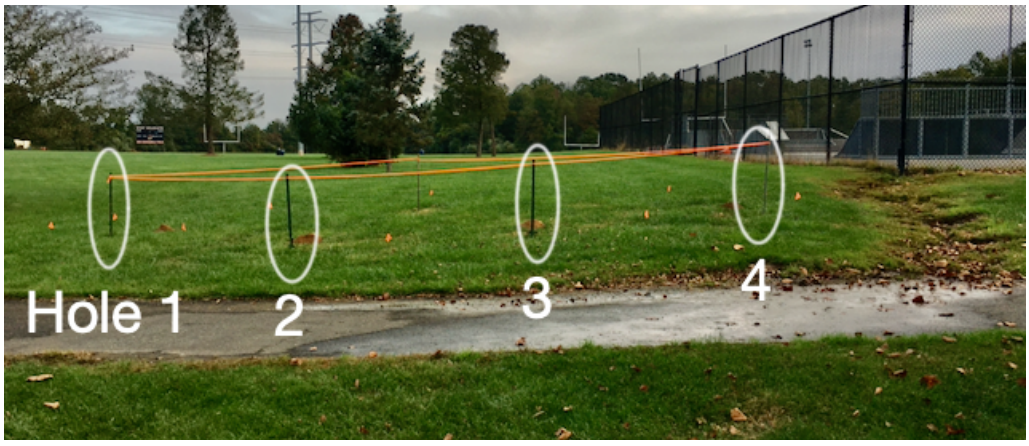


Figure 13: Infiltration test holes

The results of two infiltration tests, a week apart, are shown in the table below. Red text denotes that the hole was completely dry, so any computed drainage rates are underestimated. In both cases the soil was soaked from recent rain, and puddles were visible throughout the park.

	Elapsed	Drainage Depth (inches)				Drainage Rate (inches/hour)			
Test 1	time (hrs)	hole 1	hole 2	hole 3	hole 4	hole 1	hole 2	hole 3	hole 4
3:00 PM	0.0								
6:30 PM	3.5	5	5	7	4	1.4	1.4	2.0	1.1
8:00 AM	5.0	12	12	12	7	2.4	2.4	2.4	1.4
2:00 PM	23.0	12	12	12	8	0.5	0.5	0.5	0.3
Test 2									
9:00 AM	0.0								
11:00 AM	2.0	5	5	6	4	2.5	2.5	3.0	2.0
1:00 PM	4.0	6	6	7	5	1.5	1.5	1.8	1.3
5:00 PM	8.0	8	9	12	6	1.0	1.1	1.5	0.8
					average	*1.7*	*1.7*	*2.1*	*1.3*
		Red = hole was dry				*Red = hole dry, so rate is underestimate*			

Table 1: Infiltration test results

The first three holes drained at a rate greater than 1.5 inches/hour and were dry within 24 hours, which is adequate infiltration for a rain garden and does not require soil amendments or other actions to increase infiltration. However, hole 4 is along the drainage path and the ground was always saturated. This suggested that water needed to be diverted towards the other holes, a feature included in our design. Once that happens, that ground would likely become saturated, in which case those holes might not infiltrate adequately either. After completing this test I did not know conclusively whether I would need to take additional measures to increase the infiltration capacity of the garden.

Diversion Test

This is not a typical rain garden where water runoff from an impenetrable surface is guided directly to the garden via a drainage pipe. In this case, the water source is flowing underground and down an embankment. Our ability to influence the direction of the underground flow was uncertain. I was concerned at the outset that we would excavate the garden, build a berm, plant flowers, only to find that the water continued to follow its current path, under the berm, across the walkway, rendering the rain garden useless. I decided to test whether I could intercept the underground water flow and divert into the rain garden.

I dug along the spine of the garden and backfilled the sod into the eroded embankment. As can be seen from the photo on the left of Figure 14, this test was successful -- the groundwater was intercepted and followed the trench. After I completed this work, the walkway dried and has remained dry since, as can be seen in the photograph on the right.

Figure 14: Diversion test

That evening it rained hard, but the trench did not flood, as shown in the photograph below in Figure 15. That day I began widening the trench, to begin forming the bottom of the garden. As the day progressed, the water level continued to rise, filling the basin with water up to the grass. When I finished my work that evening the garden had 4 inches of water as shown on the right. A day later the garden had 5 inches of water, and it took a few days for that water to infiltrate.

