Bird Center of Michigan: Supporting Birds and Pollinators through Ecological Landscape Design, Realized Missions, and Future Growth

A University of Michigan School for Environment and Sustainability
Practicum Project Final Report

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Executive Summary

Habitat fragmentation is one of the main drivers in the decline of songbird species worldwide. With human population increases and the coupled increased need for housing and development, what was once natural habitat is being replaced with urbanity. When these habitat patches become fragmented, it isolates resources and creates more competition between species that can lead to inbreeding and general population decline. One way of addressing this fragmentation is through the deliberate design and planning of backyard gardens to help fill in the gaps of fragmented habitat. These smaller patches act as a stepping stone to larger habitat patches, which expands the overall habitat matrix. The overall aim of this project was to support these initiatives by developing and implementing educational gardens at the Bird Center of Michigan, providing habitat and resources to songbird populations.

The Bird Center of Michigan is a small non-profit organization in Saline, Michigan that specializes in songbird rehabilitation. Their mission is to aid birds, wildlife, and the environment through rehabilitation and public education. In 2021, they acquired a new property to call home that sits on two and a half acres. The property sits in a rural matrix of agricultural fields and low density housing. The surrounding habitat patches are highly fragmented. The goal of this project was to support the mission of the Bird Center by creating a multifunctional landscape that supports birds and pollinators while also enhancing public outreach surrounding the importance of native gardens to bird populations as a demonstration of what could be done on residential properties. To achieve this goal, we designed a three step approach: 1), assess the current condition of the Bird Center property and the surrounding ecological context; 2), design and install native gardens as well as educational signage to support public outreach; 3) , create a management plan to ensure the longevity of the resources the gardens provide to birds and pollinators.

A high priority for the Bird Center was having a low maintenance garden. Because of this, we chose to use a matrix-style planting for the garden installations. A matrix style replicates the natural environment by combining carefully selected species together to create a self-sustaining community that protects itself from invasive weeds. Species were chosen to have seasonal interest year-round and to provide resting locations, protection, and food resources for songbirds. All plants were sourced from local/regional nurseries to ensure quality and nativity. Small 5”x7” signs were designed and ordered to place in the front yard garden to showcase key species in the garden. A larger 20”x30” sign was designed for the garden entry but was not able to be printed due to material shortages and cost. These signs combined

will increase public education on the importance of native plants to songbird populations and directly relate to the mission of the Bird Center. A separate maintenance document will be provided directly to the client. This will be a resource that can be handed over to a Bird Center volunteer and easily interpreted to maintain the garden for years to come.

Overall, this project was a great success. Discussions with stakeholders indicated that they love the life and vibrancy the gardens bring to the property. They are excited for future expansion and are grateful for all of the work put into the design and implementation of the gardens and educational signs. This project has the potential to be continued by future master's students at the University of Michigan. We, being only two people, have only scratched the surface of the 2.5-acre property. While we have created a master plan, there are still areas for improvement and further implementation. We have also started preliminary data collection with bird counts and a satisfaction survey of the front yard garden. That data can easily be expanded and used for future research endeavors. We hope that the Bird Center is able to expand and further its mission at its new home, and that this project was able to support them in that journey.

Acknowledgments

We would like to thank our advisor, client, partners, and contributors for making this project possible. Thank you for your continued support, time, and knowledge in helping us through this project.

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Chapter 1 - Introduction

Birds, the closest living relatives of dinosaurs, have captivated peoples' attention for eons. From Egyptian and Greek mythology to modern day zoos and pets, unique avian characteristics and behaviors such as the ability to fly and beautiful varied songs mesmerize and fascinate endlessly. It is only today's unique environmental and climate crises that compel us to delve deeper into our connections with birds and the landscapes we both occupy. Works such as Rachel Carson's *Silent Spring* (2002) inspired many modern movements which implore the public to be aware of our actions and their subsequent consequences on our environments.

Avian species play a key intermediate role in endless food chains around the world, as they consume many insects, fruits, and seeds but are also a food source for other larger animals (Tabur & Ayvaz, 2010). They are also vital in spreading plant species via methods such as the digestion and excretion of the seeds. With around 10,000 species worldwide, it is no surprise that they are integral to many natural systems. However, it is estimated that over 150 species have gone extinct since the 1500's, and the rate of extinction is increasing due to reasons such as habitat loss, the spread of invasives, pollution, and harmful chemicals (Kaufman, 2021). With climate change and an increase in struggling avian populations and decreased survival rates, all related food chains and systems can be negatively affected. This includes insects such as pollinators, which have significant importance in human food production.

With the establishment of the first U.S. National Park in 1872 (NPS) and the National Audubon Society in 1905 (Audubon), a shift in perspectives toward active conservation of "wild" places and wild fauna begin. These refugia served to preserve pristine habitats and some took it upon themselves to help heal injured or sick animals so that they could return to the wild. While early rehabilitation took place in private homes, it was not until the 1970's and 80's that the first official wildlife rehabilitation establishments were founded.

Over the same period, a shift in the field of Landscape Architecture (LA) has been observed as well. Instead of public and private spaces that serve only to be aesthetically pleasing and functional for people, they now need to function across many different fields in order to mitigate and mend the damages incurred upon the planet's surfaces. In a published document by Bean and Yang (2009), the Sustainable Sites Initiative, which grew out of ASLA's 2005 conference, is noted as a benchmark and rating system of sustainable landscape architecture alongside the three core

aspects of sustainability: environmentally sound, economically feasible, and socially equitable. The multimodal juncture of the hands-on approaches regarding conservation, rehabilitation, and sustainable landscape architecture is where projects like this one emerge.

Client and Research Site

The Bird Center of Michigan, renamed in 2021 and formerly known as the Bird Center of Washtenaw County, is the project client. Founded in 2004 by Carol Akerlof and with the help of others like Karen Young, the Bird Center's humble beginnings took place in a small one-room location in downtown Ann Arbor. This was made possible through a grant received in 2005 from the James A. and Faith Knight Foundation and help from the City of Ann Arbor, City Council Member Leigh Greden, and the city's Facilities Management Department. Each year, the small non-profit conducted a mandatory departure, including all patients, out of the rented space and then back once elections were over, and this was on top of rigorous and personalized patient care schedules. In addition to leasing the space, the grant allowed interns to receive a small stipend for their hard work. While they did not take new patients in during their time outside of the leased space, they still took calls to answer inquiries and help people through potentially stressful animal care and rescue situations.

Andrea Aiuto, the most recent manager of the Bird Center, joined the team over a decade ago, learned the best methods of care under Carol, and eventually made her way up. Under her management, the Bird Center was able to expand and finally move out of the solitary room. They acquired a full house and property they could call their own in Saline, Michigan at the beginning of 2021. (Fig. 1)

Now, the Bird Center's mission of aiding birds, wildlife, and the environment through rehabilitation and public education continues with this new property, which comes with even more opportunities for growth. Additionally, the Bird Center is part of a larger network of dedicated animal care individuals and organizations, and they are able to field calls that come in and connect concerned citizens with the appropriate team if the case does not involve a songbird. The Bird Center continues to work closely with the Michigan DNR and International Wildlife Rehabilitators Association, and receives support from various individuals, animal welfare funds, and the Mosaic Foundation of Rita and Peter Heydon. Volunteers, interns, and staff dedicate themselves and endless hours of hard work to this cause.

In 2021, the Bird Center took in over 1500 birds and fielded over 3000 calls for help and advice. With the larger space and resources of the new property, they can

eventually increase their capacity for care and help even more birds and wildlife be free once again (Fig. 2).

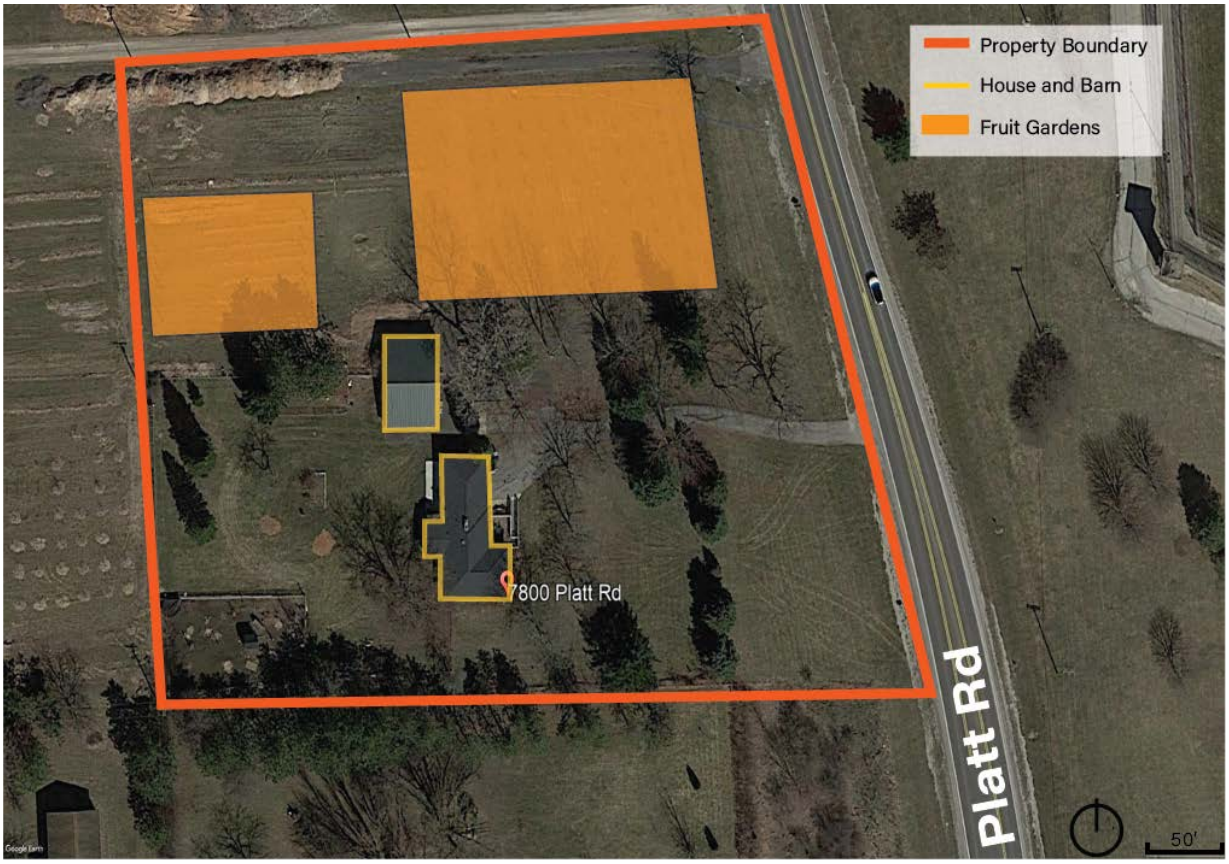

Figure 1. Existing condition of the Bird Center Property on Platt Rd.

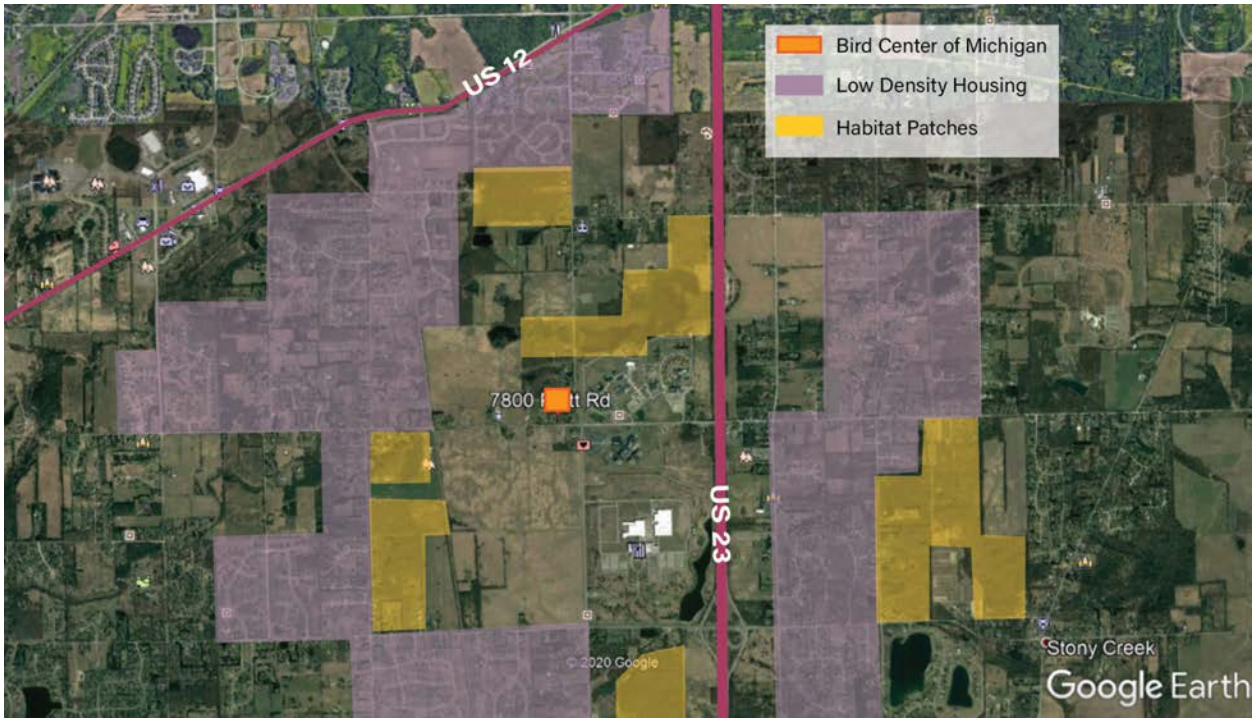

Figure 2. Surrounding site context.

Project Goals and Approach

The goal of this project was to support the mission of the Bird Center of Michigan and design a multifunctional landscape that supports birds and pollinators while enhancing public outreach surrounding the importance of native gardens in bird populations. We have designed and implemented a part of a master plan for the Bird Center by taking three approaches:

1. Assess the current conditions of the Bird Center of Michigan property and surrounding context to inform ecological design decisions,

2. Design and install educational signage for the gardens implemented at the Bird Center, and

3. Create a management plan to ensure the longevity and resources the gardens provide to birds and pollinators.

Project Significance

Impact or Value Added for Clients

Up until 2020, the Bird Center of Michigan operated out of a small room in downtown Ann Arbor, not having access to outdoor resources that are critical to birds. Moving into their new facility in Saline allowed them to gain more space indoors as well as outdoors, acquiring 2.5 acres of land. This acreage is an incredible resource to have as a wildlife rehabilitation organization, but with limited staff, the landscape would have sat on the back burner until indoor operations were streamlined. Being able to take on the landscape changes immediately, we were able to transform part of what was previously a monoculture lawn and create an ecologically focused garden that benefits birds being released from the center, nearby local populations, and those seeking a place for rest and replenishment during long migrations.

In addition to the convenience and economical aspect of on-site releases, the Bird Center can now feel secure knowing that there are food and habitat resources available on site. The management plan will also provide guidelines on how to care for the garden, detailing instructions for volunteer work days and general maintenance practices to use throughout the seasons. This could be transferred to a volunteer's responsibility or will be straight forward enough for staff to delegate tasks.

Providing the Bird Center with a master plan of the property will take away some stress from future projects as well. It is not meant to be a concrete design, but to give ideas of what the landscape could look like and how it can provide the most ecological benefits. This could also be used as a resource for future master's project groups. There would be opportunities to expand on our work and implement more gardens on site.

Societal Impacts

Natural landscapes are disappearing across the globe and it has direct impacts to wildlife and ecosystem functions. Habitat fragmentation is a key driver in the decline of songbird species. 33% of houses in the United States are built on undisturbed natural habitats (Bies, n.d.). When we break up these large habitat patches, it isolates smaller patches with limited resources, creating more competition and can lead to inbreeding, further weakening the population.

Backyard gardens can play an important role in combating fragmentation. These smaller habitat patches can act as a stepping stone to larger patches,

expanding the habitat matrix. Studies have shown that residential gardens are often associated with peaks in bird richness and abundance. They may not support many habitat specialists, but do aid in the conservation of common birds which are declining more rapidly than rare species in Europe (Goddard et al., 2017).

Garden landscapes have an indirect conservation benefit of increasing people's engagement with birds and fostering a sense of conservation in nature. Research is also emerging around the connection between wildlife interaction and human well-being. A study in Southeastern Australia showed that species richness and abundance of birds were positively correlated with human well-being (Luck et al., 2011).