I continued to observe the performance of the rain garden as I excavated it. During and after rain storms, I measured and photographed the amount of standing water as it infiltrated over the next several days. The garden would collect up to a foot of water after a storm and it would sit there for days, which was unacceptable because it could lead to safety issues, a breeding environment for mosquitos, and root rot of our plants. Following the *Rain Garden Handbook*, I drilled holes 6 inches wide 12-18 inches deep with an auger to create “sand wicks” throughout the garden and filled them with coarse sand, as can be seen in Figure 16, to increase the infiltration capacity of the garden.

Figure 15: The morning (left) and afternoon (right) after a heavy downpour

The left-hand photograph of Figure 16 shows me using a two-person auger and the right-hand photograph shows the one-person auger I used for the rain garden. Each hole was filled with a bag of coarse sand.

Figure 16: Using an auger to create infiltration “sand wicks”

Secured Site for Winter

Figure 17 shows how I secured the site for winter. The garden was surrounded by 28 inch high green fencing to keep pedestrians and pets out of the garden area for their own safety. I observed the garden after Winter rain storms to determine if the garden was infiltrating rain water adequately. When the garden was planted the fencing was removed.

Figure 17: Fencing to secure the site for Winter

Hydrology Tests and Design Modifications

It was always our plan to test the performance of the garden's infiltration capabilities through the Winter. This turned out to be a wise decision because through observations after many rain storms we determined that the garden was not infiltrating adequately, even with the sand wicks that had been created. We made three design modifications to increase infiltration and eliminate the possibility of standing water in the garden.

Design Modification: Horizontal Sand Wicks

The first design modification I tried was to create horizontal sand wicks to collect and infiltrate the runoff before it reached the garden basin. A horizontal sand wick is similar in concept to a vertical sand wick, but it extends laterally. The left-hand photograph of Figure 18 shows the horizontal sand wicks, filled with water, before being backfilled with sand. As the water flows down the embankment, it fills the horizontal sand wicks before reaching the basin of the garden. As can be seen from the right-hand figure, even with the vertical and horizontal sand wicks the basin collected a large amount of standing water.

Figure 18: Horizontal sand wicks (left) did not solve the standing water issue (right)

Design Modification: Sand Aquifer

To increase the water infiltration capacity of the garden I extended the concept of a sand wick by digging a deep and wide hole in the basin and backfilled it with 13+ tons of rocks and coarse sand as shown in Figure 19.

Figure 19: Creating an Aquifer by digging a deep and wide hole (left) and filling it with 13 tons of sand (right)

After backfilling the basin with coarse sand and rock to create an aquifer, I observed the rain garden after heavy rain storms and found that there remained the possibility of standing water, as shown in Figure 20.

Figure 20: Standing water on the aquifer

To eliminate the possibility of standing water, I installed a water overflow drainage pipe, as shown in Figure 21. The installation is a 4-inch perforated drainage pipe, surrounded by heavy plastic and weed barrier fabric, set in a bed of porous stone. It has a solid 1.25-inch PVC pipe within it, to ensure that it is never clogged by roots, and capped on both ends with grates. The conduit starts at the level of the garden surface and then drops 2 inches over the 4-foot pipe.

Figure 21: Water overflow conduit

When the entire garden aquifer is saturated and there is standing water, the conduit ensures the standing water drains away into the low spot on the other side of the pedestrian path. The drainage pipe is not visible after the compost and mulch are applied. Every few years I will pull the grates off of the pipe ends and ensure the pipe is clear from obstructions and roots. If there are roots, they can easily be removed. I have tested the drainage pipe after several storms and there has never been any standing water in the rain garden.

Horticulture

After we were satisfied with the performance of the rain garden in collecting, holding, and infiltrating rain water, I then turned to the horticulture stage of the project. The hydrology phase was hard physical labor, but it was conceptually simple because I had previous experience with groundwater and drainage. The horticulture phase was more difficult for me because I had little previous experience with flower garden design. Fortunately, a native pollinator plant expert from our community, Paula Bal, volunteered to coach and help me through the process.