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Chapter 2 - Literature Review

Introduction

This literature review will cover all topics that are relevant to the Practicum Project conducted by Ashley Truitt and Audeline Kurniawan, for the client the Bird Center of Michigan (formerly of Washtenaw County). The review aims to provide the evidence to support the landscape design produced by the project informed to the utmost level possible, so that when implemented the design will serve the ecological community in a multitude of ways and create lasting impact. Aspects that must be considered include which native plants are excellent resources to native birds, and the characteristics which make those plants favorable to birds. We also need to become familiar with the native bird population so that we may then make appropriate plant choices. Native plants, birds, and insect pollinators support and affect each other within the larger ecosystem network, so these relationships must also be examined. The review of literature will ultimately end with how this project fits into the larger context of climate change, resiliency, and the importance of education and outreach in the continuous efforts of our societies to secure the continuation and success of future human generations, despite the many challenges we may face. These elements will culminate in the highest probability of establishment, continued development, and ultimate success of our landscape design in the future.

Birds of Michigan and the Midwest

Birds have extraordinary significance in ecological contexts all over the world, and the Midwest is no exception. For example, birds eat insects, spread seeds through eating fruit, pollinate flowers, and are a source of food for larger prey birds. Thus, they are an integral component for the intermediate levels of numerous food webs. With Michigan's historical flora sitting at the crossroads of prairie and forest ecoregions (Fig. 3), birds play an immensely important role in the preservation and maintenance of what remains ecologically within our heavily urbanized landscapes, as well as the restoration of places which have been developed and where there is a desire to return the landscape to some semblance of its former ability to adequately serve local wildlife and ecosystems.

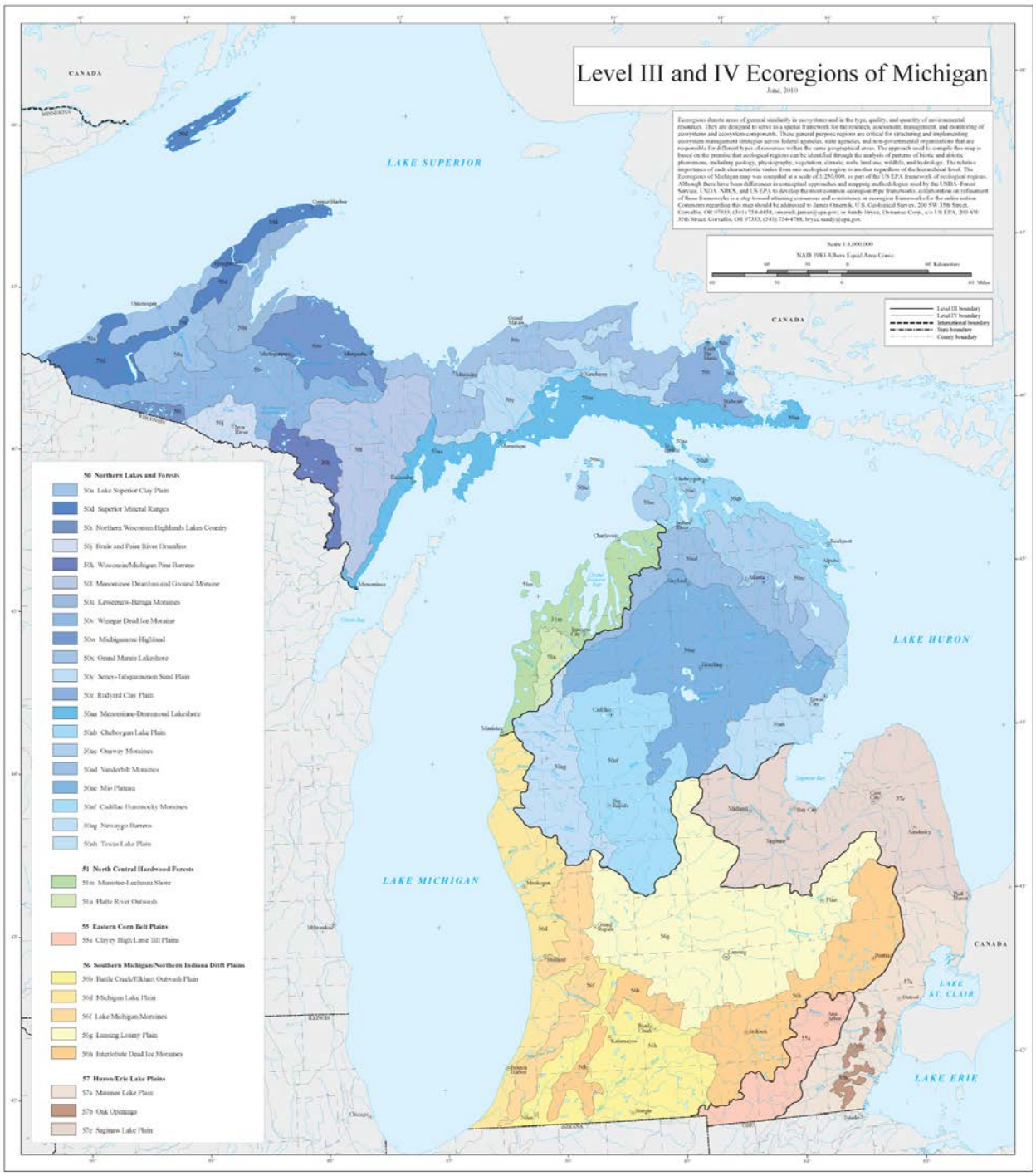

Figure 3. Ecoregions of Michigan (Environmental Protection Agency, 2021)

One of the most important roles birds have are in spreading seeds, especially those that migrate great distances annually (Pejchar et al, 2008 & Viana et al, 2016). For example, the worldwide distribution of oaks can largely be attributed to Blue Jays and their love of acorns, and some researchers have even shown that seeds can hitch

a ride on bird plumage through these long flights (Plataforma, 2016). Cedar Waxwings are an example of a renowned frugivorous (fruit-eating) species, especially in the winter and early spring (Witmer, 1996). Local distributions of plants are also greatly dependent on bird population and movement. Not only is the geographical aspect attributed to birds, but also the mechanical and chemical aspects of bird and seed interactions. Birds and seeds have co-evolved to benefit each other, where the bird eats a fruit containing seed(s) and gains vital caloric content for survival, and the seed benefits from the bird's digestive system removing fruit pulp and leaving the seed exposed, which is critical for the seed's ability to germinate after the bird has either regurgitated or defecated the seed(s) (Nowak, 2012). This natural process of fruit pulp removal via birds' digestive systems is extremely arduous for human hands and even machines to imitate in an artificial setting.

Bird diets also often consist of insects, many species of which happen to be pests to plants that humans favor, which can be a direct benefit to humans. Benefitting the birds through a native planting scheme will also benefit the plants themselves as insectivore bird species will keep troublesome insects at more manageable population levels in this mutualistic relationship. Through millions of years of adaptation and evolution, bird population levels, especially nesting and young nestling growth periods largely coincide with the same times that insect populations are high (Gray, 1993). Birds are an extremely effective and organic method of insect population control. Research shows that one pair of Evening Grosbeaks can consume up to 50,000 caterpillars within the timespan of one breeding season (Nowak, 2012). With estimates of insect consumption as sizable as this, it is clear that birds are essential to insect population control. Other studies indicate that birds can eat up to 98% of spruce budworms, a pest in Eastern forests that has periodic population explosions which birds can and do take advantage of (Nowak, 2012). It is also known that native plants host more native insects than non-native plants do, and this is important in keeping native insectivore passerine populations up because even though insects can be a pest to plants, they are still a major food source for birds. Birds also help pollinate plants through their foraging behaviors. One can imagine that as a warbler feeds on the nectar of flowers, the tiny feather barbules brush against the plants, collecting pollen within its microscopic structures, and then the pollen granules may fall off later during flight or get brushed upon another plant. In this way, our avian friends contribute to plant pollination as well (Figure 4).

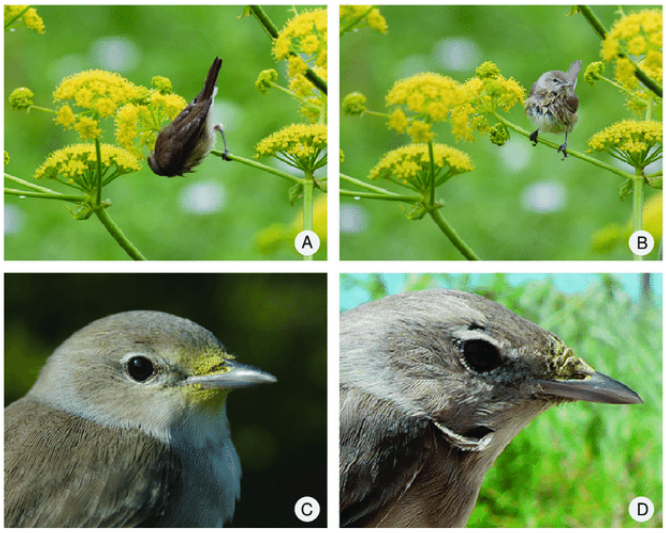

Figure 4. *A)* Garden Warbler feeding on the nectar of Ferula communis. *B)* Garden Warbler on F. communis with breasts dirty with nectar and pollen (photos by Marzia Mirabile). *C)* Garden Warbler showing fresh pollen on the bill and forehead. *D)* Garden Warbler with dried pollen on the bill and forehead (photos by Jacopo G. Cecere). (Cecere et al, 2011)

Plants of the Midwest and Their Role in Bird Ecology

Trees are perhaps the most important vegetative structures in the avian life cycle. They provide lofty locations for nests, where nutritious eggs are out of reach of most flightless predators. Fallen branches and leaves provide plentiful places for foraging and materials for annual nest building activities. The physical structure of trees also offers protection from the elements - rain, wind, sunlight etc. for when birds are eating, resting, or nesting. Trees are also a primary source of food for birds, whether it be the numerous berries and nuts they produce, the nectar from flowers, or the insects that live in, on, or near them. Trees are a main resource for pollinators as well due to the massive numbers of flowers that each tree can produce in the spring, and thus trees help support bird populations through also being a resource to insects (Donkersley, 2019).

Additionally, shrubs and herbaceous perennials are good and important alternatives to trees in terms of the resources they provide. Shrubs yield many of the same benefits as trees do, but are simply closer to the ground so birds must be careful when nesting in them because they are in closer proximity to predators. Shrubs have adapted the size of their berries to attract birds over the millenia - many “bird fruits” are an optimal average size of ⅜” in diameter, which includes small

elderberries to larger cherries, and these ranges of sizes serve different species of birds (Figure 5). (Nowak, 2012).

Figure 5. A Cedar Waxwing eating pin cherries in the winter. Cedar Waxwings become entirely fruit-dependent in winter, when most insects are dormant and flower nectar is not available. Photo courtesy Sharon Sorenson (Gannett, 2015)

Plant nativity is also a critical element to consider in the context of avian survival rates. There is some disagreement as to the official definition of "nativity", but Nowak (2012) argues native plants are those which existed on the land prior to European colonization. Wilde et al. (2015) say that native plants also share an evolutionary history with regional organisms. Nowak also notes that the Midwest is a unique biological area due to its location at the border of two different sub-biomes: forests and tallgrass prairies (Fig. 3). There is generally a higher diversity of species within boundary or transitional areas, which can be a benefit to wildlife but a hindrance to management. Local or native genotypes, also known as "ecotypes", are plants or seeds from local or regional resources, and which 'survive as a distinct group through environmental selection and isolation and are comparable with a taxonomic subspecies' (Merriam-Webster). When they are planted in similar environmental conditions as their origins, they are more likely to thrive. A single plant species can have several different ecotypes depending on the conditions under which it evolved. The Southeast Michigan area is considered to be within the North Central Tillplain ecoregion (Fig. 3). Plant species can be further classified by the specific habitats they prefer within an ecoregion, such as sunny, dry, shady, acidic, or moist. True native plants have also not been genetically modified or hybridized. For example, the original native species of corn is now only found in a few remote regions of Mexico (Nowak, 2012). Nowak also states three main reasons for choosing local ecotypes: (1) ensuring one's own landscaping success; (2) providing the best

possible options for birds and local wildlife; and (3) ensuring the genetic diversity of the plants themselves.

By utilizing native species, one can be sure that the plants are already adapted to the area and will likely thrive once established and generally require minimal care afterwards. As mentioned before, one must consider specific habitat characteristics that these plants prefer, such as well-draining soil, slope, full sun, full shade, etc. Once these aspects are considered when making plant choices, there is a high probability that most of the plants will be able to withstand local fluctuations in temperature, winter conditions, and local drought or rain patterns. Many generations of adaptation and evolution of local ecotypes safeguards them against occasional stochastic events and most importantly solidifies their stature in the local landscapes in which many of the same species already exist.

Secondly, by using native flora, one is ensuring that the best possible options for birds and local wildlife are present. As Wilde et al. (2015) and Nowak (2012) both assert, native plants naturally co-evolved with the local fauna, and thus local pollinators, insects, amphibians, small mammals, and countless other animals thus have access to adequate food and shelter. Native plants support 10 to 50 times as many species of native wildlife than non-native plants (National Wildlife Federation, 2020), and a study conducted in the Northeast US comparing suburban yards landscaped with native versus exotic plants found that exotic plants greatly reduced the diversity and abundance of lepidopteran insects, which include butterflies and moths (Burghardt et al., 2009).

The third reason for planting native presented by Nowak (2012) - ensuring the genetic diversity of the plants themselves - speaks to the importance of genetic diversity in helping plants remain durable against local extinctions, which implies a loss of genetic material and a threat to the overall survival of a species. As briefly mentioned above under reason one, the diversity of species themselves along with diversity of genetic material within each species of native plant communities is crucial in maintaining their resiliency against factors like climate change, the fluctuation of bird and insect populations in response to urbanization, and negative effects of anthropogenic activity such as pollution. One ecotype may better compete with invasive species, while another may hold characteristics that make it resistant to warming temperatures, droughts, or floods. Because the climate is continuously and rapidly evolving, researchers, resident citizens, and students alike must stay on their toes to observe what is happening on a day to day basis so that we may plan ahead for increasingly extreme weather events and changing conditions.

Another unofficial reason of emerging and increasing importance in the field of landscape architecture is that native plants uphold and preserve the “essence of

place" (Nowak, 2012). John Brookes, author of "Natural Landscapes", states that "along with an increasing awareness of the importance of using regional plants, there is also a desire to work in sympathy with the landscape" (Nowak, 2012). Li & Nassuer (2020) further posit the significance of "Cues To Care" (CTC), which refers to 'underlying perceptual, cultural, or social mechanisms' which are immediately recognizable and communicate the 'caring human intention' or presence and 'consistency with local cultural traditions or social norms for landscape appearance'. CTC goes hand in hand with Nowak's idea that our Midwestern landscapes should 'proclaim our heritage' - people should celebrate the native flora of the region and help preserve the beauty and diversity of prairies, savannas, and shrublands instead of wiping out native diversity with the monotonous lawns that are abundantly common across most cities in America.

The issue of Western urban landscapes being consumed by lawns can be traced back to French formal, English Picturesque, and Victorian origins (Müller et al, 2010). People are slowly realizing that lawns, even though they have evolved to become an important American status symbol, can be more troublesome than they are worth - they require incredible amounts of water to irrigate, they need to be mowed regularly, and require frequent use of herbicides, pesticides, and fertilizers to keep them looking healthy, neat, and manicured (Ignatieva et al, 2015). These factors greatly contribute to urban chemical runoff and pollution in rivers and waterways, which leads to things like harmful algae blooms downstream and the subsequent death of local aquatic and terrestrial wildlife populations. People are noticing the lack of wildlife and pollinators that have resulted from these swathes of lawns and associated maintenance activities. Thus, there is a growing movement towards more naturalized landscapes, which support native ecological communities more than any lawn ever will. Nowak notes that it is illegal to dig up plants from the wild without permission, as this results in several negative impacts - it is unethical and may encourage other people to do the same, it damages natural beauty, and the bare soil left behind gives invasive species a chance to move in. While native plantings may not be as affordable upfront as native plant nurseries may typically have higher price points, maintenance spending for carefully designed native gardens can in the long term cost less than a typical lawn. Helfand et al. (2006) also show that people are willing to pay premium costs for a native landscape when they are considered aesthetically pleasing, and that this is an ideal situation because it benefits both the client and local ecological communities. If landscape architects can leverage aesthetically pleasing natural planting designs in the private home sector, there is hope that great improvements can be made to heavily degraded and fragmented urban habitats.

Negative Effects of Exotics

As briefly touched upon before, native plant species support not only greater biodiversity, but also a greater number of species of native insects and birds. Thus, it logically follows that exotic plant species impose a myriad of negative effects on native insect, bird, and mammal populations. Several studies found that fewer species and numbers of native birds live in areas with exotic vegetation as compared to areas with native vegetation. Mills et al. (1989) studied the effects of urbanization and its associated exotic vegetation in 34 different neighborhoods across Tucson, Arizona. They found significantly more diversity and numbers of nesting bird species in areas with more native vegetation.

Several reasons may contribute to these decreased numbers of native fauna within areas of exotic vegetation. Researchers at the Morton Arboretum near Chicago, IL found that exotic species such as buckthorn and honeysuckle, which were originally introduced as ornamentals from Eurasia but are now extremely invasive in America, have alarming negative effects on nesting communities (Nowak, 2012). After observing 585 nests over 6 years (1992 - 1997), analysis showed that exotics do not comprise the same physical features as natives do, which play an important role in protecting nests. In the studies, Thrushes and Robins nesting in exotic shrubs lost many more eggs to predators than those nesting in native shrubs of comparable size, such as hawthorns and viburnums. One such physical characteristic that exemplifies this is that some exotics like honeysuckles have heavier branches lower to the ground, which birds may mistake for good nesting locations. However, these lower heavy branches are easily accessible by predators such as raccoons, cats, and opossums, and they also support their heavier weight for the bit of climbing needed to maneuver to these unfortunate nests. Thorns of the native hawthorns are also much more effective against predators while invasive buckthorns do not have the same thorn characteristics and are thus not nearly as useful for protecting nests. In yet another tricky display, exotics can produce leaves earlier in the spring, and thus birds may see these leaves as good cover for nests. Meanwhile, the other physical characteristics of exotics mentioned before will later fail to support egg or nestling survival.

Because the native landscapes of Michigan also consist of prairie grasses, it is important to consider them as well. The Department of Natural Resources in Maryland reports that replacement of exotic grasses with natives in many regions across the United States have resulted in exceptional rebounds of certain bird populations (Nowak, 2012). When as little as 5% of a field of exotic grasses was replaced with natives, populations of game birds increased by as much as ten times (Nickens, 2018). Similar to the shrubs, native grasses also contain certain physical characteristics which are beneficial to bird survival, such as growing in clumps rather

than very densely like exotics. Clump-growing grasses form corridors through which birds can easily travel through for foraging and avoiding predators (ex: Big Bluestem, Side-oats Grama, Indian Grass). Exotics such as fescues grow too densely for most wildlife, especially airborne species, to easily move through.

Climate Change and Plant Resilience

Why does the information above matter? One of the hardest truths humanity will need to learn to swallow is that without the existence of plants and animals, we - *Homo sapiens* - would not be able to exist, or rather, it is essentially impossible. Countless ecologists, biologists, and scientists of many other topics acknowledge this, along with the fact that many of the negative environmental and climatic changes we witness from year to year are due to anthropogenic causes (Tallamy, 2020). As also stated by Tallamy (2020), approximately only 5 percent of the land in the continental United States can be considered close to "pristine" as opposed to the other 95 percent, which has all been developed or pillaged for human use, whether it be cities, residential areas, or the thoughtless exploitation of valuable resources such as timber, oil, natural gas, or agriculture. There is an intense need for an overhaul in current ways of thought ("us versus nature") and a recognition that peoples' connections with nature is far from what it used to be. As Tallamy (2020) stated, "people began to take note of nature because it was disappearing" (Page 24).

That is where small projects like ours come in. As part of a program that is unafraid to talk about the grotesque truths we and future generations must face, it is critical to act now and start making changes at local scales. At the level of private residences and small local businesses, a tiny spark of talk and action can spread and eventually reach higher levels. Thus, it is important that we do what we can to implement projects that utilize native vegetation and seek to restore while considering the ability of certain species to be resilient to possible changes in climate. Restoration to an esteemed past idyllic state is not always the best route to take, but rather the goal is to get people to understand that plants which are native to a region are the most likely to thrive and be resilient to changes in the future. There are of course a few exceptions to this and "nativeness" is a concept that humans concocted, but we must first consider natives for the purposes of this project because they are indeed exceedingly important to local wildlife. Exotics may seem hardy because they can wipe out natives and thus appear to be better suited to the local environment, but how long they can truly last because they have not been established through the centuries is something we do not yet know. Additionally, as discussed before, there is much evidence that supports the use of native vegetation to restore or conserve populations of native insects, reptiles, amphibians, birds, and so on and so forth through the complex food webs. This is an essential concept moving forward.

Population numbers, along with the aforementioned idea of genetic diversity, is perhaps one of the most important aspects of helping plants fight against stochastic events and typical population fluctuations. When a species is thriving and has many numbers of individuals, it can withstand normal decreases in population due to these stochastic events. However, when a population is greatly decreased due to fragmentation, pollution, and other causes, when a stochastic event comes along, the entire species is at much higher risk for complete extinction.

Implications of Urbanization

Urbanization continues to spread rapidly and is one of the key drivers of environmental issues such as loss of greenspace, which leads to loss of biodiversity and can especially be seen in increased amounts of stormwater runoff (Yuan, 2016). In a natural system, water would soak into soils, recharge nearby water bodies, and eventually evaporate into the atmosphere to start the cycle again. This process is greatly altered by urbanization through increasing amounts of impervious surfaces and current infrastructure standards. These impervious surfaces result in 75-80% less infiltration of surface waters to recharge groundwater pools (Arnold and Gibbons, 1996). Research has also shown that urbanization can amplify impacts of increased precipitation as well as offset the impacts from decreased precipitation (Chen et al., 2018). A study conducted on 39 urbanized basins and 21 rural basins in the United States showed that urbanization increased annual streamflow by 103% with complete watershed urbanization (Dewalle et al., 2000). This has huge implications for how we manage our stormwater for the future, especially when thinking about the effects of climate change.

Traditionally, stormwater management is an engineered network of underground pipes that move stormwater out of a city as quickly as possible. There were two standard types of each system, combined and separated (Figure 6). The combined drainage system mixes stormwater and sewage into one pipe and the water is purified at a wastewater treatment plant to be discharged at a nearby waterbody. However, a separate drainage system has separate pipes for stormwater and sewage. The stormwater is piped into nearby water bodies, both treated or not, and the sewage is taken to a treatment plant. Both of these systems were designed to take water out of a city as fast and efficiently as possible to minimize local flood risks. It is now understood that these systems are incapable of keeping up with and managing the increasing intensity and duration of storm events as seen with the onset of urbanization (Yuan, 2016), and numerous inland regions are destroyed by swift and turbulent floodwaters each year, causing millions and billions of dollars worth of damage. Lastly, these systems were not designed for ecological functions or aesthetic value. Alternative solutions can be beautiful, adding to a city's amenities

and the residents' quality of life. Additionally, they can foster educational opportunities and promote stewardship within communities which desperately need or crave a greater connection to natural greenspaces (Echols, 2007).

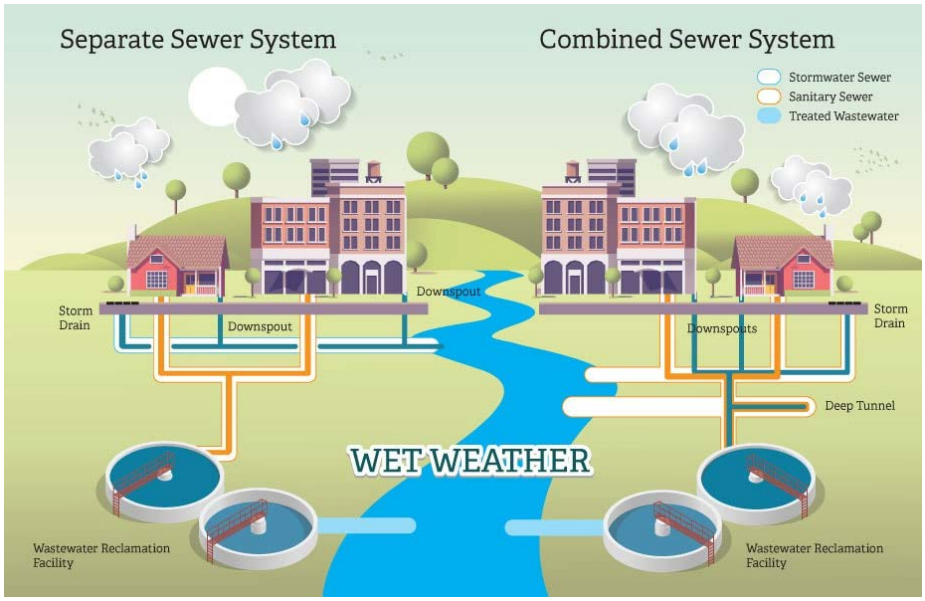

Figure 6. Combined sewer systems route stormwater and wastewater to a treatment plant together. Separate sewer systems separate stormwater and wastewater before depositing into nearby water bodies (Sewers, n.d.).

Green Stormwater Infrastructure

Green stormwater infrastructure (GSI) is defined as "...the range of measures that use plant or soil systems, permeable pavement or other permeable surfaces or substrates, stormwater harvest and reuse, or landscaping to store, infiltrate, or evapotranspirate stormwater and reduce flows to sewer systems or to surface waters." by section 502 of the Clean Water Act (What is Green Infrastructure, 2020). GSI has been shown to reduce peak flows, reduce water volumes, and remove nutrients from stormwater (Chen et al., 2019). In addition, it adds ecologically beneficial habitats to urban areas (Connop et al., 2016) and provides reductions in the urban heat island effect (Herath, Halwatura, and Jayasinghe, 2018). Green Infrastructure is an umbrella term for a variety of stormwater solutions. The following sections will go into more detail on several of the possible types of infrastructures: rain gardens; bioswales; retention basins; and rainwater harvesting.

Rain Gardens

Rain gardens (Figure 7) play an important role in mitigating stormwater runoff and provide an opportunity to promote biodiversity in an urban context. Rain

gardens are a planted depression designed to capture stormwater runoff from nearby impermeable surfaces. These plants provide many benefits including enhanced stormwater infiltration and evaporation, promoting visual aesthetics, and encouraging biodiversity (Yuan and Dunnett, 2018). A variety of perennials are chosen for rain gardens based on their ability to withstand inundation and fluctuating levels of soil moisture. Rain gardens typically have three moisture zones including a water-logged bottom, an occasionally flooded side slope, and a dryer upland (Yuan and Dunnett, 2018). Rain gardens are especially homeowner friendly, and many cities offer rain garden programs to help guide people in creating their own. For example, rain gardens are excellent to place in spots that regularly flood or along the roadside to not only create a beautiful visual barrier for increased privacy but also to bring numerous benefits to local ecological systems.

Figure 7. Typical rain garden construction with planted depression to store and infiltrate stormwater from nearby impervious surfaces (Williams, 2016).

Bioswales

Bioswales (Figure 8) are essentially elongated rain gardens. They are vegetated, mulched, or xeriscaped channels that move stormwater from one location to another (What is Green Infrastructure, 2020). Bioswales are designed to slow down the flow of water while filtering out excess nutrients and contaminants. They are mainly used to convey water to approved public sewers or other green infrastructure solutions (Yuan, 2016). Bioswales have the flexibility to provide hydrologic links among landscape features and drainage systems (Steiner and

Domm, 2012). They also provide excellent aesthetic and ecological benefits to its surroundings.

Figure 8. Bioswales collect stormwater off of adjacent parking lots (Gibb, 2015).

Retention Basins

Retention basins (Figure 9) are artificial water storage basins that have vegetated edges and hold a permanent pool of water (Yuan, 2016). These basins are typically found in urban landscapes as a water feature, and also are used to collect rainwater to use for irrigation (Yuan, 2016). Detention basins are another form of larger capacity water storage, but they do not hold onto water like retention basins. They allow for more infiltration with more permeable soils and added vegetation (Yuan, 2016). Both retention and detention basins are beneficial for trapping pollutants from runoff, provide aesthetic benefits to urban areas, and promote biodiversity (Yuan, 2016).

Figure 9. Artificial retention basin creating an urban landscape feature while storing stormwater runoff (Retention Ponds, 2020).

Rainwater Harvesting

Rainwater harvesting can be a large or small scale green infrastructure solution. Rainwater harvesting systems like rain barrels and cisterns collect and store rainwater for future use. This is typically done by disconnecting downspouts to reroute water into these collection systems (What is Green Infrastructure, 2020). Most home-rain barrels are between 50-200 gallons and sit elevated above ground. The water collected can be used for typical outdoor chores such as watering a garden or washing a car. These outdoor chores can account for 40% of an average household's water usage during the summer months (Programs & Initiatives, n.d.). Cisterns have a larger storage capacity than rain barrels and can be located above or below ground (Soak Up the Rain, 2020). They can be constructed out of a variety of materials such as cinder block, reinforced concrete, fiberglass, and steel (Young and Sharpe, 2016). A cistern will provide water to a household with a standard pressurized plumbing system (Young and Sharpe, 2016). It is important to note that rain water collects contaminants and other pollutants like bacteria when traveling across a roof. Cisterns have the proper treatment and filtration system to produce potable water, but caution should be taken when using a rain barrel to water edible plantings (Soak Up the Rain, 2020, Young and Sharpe, 2016).

Figure 10. Above ground cistern collecting rainwater from the roof of attached structure (Rainwater Harvesting & Cisterns, n.d.).

The Role of Landscape Architecture in Design

Landscape Architecture is in a unique position because it is where the fields of conservation ecology, human psychology, and design meet. It is important to note that LA can be applied to numerous scales, from the smallest garden to extensive regional areas. Consideration of how humans perceive the spaces they use or move through in addition to the local and regional ecologies must be considered and will inform the design process.

It is common for ecological landscapes to look messy and wild. Nassauer (1988, 1995, 1997) has spent decades researching how humans perceive landscapes and how that relates to their ecological value. Nassauer (1997) states that “applied landscape ecology is essentially a design problem”. Circling back to the term “cues to care”, it was coined to put the ball back in human’s courts, making landscape changes relate to human intention. Using these cues to care in a design setting, they can communicate that unfamiliar landscape elements such as prairie restorations or rain gardens, are intended to be human dominated (Nassauer, 1995). It can be common for these ecologically beneficial landscapes to be forgotten about and not managed. This then reduces their functionality and the great benefits they offer. Cues to care can help ensure that these beneficial landscapes are here to stay, even if they go through major changes (Nassauer, 1997). These cues to care can be very simple additions to a landscape, but make the world of difference when it comes to human perception. They can include fences, plantings in rows, neatness and order,

lawn ornaments, and even wildlife feeders and houses (Li and Nassauer, 2020). Nassauer (1988) had offered a “cultural sustainability” theory, stating that environmental benefits of a landscape can be sustained over time if they are consistent with cultural values. This is because people who value their landscapes will resist change. These aforementioned cues to care are a cultural element that people will place value on the landscape. Thus, it is important for landscapes to be aesthetically pleasing in order to maintain their ecological function. One can design an exceptionally ecologically effective landscape, but if people do not like the way it looks, they will not care for it and all of its value will soon be lost.

The concept of connectivity is increasingly crucial to the conservation or restoration of our urban landscapes. It is widely known that because of the explosive spread of urban development and the processes of extraction to support these developments, “wild” lands become separated further and further from each other - thus becoming ‘fragmented’. This fragmentation in the last century has reached such an extreme level that even the preservation of lands through the National Park System and legislation such as the Endangered Species Act is no longer effective at preventing the decline and extinction of innumerable species (Tallamy, 2020). However, there is hope that people and diversity can once again coexist, and this time around it is not just up to the ecologists, biologists, and scientists - everybody in communities must take steps to embrace nature and wildlife in our own backyards.

The majority of land in the US is privately owned - in 2002, 61% of the total land area was controlled by private individuals or corporations and today that number stands at about 60.2% (Gilbert et. al., 2002; Vivid Maps, 2021). Thus, by following the model of increased habitat connectivity through peoples’ backyards that Tallamy (2020), Nowak (2012), and several others propose, humanity can actively fight against the severe isolation and subsequent declines that many wildlife populations currently face. While it might be too much to ask of people to uproot entire city infrastructures and highway and road networks, it is not too much to ask that people start thinking about what they can veritably control in their own private realms. Nowak (2012) and Michigan Audubon (2018) outline potential plans for private yards, including which plants are appropriate for each type of planting scheme (ex: Prairie garden, Woodland garden, Butterfly garden, etc.) and which organisms each plant supports. These are wonderful resources for aspiring urban residents, and are a great way to jumpstart restoration of native habitats and start providing resources for the dwindling numbers of countless species across America.

Because the site of our practicum project sits within a historically agricultural area that is partially developed for housing, and the building on site is a formerly residential house that was converted into the new Bird Center of Michigan, we will be synthesizing aspects of Nassauer’s, Nowak’s, Tallamy’s, and Michigan Audubon’s

concepts and recommendations as our goals for integration and the planting design will be quite similar. The unique niche of LA is capable of bringing the concepts of aesthetics and ecological function together, all while keeping in mind the importance of communication with locals and stakeholders, the nativeness of the species we will implement, and thinking about the possible future outcomes of the design.