Revised Design of Garden Layout

In late Winter, Paula and I shared ideas about the future garden's appearance, and what types of plants should be located, given the different levels of moisture in different parts of the garden, including the dry berm, the wet basin, and the mixed moisture slope. Paula revised our design, as shown in Figure 22.

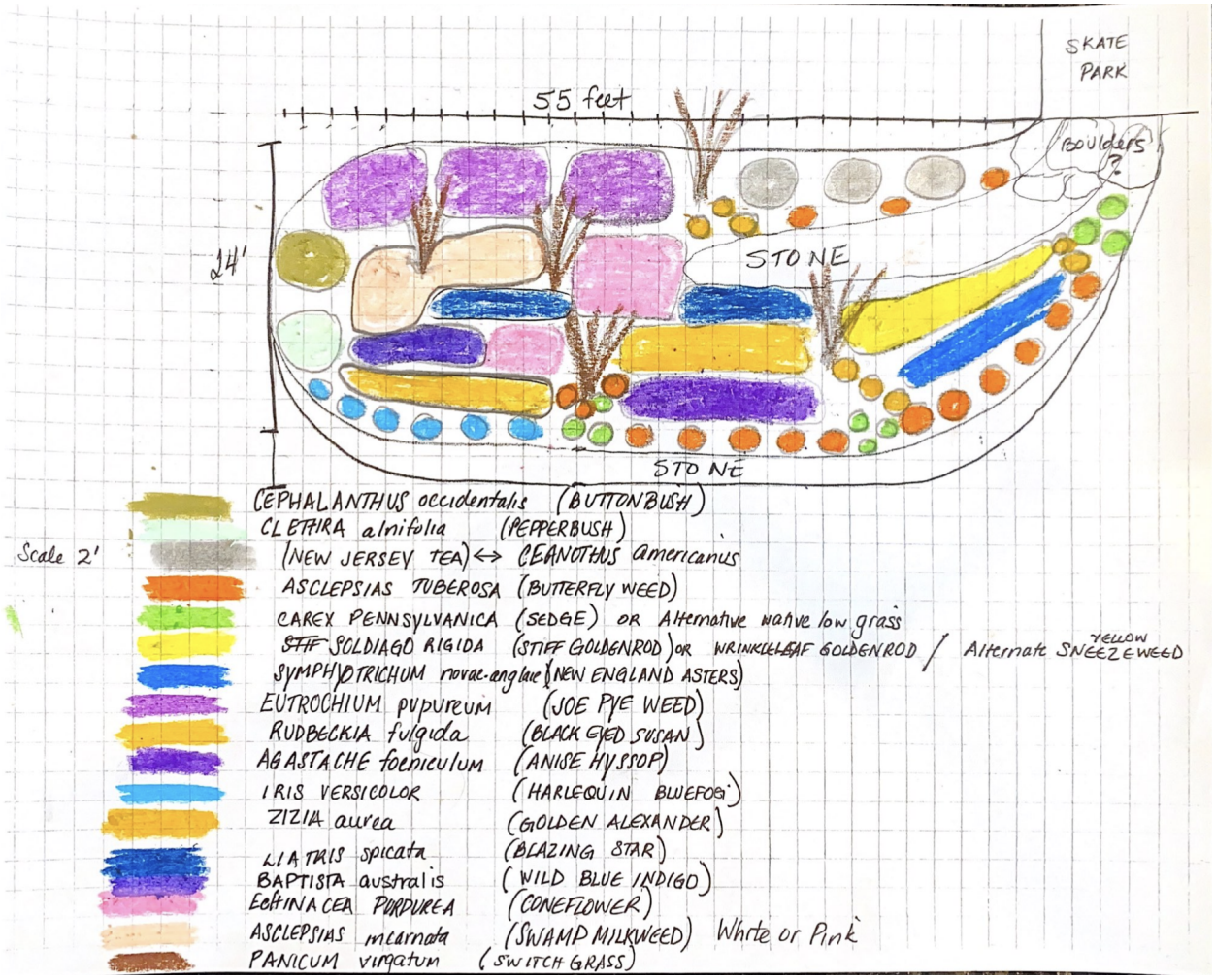


Figure 22: Revised design of garden layout

Paula's design specified mostly the same plants as the nearby Pollinator Garden, as shown in Figure 23, which has grown very successfully, and has been mostly deer resistant, so we were fairly confident that the deer would not be too much of an issue for our Rain Garden.