The Value of Education and Outreach in Science

It is important to get people of all ages involved with learning and intellectually growing throughout our human lifespans, but it is especially crucial to get children involved at a young age to cultivate their critical thinking and creativity skills. It is becoming more common for schools to build community partnerships to expand the range of opportunities for students. These relationships have the potential to be mutually beneficial and empower teachers to reconsider how we teach science (Smith et al., 2018). Smith et al. (2018) share a number of case studies on community and school partnerships. All teachers in the case studies expressed interest in creating opportunities for richer science learning. This allowed schools to become outward participants within the community and grow trust between teachers and these organizations (Smith et al., 2018). The Bird Center of Michigan sits within a number of school districts, and could become a critical partner with others in these areas. Being able to engage students with learning opportunities on the topics of native birds, ecology, and stormwater management would not only benefit the students, but also the environment in which we all live and need for sustenance and survival. This offers students a chance to truly understand how these greater systems operate and how we as humans play such an important role in the management of natural resources. Creating interest in these fields at a young age can inspire kids to get involved both now and in the future, and appreciate nature for all that is has to offer. Children are quite literally our future, so we should invest in them with great care and enthusiasm - they will soon become the caretakers of and advocates for all the wild and natural places of the world.

The COVID-19 pandemic created a suite of challenges for educators, but also brought to light many opportunities to be creative with teaching practices. For example, a school in New York started a bird nest box program pre-Covid to foster learning opportunities around birds and biodiversity, long-term appreciation for nature, and field ecology. Since the school switched to virtual learning, the program continued, allowing students to take “virtual field trips” to the nesting boxes (Houtz et al., 2020). Virtual outreach projects like this make access to science more equitable, but also bring together a sense of community, especially in times like today. This could become an outreach opportunity for the Bird Center in the future, promoting their efforts and fostering equitable learning environments within the

community. Volunteers are starting to return to the center after being closed to the public due to the pandemic, and there are plentiful opportunities here for all ages to become involved with the daily activities at the Center. There are endless possibilities for community outreach and involvement, which will garner more appreciation and support for all the hard work the staff do seven days a week, year round, to ensure that injured, sick, and abandoned birds can be returned back to the wild to be a part of the amazing ecosystems present in the Midwest, across the entire United States, and even further to our neighboring countries.

Summary

This literature review will be beneficial in informing decisions made for our practicum project. We researched information on songbird populations, native plants and their relationship to songbirds. As well as a broader understanding of climate change and the importance of education and outreach in a non-profit setting. In addition, it provided better insight into the role of Landscape Architecture in projects involving students, non-profits, and restoring landscapes to a more naturalized environment. Doing this research upfront will aid in establishing our project goals and objectives, as well as show the current gaps in research and how our project will add to the landscape architecture community.

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Chapter 3 - Methods and Analysis

Background: Project Setup

Each January, master's students in the School for Environment and Sustainability (SEAS) must decide whether to participate in the default Master Project route, or choose an alternative. Alternatives are an independently set up Practicum Project with a smaller team or a traditional Thesis. Upon entry to the required Masters Project course, a list of potential clients and projects are presented to students for inspection and sign up. Due to the online nature of the course amidst the Covid-19 pandemic in January of 2021, we decided that it would be incredibly difficult to form solid relationships with a large team of up to 6 people as well as a remote client. In addition, we wanted to have a hands-on project where we could implement a real design into the ground, which is an invaluable experience in the field of landscape architecture. An opportunity with the Bird Center of Michigan (then the 'Bird Center of Washtenaw County') presented itself at the end of January, and we were thrilled to find something that fit what we were looking for. We reached out to Andrea Aiuto, who was the manager of the Bird Center at the time, to inquire about their interest in collaborating with us for a sustainable landscape design for their newly acquired property on Platt Road in Saline, MI. Andrea was equally delighted with the idea of a collaboration with us and loved our project proposal. The Bird Center then became the client for our project.

Thus commenced the process for the approval of our project by SEAS since it was outside of the default Masters Project course and client list. We submitted the proper paperwork, received approval, and began the project. The project involved four distinct phases: Phase I, project setup and research, phase 2, front yard garden design and implementation, phase 3, backyard garden design and implementation, and phase 4, assessment, and planning for the future. In the following chapter we provide specific details of the work and activities for each phase.

Phase I

Phase I was largely planning and research. We conducted a thorough literature review to understand the importance of birds in the landscape, their role in ecological webs, and how native plantings would benefit these birds as well as the Bird Center's mission. We reached out to many individuals outside of University of Michigan who might potentially assist us with advice, feedback, or project implementation and materials. In addition to this, many possible funding sources were gathered and applied for, as plant material and equipment can quickly become

costly. Frequent communication with the client was necessary to ensure that our visions and ideas were agreed upon, and to establish an approximate schedule for future meetings.

We also researched and visited several precedent sites to gain inspiration and see how other nature areas were designed, how information was presented to the public, and what kind of maintenance might be needed for similar projects. We visited the Crosswinds Marsh Wetland Preserve first. Located in New Boston, Michigan, the preserve encompasses diverse wetland habitats, several trails, and is a popular spot for birdwatching and wildlife enthusiasts. Over 240 species of birds and 40 species of mammals have been observed there, and is home to a nesting pair of bald eagles and beavers. Crosswinds Marsh also has programs for Field Trips, public outreach, family-friendly events, teacher training, kid's summer camps, and guided canoe trips (Watts, n.d.). There is even a horse trail that joins up with the other trails on the site.

Our second visit was to the Rouge River Bird Observatory (RRBO) on University of Michigan's Dearborn campus. Although it ceased operations in October of 2018, the facility is still standing and research on European Goldfinches by former director Julie Craves still continues. The RRBO was founded by Julie Craves in 1992, and its mission was to 'explore an understudied yet increasingly critical area of research: the importance of urban natural areas to birds' (University of Michigan, n.d.). Research focused on understanding the role of urban areas as migratory stopping points for migrating birds, as little long term research has been done on whether urban stops are providing adequate resources and which resources are the most important. Craves has published over 30 articles on the subject, including one called 'A fifteen-year study of fall stopover patterns of *Catharus* thrushes at an inland, urban site' (2009), which looked at body conditions and fat percentages of three *Catharus* species stopping over in the metropolitan Detroit area. The study found that while UM-Dearborn's RRBO nature area is currently a suitable stopover sight for migrating thrushes, there may exist challenges such as frequent human disturbance and the presence of many non-native fruiting vegetation species. The RRBO, which used to be a part of the Environmental Interpretive Center, is adjacent to around 300 acres of a mixed habitat Environmental Study Area. We explored this study area and observed any educational signage along the way. The RRBO's history, research, and mission were sources of inspiration to us as we ventured around the site and thought about how we might incorporate public engagement, signage, and programs at the Bird Center.

Additionally, we conducted a soil test through Michigan State University, as they have a program where you pay a small fee, they send you a soil test kit, soil is collected in test tubes, and sent back for analysis. We received results within a couple

weeks. The analysis includes pH, soil type, organic matter, Phosphorus, Potassium, and Magnesium levels, and several other factors. They also give recommendations for what components are needed in a fertilizer for your specific yard and when to apply it. See a summary of the Bird Center's soil results below, and click here for full results.

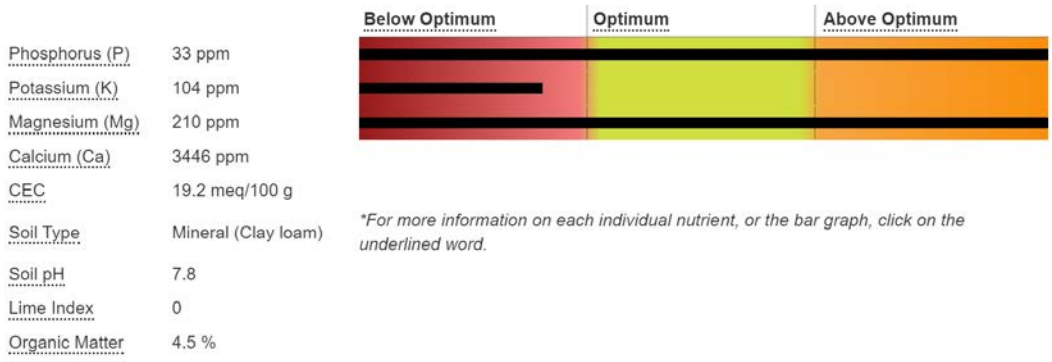

Figure 11. MSU Soil Test Results

Phase 2

Phase 2 happened over the summer of 2021 and consisted of design and implementation of the front yard garden. We took our site survey and developed a matrix style planting plan. A matrix style replicates the natural environment, where various species grow together harmoniously creating a self-sustaining community that protects itself from invasive weeds (Dyck Arboretum, 2021). We generated a plant list and assigned species to primary or matrix blocks. Primary blocks contain species that bloom for longer periods of time or have a strong form, creating a strong visual interest. Matrix blocks contain more ground cover species that blanket the landscape such as grasses or ferns. We then cross-checked our plant list with local nursery availability. Many nurseries have an online catalog of species they carry, but it may not show what they currently have in stock. Plant calculations were created based on the area of each block. A complete plant list can be found in table 1. Once adjustments were made based on regional availability, we placed orders with three wholesale nurseries; Midwest Groundcovers, Rushton Farms, and Wildtype Native Plant Nursery. Wholesale nurseries sell large quantities of plants to contractors at a reduced price. We used our connections with a local design-build firm to purchase the majority of our plants through wholesale nurseries that they have accounts with. There was a small remaining number of plants we could not source through wholesale, so we made an additional purchase from a local retail nursery, Lodi Farms. In the meantime, the Bird Center staff created an event through their Facebook page to build volunteer interest in our installation day.

Table 1. Plant list and quantities for front yard garden

PLANT INSTALLATION LIST										
	Block ID	Common Name	Botanical Name	O.C. spacing (ft)	% of block					
						#1	#2	#3	#4	Sum
						QTY	QTY	QTY	QTY	
PRIMARY	PA	Big Leaf Aster	*Aster macrophyllus*	2	50	6	22			28
		Prairie Blazingstar	*Liatris pycnostachya*	2	50	6	22			28
	PB	False Indigo	*Baptisia spp.*	3	50	4	3	6	8	21
		Bee Balm	*Monarda didyma*	2	50	10	6	14	18	48
	PC	Sweet Coneflower	*Rudbeckia subtomentosa*	2	50	21	26			47
		Butterfly Weed	*Asclepias tuberosa*	2.5	25	8	9			17
		David White Garden Phlox	*Phlox 'David'*	2.5	25	8	9			17
	PD	Wild Geranium	*Geranium maculatum*	2	50	6	10			16
		White Wood Aster	*Eurybia divaricata*	2	50	6	10			16
	PE	Sweet Woodruff	*Gallium odoratum*	2.5	50	6	4			10
		Ostrich Fern	*Matteuccia struthiopteris*	2	50	10	5			15
MATRIX	MA	Columbine	*Aquilegia canadensis*	2	40	16	23			39
		Golden Alexander	*Zizia aurea*	2	20	14	21			35
		Woodland Stonecrop	*Sedum ternatum*	1	20	6	9			15
	MB	Wild Ginger	*Asarum canadense*	2	100	54				54
	MC	Barren Strawberry	*Waldsteinia fragarioides*	2	50	7	15	7		29
		Pale Purple Coneflower	*Echinacea pallida*	2	50	7	15	20		42
TREES	T1	Autumn Brilliance Serviceberry	*Amelanchier x grandiflora 'Autumn Brilliance'*			1				1
	T2	Eastern Redbud	*Cercis canadensis*			1				1
SHRUBS	SH1	Hummingbird Summersweet	*Clethra alnifolia 'Hummingbird'*	4		2				2
	SH2	Winterberry	*Ilex verticillata*	5		4				4
	SH3	Witch Hazel	*Hamamelis virginiana*	12		3				3

While waiting for our plant order to be delivered, we conducted a preliminary bird count at the Bird Center. We enlisted the help of Eva Roos, a graduate of the MLA program at The University of Michigan and an avid bird lover. We set up a viewing area in the backyard, documenting all species heard or seen in a thirty minute period. This preliminary count gave us a baseline of how well the current landscape functions for bird habitat. We would go on to conduct another bird count after the garden was installed. This data could also be used for future research projects. A full breakdown and table of the species count can be found in phase 4.

There was a lot of preparation that went into this phase of the project. The Bird Center had an existing landscape that did not suit their needs or mission as an organization. We started with removing existing plant material from the garden beds around the house (Fig. 12). We removed invasive species and transplanted other plants if able to. Once all of the plants were removed, there was an excess of wood chips in the beds that needed to be removed and properly graded for drainage away from the house. We used spray paint to mark out the future bed lines, and removed

any sod from the planting area with a sod cutting machine (Fig. 12). Any spoils were added to a compost pile or used on site if possible. Anything that couldn't be stored on site was transferred to a local landscaping company, K.C. Runciman Landscapes. They were also kind enough to let us borrow tools for all of the prep work and on installation day. Spray paint and marking flags were used to delineate matrix block lines and the location of trees and shrubs.

Planting day was a great success. We had around 10 volunteers and we couldn't have done it without their hard work. We had spent most of our time laying out plant material in the proper matrix blocks. Volunteers came through with a 6" auger and drilled holes where the plant material was to be planted. Once the holes were drilled, other volunteers came through and finished the planting (Fig. 12). It was a very efficient system, and we ended up planting nearly 500 perennial plants, trees, and shrubs in 6 hours. A few days later, we returned to the garden to install a shredded hardwood mulch to retain moisture and prevent weed growth while the plants get established. Since we planted in the peak of the summer, we returned about twice a week to water all of the plants.

Figure 12. Row one photos show the original state of the landscaping, shrub removal, and planting bed preparation. Row two photos are taken from planting day. Row three photos show the garden complete.

Phase 3

The Washtenaw County Conservation District (WCCD) started a new grant program, The School and Community Habitat Grant. This grant aims to assist schools and community organizations with accessing plants and creating wildlife habitat. The grant is awarded through trees, shrubs, and perennial plants through WCCD distributions and technical assistance through WCCD and partners. This is a grant we were excited to apply for and receive for the Bird Center of Michigan. They will even receive a WCCD Habitat sign to install at the garden, and use as an educational tool to promote the creation of bird friendly habitats.

This garden is considerably smaller than the front yard installation, but would serve a similar purpose: provide a resting place and habitat for birds within the more protected backyard space nearby future flight cages. Having naturalized planting where birds can see it is important to help them feel more comfortable within a strange environment, especially since birds are high-stress and require a high level of visual and material engagement to keep those stress levels down and allow energy to be redirected towards healing. We used the same matrix planting method, combining plants that would compliment each other in resources provided to birds, bloom color, and bloom time. Plants were chosen based on the availability from the WCCD lists.

Table 2. Plant list and quantities for backyard garden

PLANT INSTALLATION LIST								
	Block ID	Common Name	Botanical Name	O.C. spacing (ft)	% of block			
						#1	#2	Sum
						QTY	QTY	
PRIMARY	PA	Rose Mallow	*Hibiscus moscheutos*	3	50	6	6	12
		Big Leaf Aster	*Aster macrophyllus*	2	50	6	5	11
	PB	Hairy Beard Tongue	*Penstemon hirsutus*	2	50	4	4	8
		Cardinal Flower	*Lobelia cardinalis*	2	50	4	5	9
	PC	Great Blue Lobelia	*Lobelia siphilitica*	2	50	4	4	8
		Columbine	*Aguilegia canadensis*	2	50	5	5	10
	PD	False Indigo	*Andropogon gerardii*	3	50	3	2	5
		Purple Coneflower	*Echinacea purpurea*	2	50	4	5	9
	PE	Butterfly Milkweed	*Asclepias tuberosa*	2	50	3	3	6
		Nodding Wild Onion	*Allium cernuum*	2	50	4	5	9
	PF	Pale Purple Coneflower	*Echinacea pallida*	2	50	3		3
		Golden Alexander	*Zizia aurea*	2	50	4		4
GRASS	G1	Big Blue Stem	*Andropogon gerardii*	2		5		5

We then coordinated a day that worked for the Bird Center, they created an event on their Facebook page, and we reached out to colleagues through email and social media to recruit volunteers for the planting day. In the meantime, we prepped the chosen area for planting. We again used tools borrowed from K.C. Runciman Landscapes. Then we measured and marked the garden bed outline with flags and spray paint, then we used various tools to remove the overgrown invasives, weeds, and sod within the marked area. We also pruned back the overgrown existing Forsythia shrub to lessen its enormous footprint. In addition, we removed embedded logs that had marked the previous bed, and re-graded the area to gently slope with the rest of the yard and reduce the chance for erosion (Fig. 13).

On the planting day, we used spray paint to mark the matrix blocks and set out the appropriate plants within each of the blocks at a predetermined distance from each other to maximize a “full” and natural appearance (Fig. 13). From there, it was simply getting the plants in the ground and mulching with a shredded hardwood mulch. A relatively thick layer of mulch is important for protecting the plants and the ground from drying out too quickly, especially in the summer heat. Over time, this particular mulch will break down and add nutrients and material to the organic soil beneath.

Figure 13. Row one shows photos of the original state of the garden. Row two shows the garden after it has been prepped, planting blocks laid out, and plants set in their locations. Row three shows the finished garden and a closeup of *Aquilegia canadensis*.

Phase 4

Lastly is Phase 4, which involves initial maintenance and assessment of what was planted, decisions on whether the front or back gardens need any additional plants or components, analysis of the new gardens' performance, creating a maintenance plan for the Bird Center to follow in the coming years, and finally a master design plan that the center can use to guide future University Masters or general project teams in the further development and improvement of the property.

Once the front and back plantings were completed and mulched, a good watering was done to reduce the stress of the plants being transferred from a protected nursery pot to a completely new and alien environment. Often, the soil where one is planting is far less nutritious, soft, and agreeable as the soil in the nursery pots, which are specially formulated to encourage optimal plant growth inside greenhouses. Especially after the planting at the end of July, it was necessary to return every couple days to water everything extremely well due to the temperatures being consistently in the mid to upper 90's (fahrenheit). We set up an oscillating sprinkler to run on a timer for each section and moved it once the timer was up. Audeline, one of the team members, was also participating in a part-time internship at the Bird Center and thus was able to keep a close eye on the plants during that stressful time of acclimation.

During the Fall 2021 semester, we returned frequently to check on the plants' health and to place a bird bath which was donated by Wild Bird Unlimited of Ann Arbor. We removed as many weeds that were sprouting up as we could, and removed a fallen Pear tree that was covering a back portion of the side garden located adjacent to the neighbor's property. Several sudden and severe storms had swept through and caused many trees around Ann Arbor to be downed. Once the weather cooled down and autumn rains increased in frequency, we reduced watering via the sprinkler to 'as needed' and recommended that the Bird Center staff keep an eye on this as well.

We encountered a few other issues throughout the fall as we continued our check-ins, which is to be expected with any outside project. A large well-established groundhog was discovered to be roaming the grounds and digging through the newly planted garden, which resulted in the death of 2 of the 4 Michigan Holly (*Ilex verticillata)* shrubs located near the back of the side of the house. It also dug through the sand beneath the window wells, which raised concerns about possible interference with wires and the structural integrity of that side of the basement. The groundhog's den was found to be located at the back of the pole barn on the north end of the site. However, after much deliberation and with consideration for the animal's survival and the low chance of success with relocation, it was decided to let

the groundhog remain on site but employ other non-lethal methods to deter it from disturbing the garden. Several staff and board members have tried leaving a seed trail elsewhere and placing broken pieces of clay pottery in the window wells.

Beginning in September, we began researching signage for the garden. We planned to label some of the primary matrix plants to highlight their importance, and design a larger entry sign to the garden to inform visitors on the garden's function and how native plants are imperative for bird survival. We gathered quotes from several local signage companies and decided to go with a company called Signarama. We ordered 12 smaller 5"x7" signs with 18" stakes for labeling 11 plants and the bird bath. We were unable to find an appropriate choice for the larger 20"x30" entry sign, as all companies we reached out to quoted incredibly high prices and long wait times due to the shortage of materials, staffing, and supply chain issues related to the COVID-19 pandemic. It was then decided that we would design the larger sign and hand it off to the Bird Center at a later date so that they could order the sign and have it implemented on their own time. See examples of the smaller individual plant species signs below (put in November 12, 2021) and the design created for the large educational sign.

Figure 14. Plant Signage from Signarama. 12 signs total. 3 featured here: Big Leaf Aster (*Eurybia macrophylla*), Hummingbird Summersweet (*Clethra alnifolia*), and Eastern Redbud (*Cercis canadensis*).

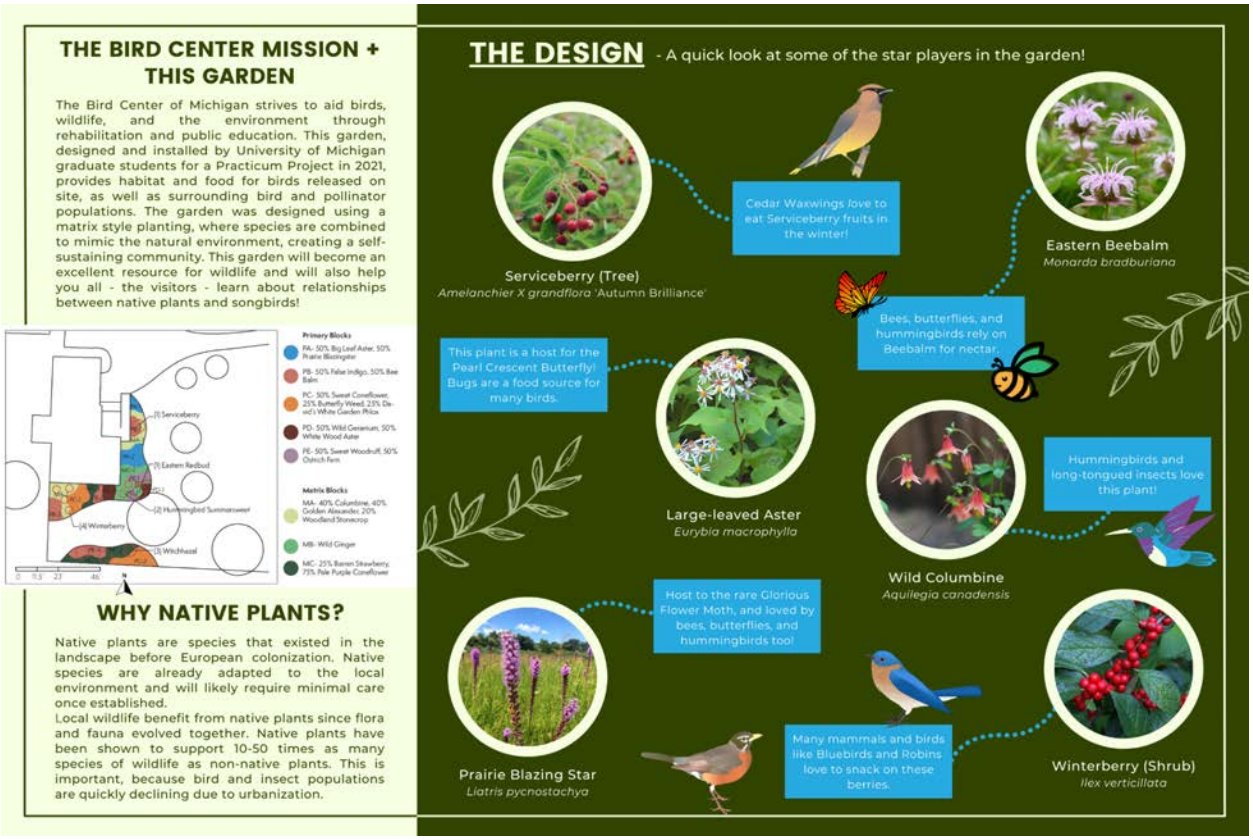

Figure 15. Large educational sign design (30" x 20") to introduce the front yard garden and explain garden function to visitors (full size PNG located in google drive).

For an initial analysis of site function, we conducted a songbird species count on site before the July planting and afterwards during fall migration season. The first species count occurred on June 29, 2021 from 7-8 PM. According to the British Trust for Ornithology, birds are most active for feeding in the early morning and in the evening right before they look for a place to sleep (BTO, n.d.). Since there is a bird feeder in the backyard of the center, we surmised that a spot under the large maple tree with binoculars would be a good place from which to watch the feeder. The first species count resulted in 17 species. The second species count occurred on September 28 from 9-9:30 AM, which is at the tail end of warbler, flycatcher, vireo, and thrush migrations (Kaufman, 2021). We counted 14 species during this shorter time period. According to Audubon, fall migration occurs anywhere from July to January, as opposed to spring migration, which happens within a much shorter time period (Witko, 2020). This, along with the fact that we went later in the morning, are potential reasons why the species count in September was lower. However, with the continued growth and establishment of the native plantings and future plans for even more restored spaces, birds are sure to find both the front and back gardens a suitable stop for rest, food, and cover.

Table 3. Bird Species Counts on 6/29/21 and 9/28/21

	Date: 6/29/2021	**Time**: 7:00 - 8:00 PM		**Date**: 9/28/2021	**Time**: 9:00 - 10:00 AM
	Species Common Name	**Species Scientific Name**		**Species Common Name**	**Species Scientific Name**
1	Cedar Waxwing	*Bombycilla cedrorum*		Mallard	*Anas platyrhynchos*
2	Eastern Bluebird	*Sialia sialis*		Black-capped Chickadee	*Poecile atricapillus*
3	Mourning Dove	*Zenaida macroura*		House Finch	*Haemorhous mexicanus*
4	American Robin	*Turdus migratorius*		Canada Goose	*Branta canadensis*
5	Tree Swallow	*Tachycineta bicolor*		Red-breasted Nuthatch	*Sitta canadensis*
6	Killdeer	*Charadrius vociferus*		Killdeer	*Charadrius vociferus*
7	House Finch	*Haemorhous mexicanus*		House Sparrow	*Passer domesticus*
8	House Wren	*Troglodytes aedon*		Eastern Bluebird	*Sialia sialis*
9	Northern Cardinal	*Cardinalis cardinalis*		Yellow-rumped Warbler	*Setophaga coronata*
10	House Sparrow	*Passer domesticus*		Blue Jay	*Cyanocitta cristata*
11	Chipping Sparrow	*Spizella passerina*		American Robin	*Turdus migratorius*
12	America Goldfinch	*Spinus tristis*		Brown-headed Cowbird	*Molothrus ater*
13	American Crow	*Corvus brachyrhynchos*		European Starling	*Sturnus vulgaris*
14	Common Grackle	*Quiscalus quiscula*			
15	European Starling	*Sturnus vulgaris*			
16	Ruby-throated Hummingbird	*Archilochus colubris*			
17	Chimney Swift	*Chaetura pelagica*			

Maintenance Plan

The maintenance plan for the newly naturalized landscape of the Bird Center will be relatively simple. As the years continue to pass, less maintenance should need to be done for the gardens, as the matrix blocks will fill out and a beautiful prairie-like appearance will result. Over the years, a naturalized garden requires less time and money to maintain than a conventional lawn, due to the reduced use of irrigation, pesticides, fertilizers and mowing (Meyer, 2019). A “natural-looking” garden is something that the staff, locals, and visitors may need to get used to, because people often expect a clean, angular, and bordered garden in front of a house. However, we as Landscape Architects in the making, are hoping to encourage a different view of gardens. Flowing lines, mixed matrices, and softer borders all contribute to the naturalized scheme of the design, which ultimately supports the sustainability goals of the center and benefits the wildlife and ecosystems of the property and surrounding areas. See below for the different components of the maintenance plan, and the best practices for ensuring the success and growth of the new Bird Center landscape.

The full maintenance plan is in a separate supplementary document that will be given directly to the client and be kept in their files for quick reference.

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Chapter 4 - Master Plan

With existing grapevines and an apple orchard on the North end of the site, the majority of the master site plan's recommended future features are relegated to the Southern portion. The Rain Garden labeled as #1 (Figure 18) will likely be the only thing we propose for that northern area, as there is already an existing depression within the topography where stormwater drains to and sits for a long time before ground absorption or evaporation occurs. This is mainly an issue during the wet summer months, so a rain garden in that spot will help water infiltrate via plants' clay-adapted roots reaching deep into the ground. The dimensions given in the detailed plan for this rain garden are the minimum requirements to capture water from the adjacent pole barn's roof and a portion of the gravel driveway/parking lot. However, the Bird Center is welcome to expand the size of the garden if they would like to in the future. As an added idea, this area could become a spot for future education through something like an observation deck and gathering space for groups of people. This "deck" could be multifunctional and also serve as a locus for public outreach programming with the BC's educational ambassador birds.

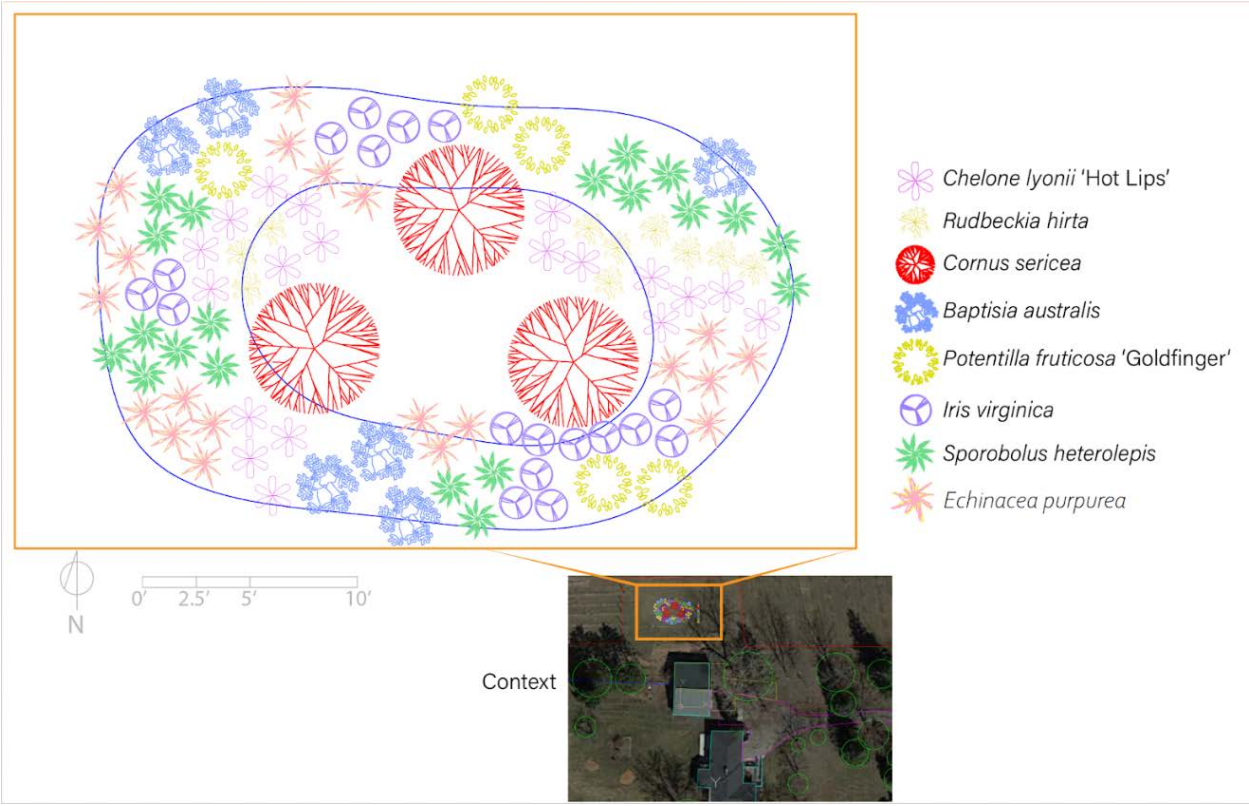


Figure 16. Magnified Rain Garden Planting Plan on North end of site

The small-medium trees we recommend for #2 on the key would likely be a small grove of Dogwoods, Serviceberries, or another similarly sized species (Fig. 18). The current Apple tree in that spot is slowly dying, and while dead/dying trees are immensely important for the local ecosystem and *should not* be cut down, some trees may be planted near it so that when the older specimen does finally decay on its own, there will be some at the ready to replace the lost resources.

Numbers 3 and 5 are perennial beds that were already planted as part of the first few phases of the Practicum Project, occurring in late summer-fall of 2021. We recommend a second smaller rain garden (#4) at the southern border of the fence, as this spot is already low and the terrain going towards that spot shows signs of erosion from the downspout at the corner of the house (Fig. 18). In addition, that area of the backyard is utilized for frequent cleaning of bird enclosures with the garden hose, and thus we want to ensure that further erosion does not occur and there is a proper spot to catch and clean the nutrient-rich water flowing down the hill.

Regarding the “front yard” portion, we left about half of the open lawn area alone for future events. It is a nice flat area that is easily accessible and visible to visitors, so it makes sense to keep this as an option. As we discovered through our primary research, the open area to the east of the front yard is considered part of the city road’s easement and thus we do not have jurisdiction over it. The Bird Center should probably avoid costly investment into this area, as the city could change it at any moment. Two additional perennial beds are proposed in the master plan for the front yard, so that a larger patch of native species and thus resources can be present for the birds. There is an integrated walking path that weaves in between the two beds to create some dimensional interest for visitors (Fig. 17). We envision that this site can become full of life, seasonal interest, and ecological services for the local fauna that many adore.