Figure 23: Nearby Pollinator Garden

In early February we ordered the plants from *PinelandsDirect.com*, who had supplied the plants for the Pollinator Garden. Paula provided a list of plants, as well as a list of backup plants, in case *Pinelands* could not fill our initial order.

Soil Preparation

Leading up to Planting Day in late May, Paula and I applied soil amendments, compost and soil to the garden. First Paula applied gypsum to the clay soil and Espoma BioTone and Microhhorazie fungi to the sand base shown in Figure 24.

Figure 24: Applying soil amendments

We then covered the sand surface with some of the original soil that we had stored on top of the berm. Figure 25 shows that berm soil being transferred to the garden.

Figure 25: Original soil being added back to garden

After adding the soil level, we covered the soil surface with eight (8) cubic yards of rich compost donated by West Windsor Township. Figure 26 shows the compost layer.

Figure 26: Compost added on top of the soil layer

Finally, Paula applied fertilizer to the compost layer. We then removed the surrounding fence, mowed down the tall grass, and started moving mulch (donated by the Township) to the berm, as shown in Figure 27. We were now ready for Planting Day.

Planting Day

Paula picked up the plants in late May from *PinelandsDirect*, and she invited our Environmental Commission members and selected expert gardeners from our community.

Figure 27: Garden being prepared for Planting Day

Planting day was scheduled for May 29th. Our group planted our new plants under Paula's direction, we mulched the Rain Garden and nearby Pollinator Garden, and then we watered the new plants at the end of the day. Figure 28 shows our team at work.

Figure 28: Planting team at work

Our Township kindly provided watering equipment and access to a water source at the nearby baseball field concession stand, which the team had used the year before to water the new Pollinator Garden nearby.

I have visited our garden nearly daily for the past month, and watered it several times. Although there is clear evidence of animals feeding on the leaves, all of the plants have survived, and are healthy. Some of the plants are already flowering!

Education

One of the goals of this project is to help educate West Windsor residents on the benefits of rain and native pollinator gardens, and to provide the inspiration, encouragement, knowledge, tools and guidance to create their own gardens and join the environmental movement.

There are dozens of books on rain gardens and pollinator gardens, with beautiful photographs and illustrations, produced by gifted writers and experts. There are dozens of websites of similar quality. Do all these books and websites motivate people to go outside and create rain gardens and pollinator gardens?

In my experience, a beautiful garden, with its dazzling colors, scents, and wildlife are what inspire people to create their own gardens. If we want to reach a lot of people and raise their awareness -- the garden itself may be the best advertisement.

As I was digging the garden on the weekends, I said hello to folks as they walked by the garden -- who are they? There were plenty of walkers, friends chatting while enjoying their exercise. There were dogs and their humans out for a walk. Young couples strolled by with their children. Kids in the skatepark rode up to the fence and looked down into the garden; their parents, waiting for their kids to finish skating, wandered over to see what I was doing. Families parked their cars nearby and then walked by the garden on their way to the athletic fields. Others parked nearby for the basketball courts, dog park, Waterworks and other activities. A very large number of people walked by the pollinator garden and rain garden every day! How do we leverage this exposure to inspire people to join us and plant their own gardens?

When pedestrians stop to admire the garden, they see the sign explaining these features.

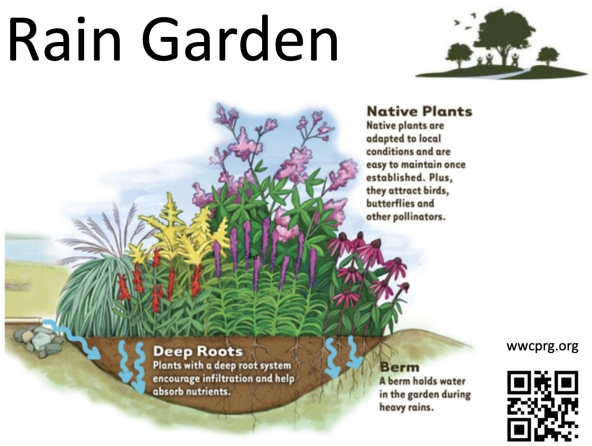


Figure 29: Current signage at the rain garden site

They point their phone to the QR code in the lower-right corner of the sign, or type in the website address. This takes them to the website wwcprg.org (West Windsor Community Park Rain Garden), which is a simple webpage until a more sophisticated site is completed.