Figure 17. Perspective of Front Yard Proposed Perennial Planting

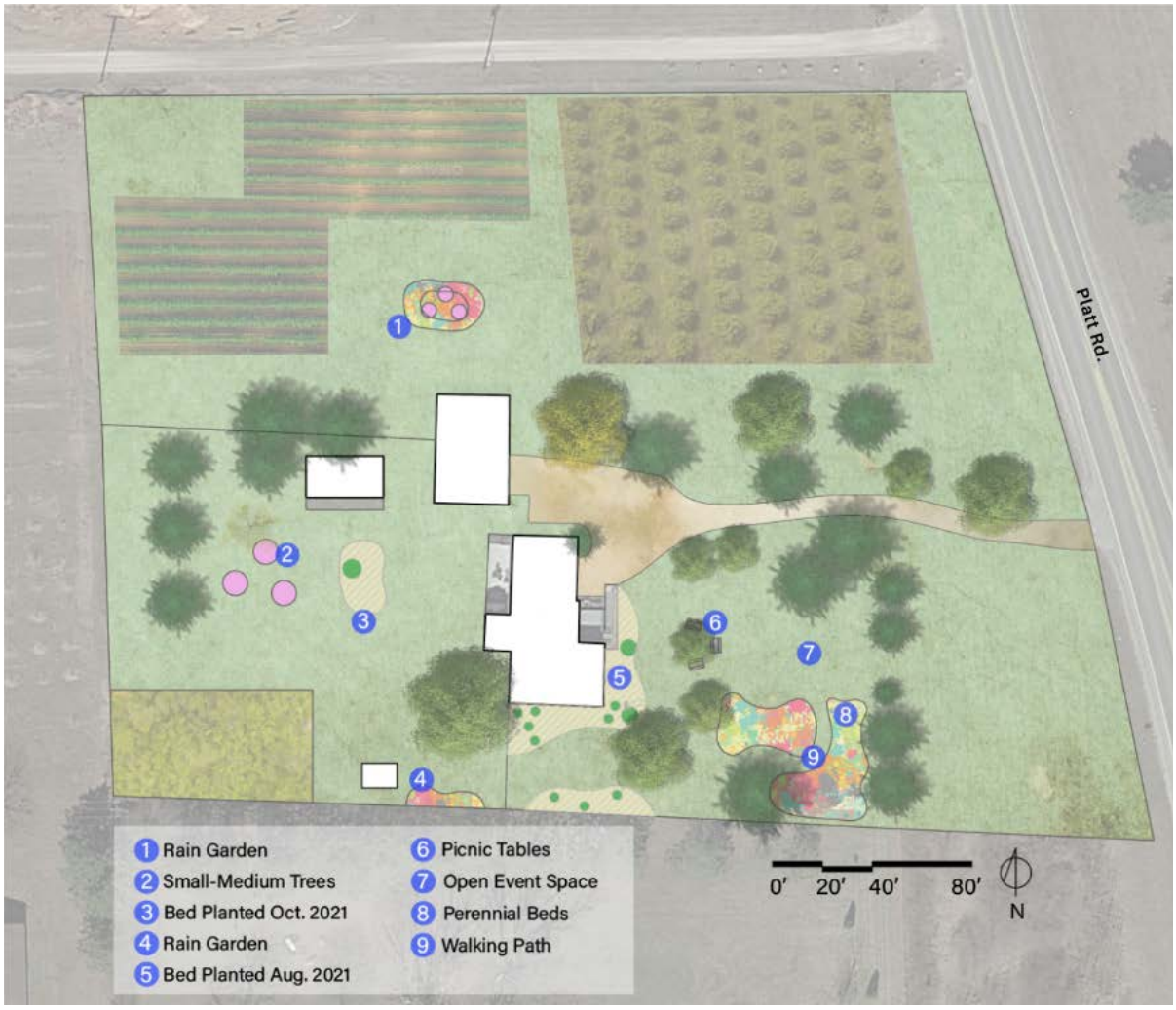


Figure 18. Master Site Plan with Existing and Proposed Features

Chapter 5 - Lessons Learned, Future Recommendations, Conclusions

Lessons Learned

As with anything in life, there is always room for review and improvement. The COVID-19 pandemic certainly impacted many aspects of the project in ways that were impossible to foresee. Due to the pandemic affecting labor market stability and it being our first time completing a landscape project from design to implementation, we experienced difficulties such as plant species supply shortages and inflated prices for sign materials, most of which we did not anticipate. Each obstacle required a reassessment, thorough communication between team members and the client, and decisions to move forward that everyone agreed upon. Another part we underestimated was how time consuming and difficult it would be to remove sod from the area we delineated on AutoCAD. A computer screen plan-view of a site is astonishingly different from the site experienced in-person. It is easy to draw a line in AutoCAD, but each line equates to real work on the ground. We realized after planting that the front yard would benefit from a few additional shrubs to cover the brick wall which extends to the left of the house. After removal of the existing overgrown invasive Honeysuckle and non-native Euonymus shrubs, the brick wall became quite an eyesore and was not something we had thought about. This is why it is so important to ground-truth a site plan and have first-time experiences like these - so we understand the time requirements, equipment, and physical labor involved in something as simple as removing sod. In the future, we would definitely use a machine like a BobCat with a bucket attached to the front to help carry the heavy rolls of clay-ridden sod to the dump truck bed, as that was the most difficult part. We spent almost an entire day solely on sod removal, and made the mistake of only using wheelbarrows and a ramp up to the truck bed for dumping.

Additionally, non-profit organizations bear the burden of securing funding on their own. Running a wildlife rehabilitation center is no easy task, and requires incredible amounts of resources for daily functioning. Likewise, we had to secure funding largely on our own for this project, and understanding the challenges that come with this are important. Setting aside enough time to search for scholarships and grants that would support our budget for plant materials and labor was intense, and keeping everything organized in the shared Google Drive in spreadsheets and checklists was definitely helpful. We understand now the difficulties that nonprofits face with funding, having gone through a similar experience ourselves. It helped us

see what this kind of work requires, and also gave us better appreciation for the processes and dedication involved.

One last consideration is that this was a practicum with only two people, and the workload was much more on each individual than it would be across 4-6 people on a traditional Masters Project team. Although we may have benefited from a larger team, we also enjoyed having less scheduling conflicts, tighter decision maneuvering, and clearly defined tasks. Another positive with the practicum is that we were given the opportunity to create our own project from scratch, set our own goals, and hold ourselves accountable for meeting them. Time management was incredibly important, and again, communication was absolutely key. Without frequent communication, we would not have been able to move the project along at the pace that we did. We front-loaded the majority of the work for the first half so that any unexpected aspects and extras could be taken care of with minimal stress during the latter half. We knew that with job interviews and wrapping up graduate school, we would already have plenty on our plates during the last semester.

Future Recommendations

Educational Opportunities

With the 2.5 acres of available space, the Bird Center has incredible opportunities for hosting a greater range of educational programming directly on site. For example, 'Blue' and 'One-Eye', the BC's two educational ambassadors, are currently in training to become more comfortable with public interactions, loud noises, and sometimes chaotic situations. Blue is a Blue Jay and One-Eye is a Mourning Dove, and they are well on their way to becoming amazing representatives for the BC. Educational ambassadors are a great way to both bring people to the center and reach the public in other locations, such as schools, outdoor parks and recreation areas, nature and conservation-related events, and even unlikely places such as senior living facilities. Spreading the word about the BC's important work, mission, and goals can be supplemented by the tangible presence of these ambassadors. Few people get the chance to see such wonderful creatures up close, and it is experiences like these that can make a huge impact on someone's life, young or old. Inspiring younger generations to care about the environment and its integrated systems in the future, and getting adults actively involved as well is the ultimate goal of educational programming.

Blue and One-Eye, along with on-site and outreach programs will be critical in not only inspiring action, but also help secure robust volunteer and internship cohorts. Volunteers are essential to the daily functioning of the BC, and interns bring tremendous assistance during the hectic summer months (peak breeding season for

most bird species). Because the BC is a non-profit, the vast majority of work and funding is possible through grants, donations, and volunteers. Thus it follows that outreach and education is imperative to the BC's future success.

Although the BC did not secure a Masters Project team for the 2022-2023 academic year, this is always an option in the future and is a great way to connect students with meaningful hands-on work and the BC with resources that a large well-established university might be able to provide. Typical Masters Project teams consist of 4-6 people, and each student automatically is allotted $1500 from the university to use towards a project. The BC's imagination can stretch as far as it likes concerning the possible projects and that Masters students could potentially work on, whether it be the sustainable development and sourcing of lumber for flight cages, the transition of the BC to 'clean energy' and water usage, or the continuation of master plan design implementation and updates from what was already accomplished in the 2021-2022 phase.

In addition to Masters Projects, universities are a prime space for reaching undergraduate and graduate level students through events like career fairs (university-wide, undergrad or grad-specific, or school-specific like SEAS), Earth Day, and Earthfest. Leveraging partnerships with student organizations, local nature or sustainability-oriented community groups, and schools can further the BC's positive influence.

Fundraising events that involve public participation are another opportunity for utilizing the educational ambassadors as well as raising awareness and securing more funding. These also have the potential to be truly enjoyable for participants. A ticketed 'painting and wine night' for adults, auctions, guided bird-watching hikes, and interactive storytelling events for kids and families are just a few examples. There is a lot of power in storytelling and oral traditions, and this could be an interesting way to bring that back into peoples' lives. The history of birds or even the story of each species could be worth sharing, and many children absolutely adore stories.

General Recommendations

We created a QR code that links to a Google Forms survey which asks visitors their opinions on the aesthetic and habitat quality of before and after pictures for the front yard. In the winter, it may be harder for visitors to visualize as most of the plants are dormant, but during warmer months it would be a good way to get people to explore the garden. While the timeline of our project did not allow us to collect sufficient data on visitor opinions for the final report, this form can continue collecting data for as long as the BC desires and could potentially contribute to a longitudinal study for future students to incorporate into a new project. The BC can

also use feedback from this survey to inform future decisions for landscape improvements and visitor satisfaction.

A part of the project that has not been implemented yet, but that we hope will be placed soon, is a memorial bench honoring the late Maureen. Molly Tamulevich of the Michigan Humane Society spearheaded this portion and is securing the bench and plaque. We set aside a space under the Redbud tree in the front yard for this bench to be placed later on, and hope that this area will serve as a space for visitors to rest and observe the garden, bird bath, and all the flora and fauna in action. Another portion that we were unable to implement was the larger educational sign for the entrance to the garden, which as mentioned previously, was due to the unexpectedly high cost estimates. If the BC wants to in the future, they may take the design that we created for this entrance signage (Figure 13) and submit it for production with a signage company of their choosing. A full size high-quality PNG of the design is located in the shared Google Drive that the BC has access to.

If any issues arise with the portions we implemented, the resources compiled in the maintenance plan as well as past collaborators could all be potential contacts for the BC to reach out to. While both of us will be moving away from the Ann Arbor area for new professional endeavors after graduation in April 2022, we will still be reachable via email and we are excited to see how the gardens grow and fill out over the years.

Conclusions

Overall, we are satisfied with the results of the project and what we were able to accomplish with a small team of two and a relatively short timespan of 1.5 years. It was an incredible learning experience for both of us and produced valuable positive outcomes for the client and students alike. Because Landscape Architecture remains largely misunderstood, it was important for us to work with a client that was willing and open to understanding and learning with us about the role LA's can play in the creation of sustainable landscapes. We feel that a beneficial reciprocal relationship formed between an admirable non-profit and the graduate academic realm, and that our aligned goals and shared vision allowed for the success of the project.

To conclude, we hope that the BC is also pleased with the project and that they can take what we started and expand upon it going forward. We were fortuitous in having such an amicable, supportive, and communicative client, and wish the BC all the best in future endeavors.

Closing Remarks

We hope that the BC is able to expand and further their mission, and that this project supports these aspects along with helping to solidify 7800 Platt Rd as the BC's new home. Thank you again to the BC, collaborators, advisors, volunteers, friends, and colleagues who supported and helped us throughout this amazing experience - we are so grateful for everything.

Appendix

- Front and backyard design plans
- Seasonal interest/ wildlife value chart
- Suggested plant list for future gardens
- Rain garden handbook and plant lists (Washtenaw County Water Resources; Susan Bryan and Shannan Gibb-Randall)
- Maintenance plan

Planting Design for the Bird Center of Michigan

0 11.5′ 23′ 46′

1″=23′

N

Primary Blocks

PA- 50% Big Leaf Aster, 50% Prairie Blazingstar

PB- 50% False Indigo, 50% Bee Balm

PC- 50% Sweet Coneflower, 25% Butterfly Weed, 25% David's White Garden Phlox

PD- 50% Wild Geranium, 50% White Wood Aster

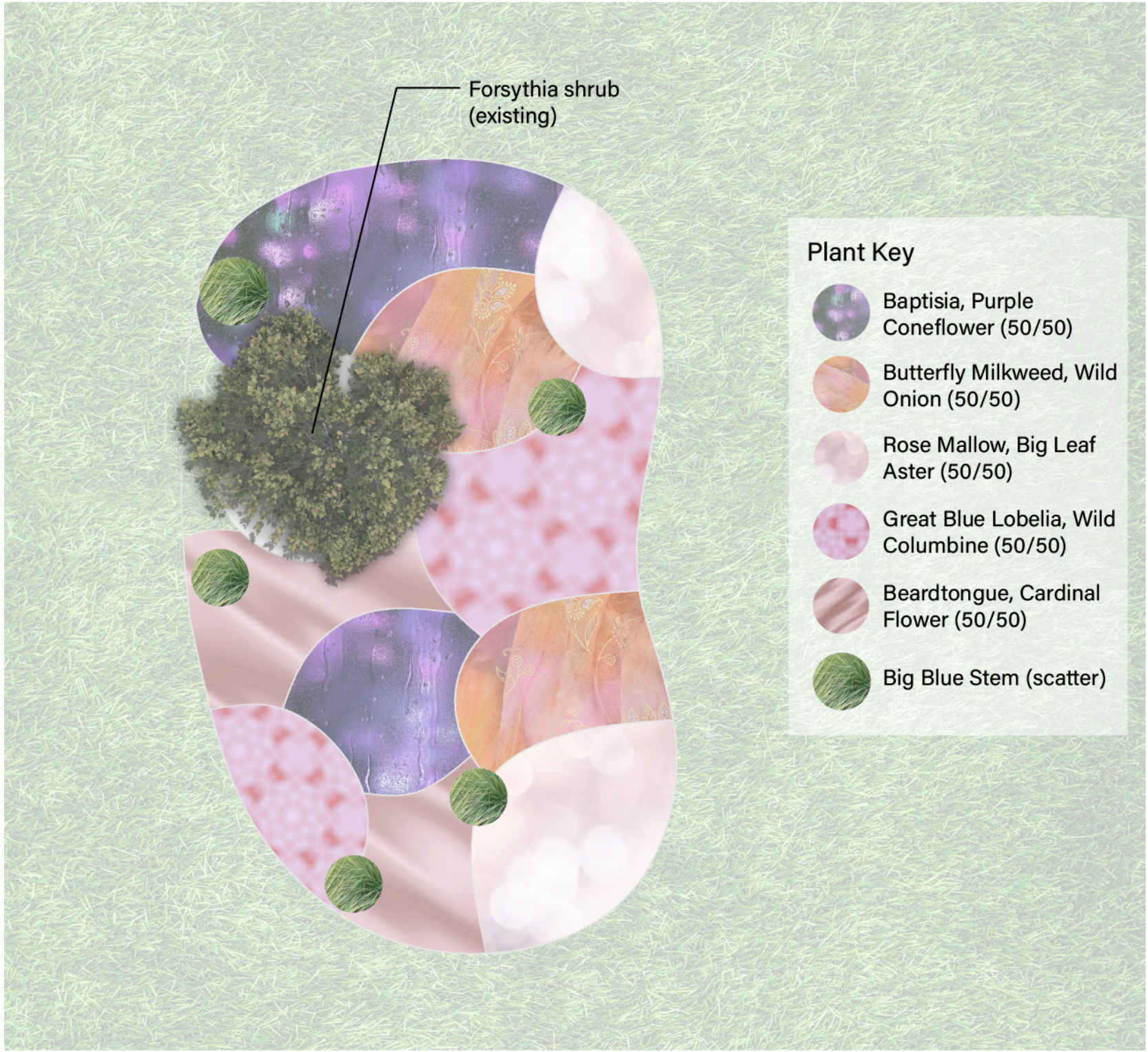
PE- 50% Sweet Woodruff, 50% Ostrich Fern

Matrix Blocks

MA- 40% Columbine, 40% Golden Alexander, 20% Woodland Stonecrop

MB- Wild Ginger

MC- 25% Barren Strawberry, 75% Pale Purple Coneflower


Forsythia shrub
(existing)
Plant Key
Baptisia, Purple Coneflower (50/50)
Butterfly Milkweed, Wild Onion (50/50)
Rose Mallow, Big Leaf Aster (50/50)
Great Blue Lobelia, Wild Columbine (50/50)
Beardtongue, Cardinal Flower (50/50)
Big Blue Stem (scatter)