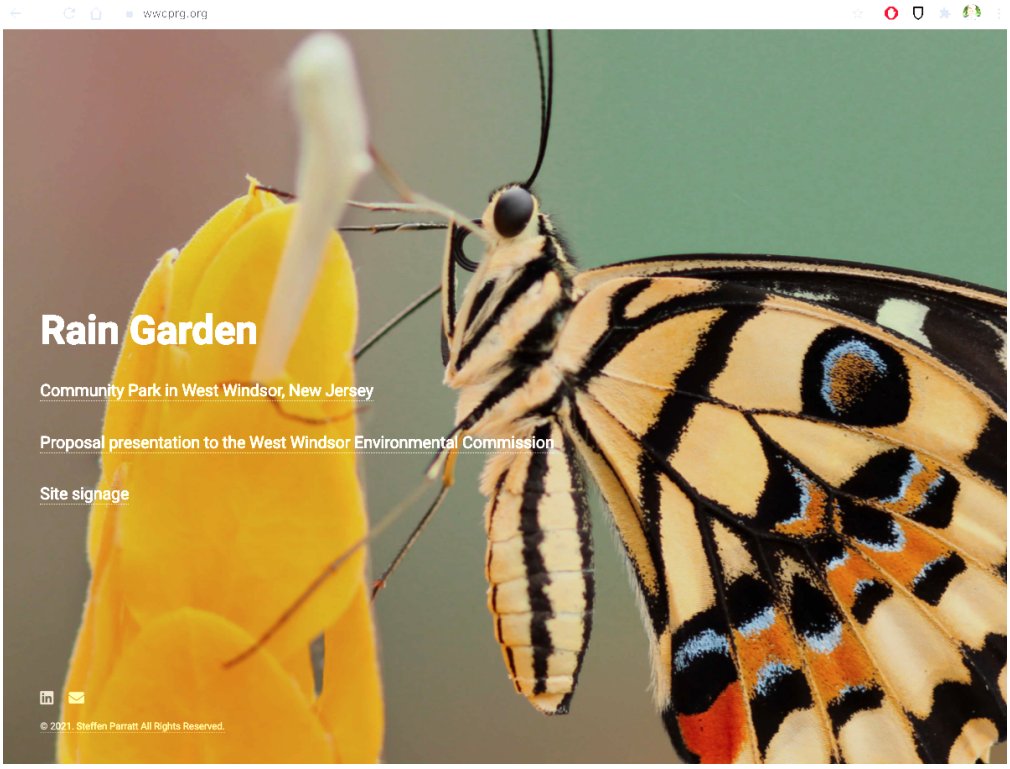


Figure 30: WWCPRG.org website

The website shows a bunch of beautiful garden photos, explains the benefits of native pollinator rain gardens, shows how to construct a rain garden with photos and text, and points to other educational resources. Importantly, it provides a link to wwcprg@gmail.com, that allows them to reach out to our team for advice, guidance, and maybe even volunteer support for their project. In return, we ask for photographs of their project, and to join our volunteer team. Over time, West Windsor Township will be covered with native pollinator gardens and rain gardens!

I frequently visit arboretums, gardens and parks. I enjoy experiencing nature, but I also enjoy studying the design of these areas -- seeing what works well, and what works less well. There are some obvious features of popular natural destinations:

- *Accessible* -- sites that are near parking, with hard surface walkways, are accessible to all ages, the very young to the very old. Clearly this site meets that requirement.
- *Bench in the shade* -- wildflowers bloom in the hotter months and this site is in full sun. It can be difficult for many people, particularly the very young and the very old, to enjoy a garden standing on an asphalt in the blazing hot sun. Having a bench or two in the shade of the nearby trees would be a positive addition. The Township has offered me a free bench and I plan to install it when I receive it.
- *Education* -- small doses of educational materials delivered discreetly without detracting from the beauty of the garden.