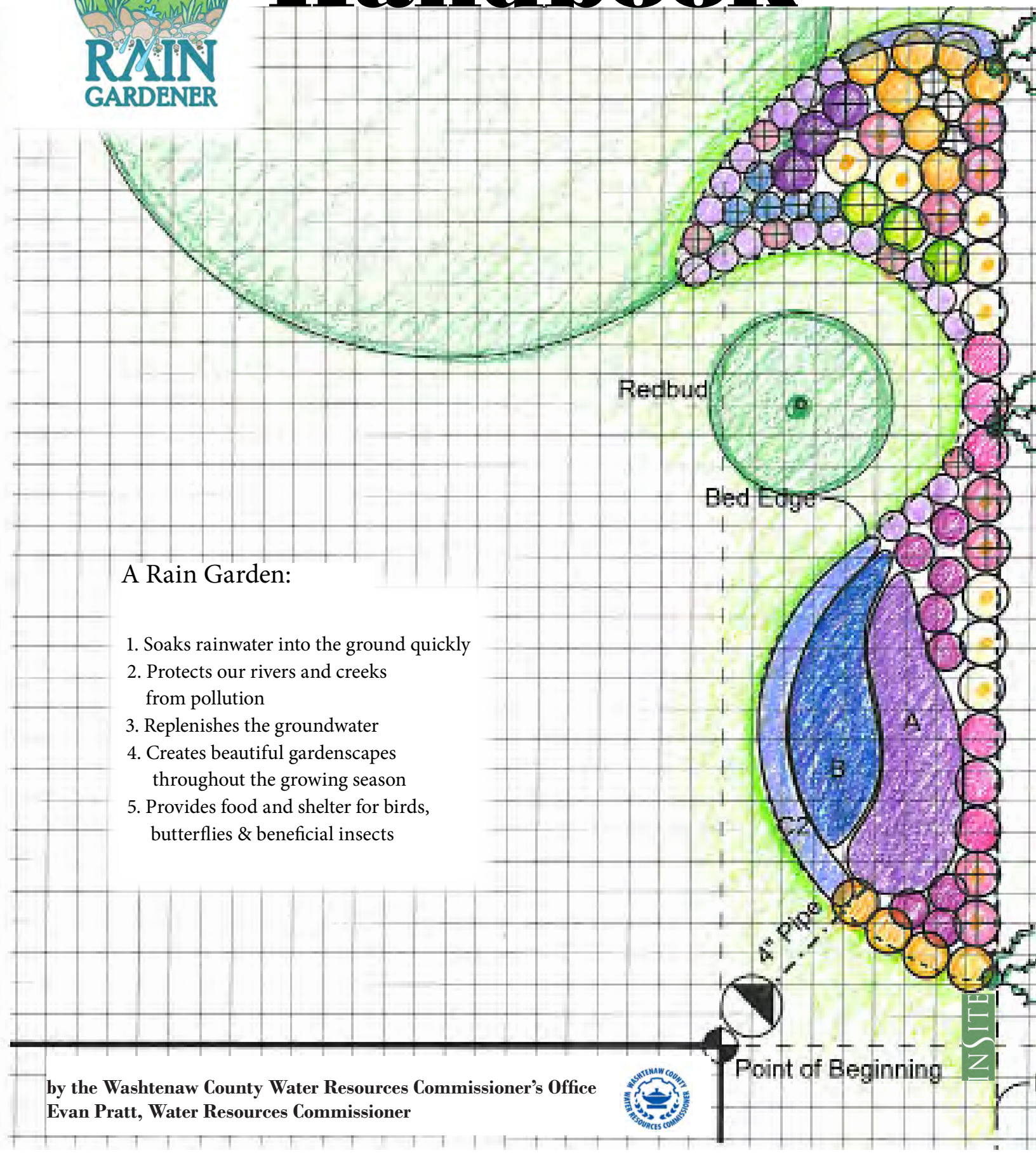
Plant Name	Wildlife Value	Resource for Birds	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Autumn Brilliance Serviceberry		Fruit, Resting				✻		...	...			◆		
Eastern Redbud		Resting				✻						◆		
Hummingbird Summersweet		Resting, Protection							✻	✻		◆		
Winterberry		Fruit, Resting, Protection	...	...	...	...		✻					...	...
Witch Hazel		Resting, Protection		✻	✻							◆		
Barren Strawberry						✻	✻							
Bee Balm		Attracts Food	...	...	...	...			✻	✻	...	...	...	...
Big-Leaf Aster		Attracts Food	...	...	...	...				✻	✻	...	...	...
David's White Garden Phlox		Attracts Food	...	...	...	...			✻	✻	✻		...	...
Columbine		Attracts Food				✻	✻							
False Indigo		Protection, Attracts Food	...	...	...		✻	✻	...	...	...	...	...	...
Golden Alexander		Attracts Food	...	...	...		✻	✻	...	...	...	...	...	...
Ostrich Fern														
Pale Purple Coneflower		Attracts Food	...	...	...	...		✻	✻	...	...	...	...	...
Prairie Blazing Star		Attracts Food	...	...	...	...			✻	✻	...	...	...	...
Butterfly Milkweed		Attracts Food	...	...	...	...			✻	✻	✻	...	...	...
Sweet Coneflower		Attracts Food	...	...	...	...			✻	✻	✻	✻	...	...
Sweet Woodruff						✻	✻							
Wild Geranium		Attracts Food				✻	✻							
Wild Ginger						✻	✻							
White Wood Aster		Attracts Food								✻	✻			
Woodland Stonecrop			...	...	...	...				✻	✻	✻	...	...

Key: ✻ Flower Color | **...** Seedheads Present | ... Fruit Present | ❖ Fall Color

Plant Type	Botanical Name	Common Name	Typical Height (ft)	Typical width (ft)	Light Type	Details on Light Needs	Soil Type	Soil Moisture	Details on Soil Moisture Needs	Bloom Time	Bloom Color	Ecological Value
Trees	*Cercis canadensis*	Redbud	1.8-2.5' h	25-35' w	F-Psh	Part shade best in hot summers	L	M	Well drained	April	Pink, Purple	Bee,Bird
	Amelanchier grandiflora 'Autumn Brilliance'	Autumn Brilliance Serviceberry	20' h	15' w	F-Psh		L, S, C	M	Tolerant of a somewhat wide range of soils	April	White	Bird
	Acer saccharum	Sugar Maple	40-80' h	30-60' w	F-Psh	Tolerates heavy shade	L	D, M		April	Green	Bird
Shrubs	*Potentilla fruticosa*	Shrubby Cinquefoil	2-4' h	3-5' w	F-Psh	More flowers in full sun	L, S, C	MD	Well drained	June-Sept	Yellow	Butterfly, Erosion Control
	Ilex verticillata	Winterberry	5' h	5' w	F-Psh		L, S, C	MW	Tolerates poorly drained soils	June	White	Bird
	Aronia melanocarpa	Black Chokeberry	4' h	4' w	F-Psh	Best fruit production in full sun	L, S, C	DM	Tolerates wet soil	May	White	Bird
Perennials	*Aquilegia canadensis*	Columbine	2-3' h	1-1.5' w	F-Psh	Prefers light to moderate shade	L, S	M	Well drained	April-May	Red, Yellow	Bird
	Chelone glabra	White Turtlehead	2-4' h	1-2' w	F-Psh	Does better in light shade or morning sun to avoid dry soil	L, S, C	MW	Keep soil moist	Aug-Nov	White	Bee, Bird, Butterfly
	Echinacea pallida	Pale Purple Coneflower	2-3' h	1-1.5' w	F-Psh	Best in full sun	L, S	DM	Well drained	June-July	Purple, Pink	Butterfly
	Eurybia macrophylla	Big Leaf Aster	2-4' h	2-4' w	Psh-Sh	Best in part shade	L, S, C	M		July-Oct	Blue	Butterfly
	Maianthemum racemosum	False Solomon's Seal	2-3' h	1.5-2' w	Psh		L, S, C	M		April-May	White	Bird
	Potentilla simplex	Common Cinquefoil	1.5' h	1.5' w	Psh-Sh		L, S, C	M		June-July	Yellow	
	Zizia aurea	Golden Alexander	1.5-3' h	1.5-2' w	F-Psh		L, S, C	M, W		May-June	Yellow	Bee, Butterfly
	Veronicastrum virginicum	Culver's Root	3-4' h	2-3' w	F	Flops in too much shade	C, L	MW		May-Aug	White, Pink, Blue	Butterfly
	Asclepias purpurascens	Purple Milkweed	2-3'	1'-3'	F, PSh	Prefers part shade, especially in dry soils	C, L	DM	May wilt in drought, especially young plants	June-July	Pink, Purple	Bee, Bird, Butterfly
	Dalea purpurea	Purple Prairie Clover	1'-3'	1'-1.5'	F	Best in full sun	L, S, C	MD	Well drained soils	June-Aug	Purple, Rose	Bee, Butterfly
	Liatris pycnostachya	Prairie Blazing Star	2-5'	1.5-2'	F	Too little sun may cause twisted growth	L, S, C	DM	Requires moisture, dry conditions can cause leaf loss--6.8 pH ideal	July-Aug	Purple, Rose	Bee, Bird, Butterfly
	Lobelia siphilitica	Great Blue Lobelia	2-3'	1-1.5'	Psh		L, S, C	MW	Tolerates full sun with sufficient moisture, not at all drought tolerant	July-Sept	Blue	Bee, Bird, Butterfly, Erosion Control
	Baptisia australis	Blue False Indigo	3.5' h	3.5' w	F-Psh	Best in full sun	L, S	DM	Tolerates drought and poor soils	May-June	Blue, Purple	Butterfly
	Monarda didyma	Beebalm / Bergamot	3' h	3' w	F-Psh	In hot climates, needs afternoon shade	L	M	Soils should not dry out	July-Aug	Red, Pink, Purple	Bee, Butterfly
	Rudbeckia hirta	Black Eyed Susan	3' h	2' w	F		L, S	MD	Best in moist soils, though not wet	June-Sept	Yellow	Bee, Bird, Butterfly
Grass/Sedges	*Carex pensylvanica*	Pennsylvania sedge	0.5-1' h	0.5-1' w	Psh-Sh	Sun-dappled part shade preferred, heavy shade tolerant	L, S	MD	Good drainage needed	May	Yellow	Erosion Control
	Panicum virgatum	Switchgrass	5-6'/3' total/base	2-3' w	F	May flop in too much shade	L, S, C	DM	Flops in rich soils, prefers moist	July-Sept	Purple	Bird, Butterfly, Erosion Control
	Schizachyrium scoparium	Little Bluestem	4-3'/1.5-2' h total/base	1.5-2' w	F		L, S, C	DM	Best on well drained soils & better competitor in less fertile soils	Aug-Nov	Purple	Bird, Mammal, Erosion Control
	Sorghastrum nutans	Indian Grass	4' h	2' w	F		L, S, C	MD	Average, dry to medium, well-drained soils	Aug-Sept	Yellow	Bird, Butterfly
Ferns	*Athyrium filix-femina*	Lady Fern	2-3' h	2' w	Psh-Sh	Tolerates full sun with constant moisture	L, C	M	Tolerates drier soil than many other ferns			
	Onoclea sensibilis	Sensitive Fern	3.5' h	3.5' w	Psh-Sh		C	MW	Needs consistent moisture			
Groundcover	*Fragaria virginiana*	Wild Strawberry	0.5' h	1.5' w	F-Psh		S, L	M		April-May	White	Bird
	Asarum canadense	Wild Ginger	0.5-1' h	1-1.5' w	Psh-Sh		L, C	MW	Prefers constant moisture	April-May	Purple, Brown	

Light Type	
F	Full Sun
Psh	Part Shade
Sh	Shade
Soil Type	
S	Sand
C	Clay
L	Loam
Soil Moisture	
D	Dry
M	Moist
MD	Dry to Moist
DM	Moist to Dry
MW	Moist to Wet
WM	Wet to Moist
W	Wet

Master Rain Gardener Handbook



A Rain Garden:

1. Soaks rainwater into the ground quickly
2. Protects our rivers and creeks from pollution
3. Replenishes the groundwater
4. Creates beautiful gardenscapes throughout the growing season
5. Provides food and shelter for birds, butterflies & beneficial insects

by the Washtenaw County Water Resources Commissioner's Office
Evan Pratt, Water Resources Commissioner

WHAT IS A RAIN GARDEN?

Rain Gardens are shallow gardens filled with beautiful plants that collect rain water and runoff and let it soak into the ground naturally. This helps to clean the water, protect our rivers and lakes, and reduce flooding. Rain gardens also create healthy habitats for wildlife, birds, and pollinators.

- Cleans water by filtering pollution and stopping trash
- Protects our rivers, lakes, and drinking water sources
- Reduces flooding in homes and on streets and sidewalks
- Native plants provide beautiful, healthy habitats

Illustration by InSite Design Studio, Inc.

How do Rain Gardens Help Keep our Water Clean?

As rain falls from the sky and lands on hard surfaces like roofs, streets, and sidewalks it picks up pollution, dirt, and trash. This dirty water and pollution then rushes into storm drains which empty right into streams, rivers, and lakes. The water is not cleaned first!

Rain gardens help protect our water by cleaning rain water and runoff before it reaches our streams, rivers, and lakes. The soil and plants act like a natural filter to clean the water as it soaks slowly into the ground. This helps stop dirty, polluted water and trash from going into our rivers and lakes.

The native plants that thrive in rain gardens have deep roots that help water to soak into the ground. They grow in wet and dry weather and will need less watering and weeding. These plants also support important, healthy habitats that can attract birds, butterflies, local bees, and other pollinators.

We can take action to keep our water clean by planting rain gardens and directing rain water runoff into them.

For more information visit: www.washtenaw.org/raingarden

WASHTENAW COUNTY WATER RESOURCES COMMISSIONER

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3

INTRODUCTION

Background

In most towns and cities, rainfall and snow melt are whisked away into an engineered stormwater system of pipes and basins that funnel water directly into local streams & rivers. This water does not get cleaned or filtered first.

After its trip through the pipes, stormwater is no longer just rainwater. It is hot - stormwater is warmed as it flows over hot pavement. It's also polluted with oil and gas, phosphorous, e-coli, and trash that are washed off the streets and carried to the creek. And it is huge - a small creek can flow like a river after a rainfall, eroding the banks and muddying the river.

In the river, the polluted runoff poisons fish, plants and other species that depend on them, including us. Stormwater is the #1 source of pollution in rivers today. Stormwater is the #1 source of pollution in rivers today.

Most communities get their drinking water from a combination of water drawn from the river and from wells. River water polluted with runoff can be more expensive to purify at water treatment plants. Well water is only available if rainwater soaks into the ground and recharges the ground water.

Woods and prairies historically soaked in almost all the rain that fell on them. Concrete soaks in none.

People play, boat and fish in the river. If contamination levels are too high, restrictions can be placed on recreational activities such as swimming and fishing.

There is a simple way to do your part to keep pollution out of the river, reduce flooding, recharge the water table and revitalize your yard:

Rain Gardens

Rain gardens help protect our nearby water bodies by filtering and soaking water back into the ground. For a modest 1,500 square foot home, 5,000 gallons of water from a one inch rain storm run off from roofs, driveways, patios and even lawn.

A simple, low-maintenance rain garden can capture much of that runoff, similar to how the natural environment would function. Learn how you can mimic nature's effects by following this guide to rain gardens.

Photo credit: Susan Bryan Master Rain Gardener Leslie Kellman

WHAT CAN I DO TO HELP?

Drawing by Tom Winebrenner

What can you do to help? A lot!

1) **Build a Rain Garden**
Soak in the rainwater right in your own yard. Plant some beautiful flowers that include native plants. These old-timers provide wildlife habitat, nectar for pollinators & are a beautiful addition to your yard.

2) **Mulch Leaves In Place**
Use a mulching mower so the leaves decompose and feed your grass - for a beautiful lawn. Or, rake leaves in the fall so they aren't washed into streams & lakes. Fertilize your lawn sparingly.

3) **Pick up Litter**
Pick up litter before it enters the storm drain.

4) **Scoop Pet Waste**
Or otherwise, it's gross. Enough said.

5) **Clean up Oil and Gas from your Car**
Clean up any oil or gas spills from your car and repair any leaks or drips. Keep your car tuned up and in good repair.

6) **Plant Native Flowers, Trees, & Shrubs**
Add a native plant buffer strip around streams & lakes to reduce erosion and stabilize the bank during large storm events. Long root systems of native plants prevent sedimentation.

6) **Become a RiverSafe Home**
Take a quiz and earn a credit on your water bill!
City of Ann Arbor Residential Stormwater Credit
www.a2gov.org

Watersheds

Where does the rain water runoff from your property go? In Washtenaw County, the water flows one of six ways: to the Huron River, the River Raisin, the Grand River, Stony Creek, the Rouge River, or Swan Creek. All watersheds flow into Lake Erie except the Grand River Watershed, which flows to Lake Michigan.

Which watershed are you in?

- Look at the map attached to see in what watershed your property lies.
- Get involved! Many of the watersheds have Watershed Councils, which coordinate conservation efforts for that river. You can participate in Adopt-A-Stream, River Roundup insect monitoring, a River Clean Up day, run in a 5K fundraiser, or take a class on naturalizing your landscape.