- *Something for everyone* -- a family lingers and explores when there is something for everyone to enjoy: a bench for the weary, beautiful flowers and signage explaining some interesting natural facts for curious adults, little surprises for little kids, such as painted plywood bunnies, frogs, and other animal depictions hiding among the plants.
- *Tid*y -- gardens feel special when they are treated special, with love and attention. A wild garden still needs to be a tidy garden: trimmed boundaries, weeded, free of litter and dead plants, bald spots replanted, and readable signage.
- *Variety* -- professionally managed gardens often offer more than just flowers and plants, but also bird houses, beneficial insect habitats, and seasonal displays. An educational sign explaining what is happening underground in the rain garden during the Winter, and what to expect in Spring, builds anticipation for a return visit!

I plan to include as many of these features as possible, so that all passersby linger at the garden, reading about rain gardens, and return often to see what is new and what has changed.

Maintenance

Gardens require maintenance, particularly in the early weeks, months, and years. Watering will be required during dry spells. Some plants will not be suited for the specific environment, for whatever reason, and will need to be replaced. Weeds and invasive plants will spring up alongside the flowers and will need to be removed. Some experts say that the most important question to be answered when planning a garden is -- who will maintain it? Maintenance is very important.

Every garden needs regular maintenance for its health; that is the first consideration. A second consideration is what maintenance is required for the garden's visitors. Like many gardens, this is a showcase garden, for educational purposes, in a heavily trafficked area. If the garden is always tidy, healthy, and interesting, visitors will form a positive view of rain gardens. If it is unkempt, messy, and neglected, visitors will form a negative view.

Sometimes a garden can appear messy, but for good reason. Cutting back some stalks in the fall, but leaving them standing, can be very beneficial for insects, birds, and other wildlife, but look messy for the uninformed. Having educational signage explaining the benefits of these stalks, and other aspects of a garden in winter, can turn a negative view into an enlightened positive view!

Appendices

Appendix A: NJ One Call

According to the Rain Garden Manual of NJ, rain gardeners should call 1-800-272-1000 to locate utility lines before digging. The *Manual* instructs gardeners to mark the proposed rain garden with while spray paint or white flags.

I called NJ One Call and spoke with a friendly representative who informed me that is not the process they follow in this type of situation. Instead, they start with the nearest intersection (Princeton Hightstown Road and Bernt Midland Blvd), identify a direction of travel (North along Bernt Midland) a specific distance (700 feet), and then identify a quadrant (another 150 North and 100 East of Bernt Midland) to be checked for utilities. Since I was down in Maryland at the time of this call, the representative and I did the whole process using Google maps, which provides latitude and longitude data, which we shared. She then submitted the ticket.

Minutes after that call, I received a call from a representative of Sunoco Pipeline. He was very familiar with the park and wanted to know specifically where I was planning to dig. He was concerned about the pipeline that runs under the high-voltage lines further down Bernt Midland. I explained where the garden would be located, and he told me that area was a far distance away from the pipeline. Four days later I received an email (below notifying me that all utilities were reporting no conflict.

```
From: <nj@occinc.com>
Date: Tue, Oct 5, 2021 at 1:19 PM
Subject: Ticket Check Status for NJ Ticket 212741701
To: <steffen parratt>

Ticket Number: 212741701
Location:      BERNT MIDLAND BLVD WEST WINDSOR, NJ

As of 10/05/21 13:19 EDT, participating facility owners have responded to Ticket Check
as follows:
```

District Code	Status
COMCAST CABLEVISION OF MERCER	Clear/No conflict
JERSEY CENTRAL POWER & LIGHT	Clear/No conflict
MCI	Clear/No conflict
PSE&G ELECTRIC & GAS	Clear/No conflict
NEW JERSEY AMERICAN WATER COMP	Clear/No conflict
ENERGY TRANSFER	Clear/No conflict
WEST WINDSOR TOWNSHIP	Does not participate in Ticket Check. Please call (609)799-8370 for more information

```
Does not participate in Ticket Check: This member does not post their positive
response status back to this system. It does not mean that they were not
notified of the request to excavate.
```

The email noted that this service does not cover any underground services for West Windsor Township. I contacted Mr Dobromilsky and he confirmed, after some research, that there are no township utilities in the vicinity. At this point I was approved to dig in the area.

Appendix B: Infiltration Tests

Test 1 : 5-6 Oct

It rained the day before, there were puddles everywhere. Filled all holes at 3pm.

By 6:30 pm

- hole 1 (west most) down 5 inches
- hole 2 down 5
- hole 3 down 7
- hole 4 down 4

By 8 am (next morning)

- hole 1 (west most) dry
- hole 2 dry
- hole 3 dry
- hole 4 down 7 inches

By 2pm

- hole 1 (west most) dry
- hole 2 dry
- hole 3 dry
- hole 4 down 8 inches

Test 2 : 11-12 Oct

Rained night before. Puddles, holes wet and muddy, but no standing water. Filled holes at 9am

By 11 am (2 hours)

- hole 1 (west most) down 5 inches
- hole 2 down 5
- hole 3 down 6
- hole 4 down 4

By 1 pm (4 hours)

- hole 1 (west most) down 6 inches
- hole 2 down 6
- hole 3 down 7
- hole 4 down 5

By 5 pm (8 hours)

- hole 1 (west most) down 8 inches
- hole 2 down 9
- hole 3 down dry (12+)
- hole 4 down 6

Appendix C: Attendance on Planting Day

Andrea Mandel (3 hours)

Angela Castano Diez (5 hours)

Corrina Storino (1 hour)

Elliot Gordon (3 hours)

Ephraim Buhks (3 hours)

Michael Stevens (2 hours)

Paula Bal (10 hours)

Steffen Parratt (10 hours)

Appendix D: Project Expenses

Personal	Donated	
$36.00		Website
$3.00		Safety tape
$187.00		Safety fencing and posts
28.6		Bags of sand
62.91		Auger rental
$1,541.88		Native plants
$447.83		10 cubic yards of sand
	$224.00	8 cubic yards of compost
	$280.00	10 cubic yards of mulch
$57.57		Weed barrier
$2,364.79	504.00	**$2,868.79**

Appendix E: Volunteer Hours

Steffen Parratt 193 hours

Other volunteers 80 hours

Total hours 273 (as of 2 July 2022)

Acknowledgements

Our beautiful new native pollinator rain garden in West Windsor Community Park is the result of the dedication and efforts of many individuals who I would like to acknowledge, in chronological order:

- Kathryn Homa, MIchele Bakacs, and their colleagues at the *Rutgers Cooperative Extension of Mercer County* and the *Rutgers Environmental Stewards program* taught me how to build a rain garden and provided the inspiration to do this project. Their *Stewards* program has had a huge positive impact on my life as a community volunteer.

- Dan Dobromilsky, West Windsor's landscape architect, was the person I turned to find a project in our community, and he suggested the need for this rain garden. I have known Dan for more than a decade, as he provided many Eagle projects, and a patient helping hand, to the Boy Scouts in our town. Dan helped me understand the groundwater flows that we were trying to channel, and he also provided compost, mulch, water equipment, and a lot of great advice and expertise.

- Paula Bal, a native plant and pollinator expert in our community, volunteered to help at the very beginning of the project. I lacked many of the skills and knowledge that were necessary to complete this project – proper soil preparation, garden design, native pollinator plants for different moisture conditions, native nurseries, and many related topics – and she guided and helped through the entire process. We could not have done this without her, and I am very grateful for expertise, hard work, and friendship.

- Ephraim Bucks, Andrea Mandel, Elliot Gordon, and Michael Stevens for their advice throughout the project and for their hard work planting the garden. I appreciated the support of our entire West Windsor Environmental Commission, Town Council, and our Mayor throughout the project.

- Angela Castano Diez, Corrina Storino, and Emily – enthusiastic and expert native gardeners in our community – who helped plant the garden, and who continue to give me guidance and support in my journey to become a native pollinator gardener.

- My wife Susan visited our garden nearly every day for the past year, taking pictures, observing the accumulated water depths, and thoughtfully stopped by on many hot days to bring much-needed water and food as we built the garden. She did everything she could to help make our garden a success.

- Over the past year, countless park visitors stopped by to inquire about our garden. I am grateful to all of them for their enthusiasm and support. I hope they enjoy viewing our garden as much as we enjoyed building it.