Watershed Non-Profits

Friends of the Rouge

www.therouge.org

Rouge Rescue, Benthic Macroinvertebrate Sampling, River Restoration, Rouge Frog & Toad Survey, Run for the Rouge 5K Trail run, "Naturalizing the Home Garden" workshop.

Stony Creek

www.crwc.org

The Clinton River Watershed Council coordinates activities that benefit Stony Creek.

Upper Grand River Watershed Alliance

www.uppergrandriver.org

January Stonefly Hunt, "State of the River" conference in February, Stormwater-Lunch webcast series March, construction of a stormwater wetland at RA Greene Park in Jackson, dry- and wet-weather water quality sampling, spring and fall Adopt-A-Stream Events.

Huron River Watershed Council

www.hrwc.org

You can sign up to get e-mail updates, which means you receive their bi-weekly newsletter "News to Us." It is a good way to keep abreast of the newest ideas on how to keep the river clean. Volunteer programs include:

Adopt-A-Storm Drain, Huron River Clean Up, River Roundup insect sampling, Winter Stonefly Search, Field Assessment, Water Quality Sampling, Suds on the River annual September fundraiser.

River Raisin Watershed Council

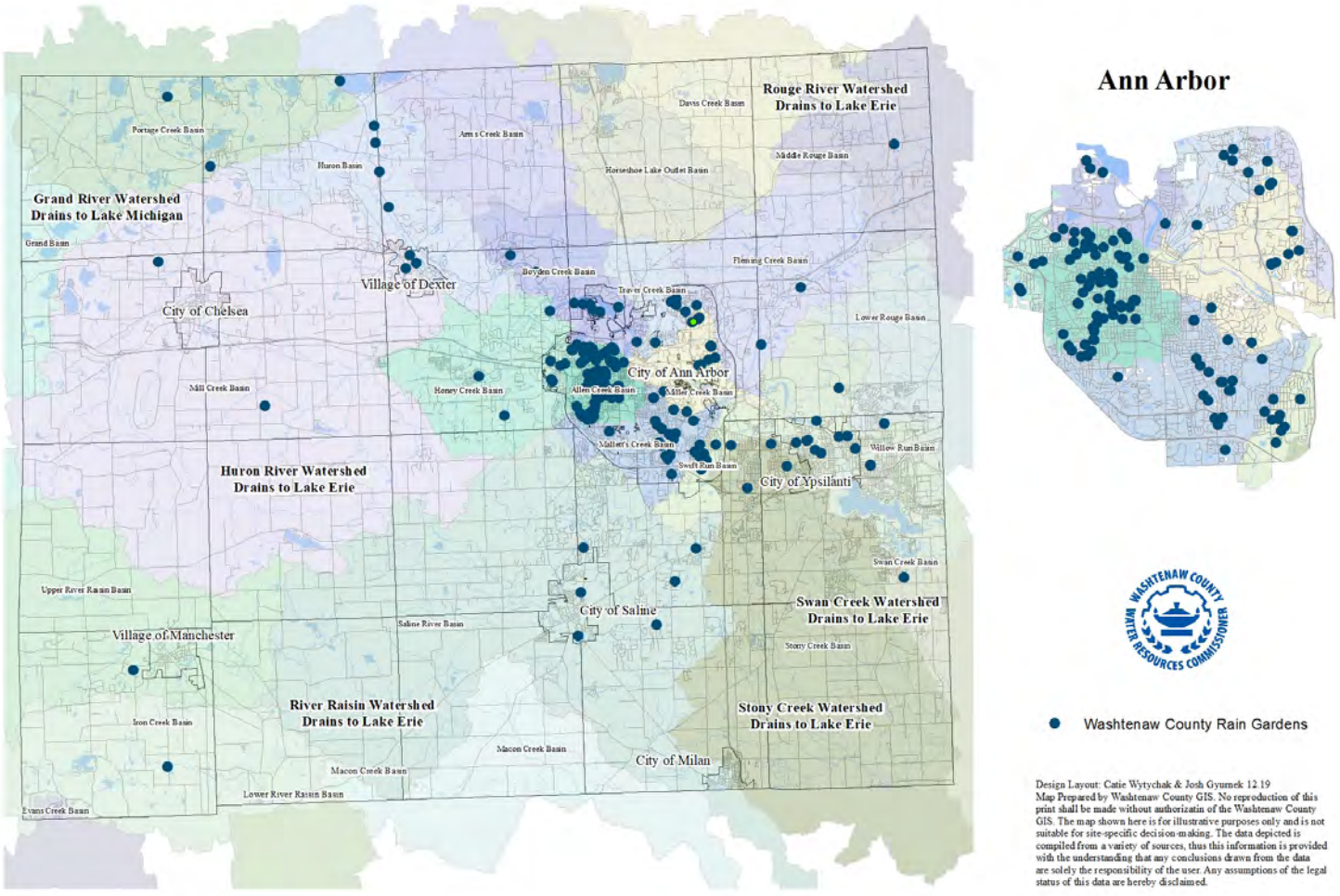
www.riverraisin.org

Volunteer in Adopt-a-Stream, River Roundup insect sampling, or invite them to give a presentation to your civic group.

Swan Creek

None! Anyone want to start one?
This is in part of Ypsilanti and Augusta Townships.

Rain Gardens & Watersheds



Other Good Resources:

The Blue Thumb Guide to Rain Gardens
The best book on how to construct a rain garden. by Rusty Schmidt, Dan Shaw, and David Dods.
bluethumb.org/raingardens

Rain Garden Online Discussion Forums
Great Lakes Gardening Forum. www.houzz.com/discussions/great-lakes-gardening
Facebook Group: www.facebook.com/groups/MasterRainGardener

Videos Ideas from Kevin's Rain Gardens, a landscaper in Illinois. Time lapse of digging the rain garden. YouTube: KevinsRainGardens.

Rain Garden iPhone App
nemo.uconn.edu/tools/app/raingarden.html
by Connecticut Cooperative Extension.

Rain Garden Calculator
Raingardenalliance.org/right/calculator Get a quick estimate of the size and costs of your rain garden. But watch out! If you pick clay as your soil, they estimate a much bigger rain garden than we recommend.

Lakescaping for Wildlife & Water Quality
Book by Carol L Henderson and the Minnesota Department of Natural Resources. Preserve or restore the natural beauty that attracted you to lakeshore living in the first place.

Michigan Natural Shorelines Shoreline ambassador certification class and a list of certified shoreline contractors to plant a natural shoreline and take care of your lake.
www.mishorelinepartnership.org/mi-shorelines

Michigan Conservation Stewards Class on conservation, ecology, natural resource management as well as terrestrial and aquatic ecosystems both in the classroom and in the field. mnfi.anr.msu.edu/programs/conservation-stewards-program

Wild Ones The native plant support group! Monthly educational meetings, seed swaps, and field trips.
www.WildOnes.org

Master Composter Class From backyard composting, vermiculture (worm composting!), compost tea, and soils.
www.washtenaw.org/355/Master-Composter-Class

RAIN GARDEN ESSENTIALS

A simple solution with a big effect

A rain garden is a shallow garden that captures water and soaks it into the ground. It fills up with the rain that falls on it – plus rainwater that runs off a hard surface like a roof or a driveway. It is a simple solution but it has a big effect.

The runoff water has picked up pollutants that the rain garden can filter out: phosphorus and nitrogen from fertilizers; bacteria from animal waste; oil, grease and heavy metals from cars, and just plain old "dirt" called sediment.

Studies have shown rain gardens are effective at removing pollutants harmful to human health. How? Sunlight destroys bacteria and viruses harmful to humans. Petroleum is eliminated by bacteria in the soil. Heavy metals are adsorbed by soil and mulch particles. This is in addition to those substances which are bad for the environment like nitrogen-containing compounds and phosphorous, at rates of over 90%.

Rain gardens require less watering than regular gardens during hot summer months. Because they capture water from the roof, a rain garden gets enough water that it doesn't need water from the tap. Your water bill can be reduced by using free water from the sky.

Essential Steps

1. **Locate** where you will put the rain garden. Pick a location at least 15 feet from the house and downhill from the downspout.
2. **Measure** how big the roof/driveway/sidewalk that will drain to the rain garden is. Draw up a base plan.Call Miss Digg (811) to locate underground utilities.
3. **Size** the rain garden. Do the calculations so you know what size you are aiming for. The area of the depression should be 20-30% the size of the contributing roof or driveway.
4. **Design** the rain garden. Make a drawing that shows the size, shape, and plants.
5. **Plan the drainage**. Direct the water to your rain garden location, either overland or through a buried pipe.
6. **Dig** the rain garden. Dig a garden bed that will hold water 3-6" deep.
7. **Add soil amendments**. Rototill in compost, spread mulch.
8. **Plant** your rain garden with beautiful plants of your choice.
9. **Maintain** your garden so it looks great! Water your garden if it doesn't rain, until it is well established. Fertilizers aren't necessary but weeding is, especially at the beginning.

Photo of Roger Moon's Rain Garden. Designed & Installed by Roger Moon. Photo credit: Susan Bryan.

Water Flows Downhill

Water flows down the gutter,
into the downspout,
downhill over the grass,
and into the rain garden,
Where it soaks into the ground.
Beautiful!

Catch it before it runs onto the driveway and into the street!
Once water is in the street, it picks up pollution before taking it to the nearest river.
Yuk!

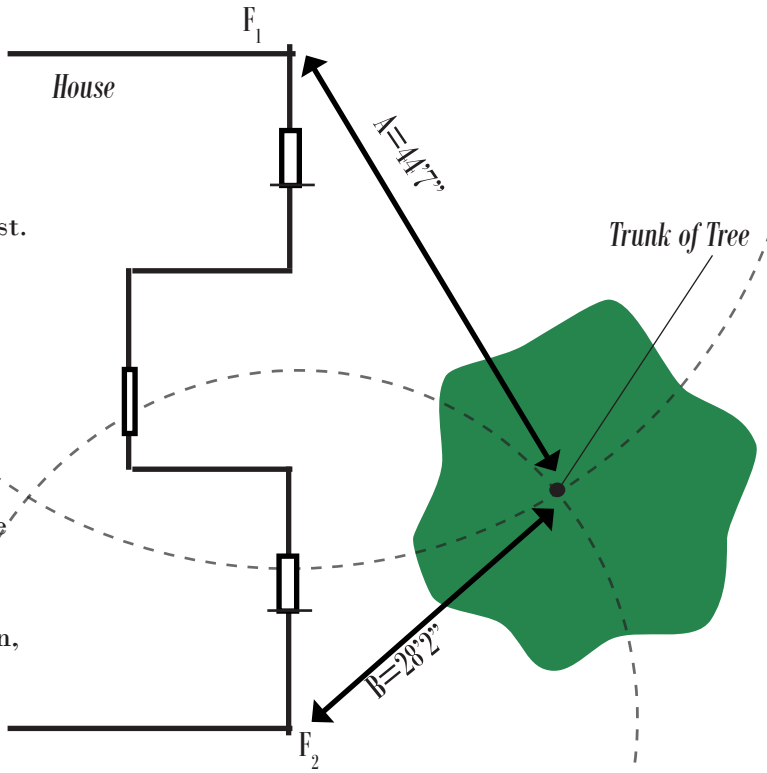
Locating

1. The garden must be at least 15 feet away from any building to prevent potential water seepage into the basement.
2. Select a spot that is flat or gently sloping and is downhill of the downspout. Avoid tree roots. Make sure overflow from the rain garden will go to a safe location, away from a building.
3. Do not place a rain garden over a septic tank, leach field or drinking water well.
4. Call Miss Dig at 811 at least three days before digging to avoid public pipes & utilities.
5. Avoid any private wiring or utilities such as driveway lights, sheds with electricity or lawn irrigation pipes.

Measuring

Now that you have chosen a general location for the future rain garden, create a base plan that has all the elements that are currently on the site. This is so you can draw up a rain garden plan "to scale". Include the house, trees, fences, sheds and bed lines that are near the future rain garden on the base plan. Being able to draw the rain garden plan "to scale" on an accurate base plan will help accurately estimate quantities of plants, mulch & compost. It is handy!

1. First start with a piece of graph paper. Each square on the paper might equal one square foot in the real world, depending on the size of your site. Make sure your graph paper is big enough to include your rain garden's location. To do that, go outside and measure the space. Count the number of squares across your paper and make sure the plan will fit on the paper.
2. Measure the distance between two fixed spots. (Often, this is two corners of the house.) Draw them, on the graph paper to scale.
3. Start locating other objects in the yard, and draw them on your plan accurately (trees, fences, etc.) To do this, measure between both of the fixed spots, and the object. Sketch them on the plan in an approximate location, and write down the distances to each of the fixed spots. For example, A=44'7"; B=28'2".
4. Go back inside and using a string or compass that is measured to length, triangulate the exact location of the objects on the plan. Use the graph paper squares to make the string the first length that you measured (A). Holding one end of the string on the first fixed spot (F_1), draw a semi-circle with the other end with the string the length you measured. Then use the graph paper to make the string the second length you measured (B). Holding one end of the string at the other fixed spot (F_2), draw a semi-circle that crosses the first. Where the two circles cross is the location of the object. Erase the approximate location, and re-draw it in the exact location.
5. Repeat this process for fence ends, trees or other objects that will affect the location of the rain garden. Sketch in the approximate location of the future rain garden too.



Now you have a base plan on which to draw the shape of the rain garden.

Activity courtesy of J. Hiss & N. Booth, (2002) "Residential Landscape Architecture" Design Process for the Private Residence. Prentice Hall.

Sizing

1) Measure the length and width of the impervious surfaces (roof or driveway) that will flow to your rain garden. Multiply length time width to find the area in square feet.

2) Design the garden to be 4-9" deep and 10-30% the size of the impervious surfaces.

3) To figure out the exact size of your rain garden, first test your soil permeability by digging a hole that is the width of your shovel and 18" deep. Fill with water, wait until dry. Fill the hole again with water and time the rate of infiltration.

4) If your hole drains within 24 hours, then you will want your rain garden to be 10% the size of your hard surfaces and the depth to be between 4 and 9 inches. If the hole takes longer than 24 hours to drain, size it at 30% your impermeable surface area and a depth of 3-4".

Time to Drain	Impermeable Multiplier	Depth in inches
within 24 hours	0.1	4-9
longer than 24 hours	0.3	3-4

Example

If the impermeable surface draining into my rain garden is 750ft² and my test hole drains within 24 hours, the rain garden should be:

750 x .1 = 75 square feet large
for example, the dimensions could be
7.5'x5' or 5'x15'

Since it drained within 24 hours, it should be:
4-9 inches deep*

* You will have to dig your garden two inches deeper than the final elevation to allow for added compost.

5) On your base plan, since one grid box equals one foot, you can count the boxes in the outlined garden to see how many square feet your rain garden is. Count up the boxes in your sketched garden to see if you are making it big enough.

If there isn't enough space on your property for the needed area, or if long term maintenance isn't possible in such a large garden, it is acceptable to make the rain garden smaller. Every little bit helps!

Can't Get Outside to Measure or Test Soil?

You can use the Interactive Map WashCo to measure your impervious surface by entering your address in the search bar on the top right.

mapwashtenaw.washtenaw.org

You can also find out your soil type by scrolling down on the left hand "Identify Results" section to select the NRCA Hydrologic soils layer.

Design

1) Draw a rain garden outline on the base plan you just made. Make it any shape you like. Draw in the berm, if you are digging on a slope, on the downslope sides (see page 19 for more information). The berm can take up a surprising amount of room, especially on steeper sites. Make sure you will only be changing the grade of your property, not the grade of your neighbor's property. The rain garden should be at least 2 feet away from the property line.

2) Make sure there is at least ten feet between any structure with a basement (for instance your house, or your neighbor's house) to the rain garden.

3) Make the garden a pleasing shape that goes with the rest of the garden.

4) Count up the grid boxes in the designed rain garden (not including the berm) to see how many square feet the rain garden is. Are you in the ballpark of the number of square feet you calculated? If not, revise a bit.

5) Decide how water will get to the rain garden: overland swale or underground pipe. More information is on page 18. Draw the path and type of conveyance on the drawing.

6) Select a rainwater overflow outlet location for when the garden fills up and spills over. Make sure it flows away from any buildings and to a safe place.

7) Select plants. Plants for the sides and bottom of the rain garden should include those adapted to the extremes of wet and dry conditions. Plants for the berm should be adapted to dry conditions.
See the suggested plant list on page 21.

8) Consider the height, bloom time, sun requirements and color to create a garden you will like.

9) Include some personalized details. A defined border can make the garden look polished. Including stepping stones or stumps can be fun for kids to play on. These are useful for perching on to weed from too. Buy some labels for the new plants so you can identify them when you are weeding.

Miller Ave Rain Gardens in Ann Arbor. Design by Susan Bryan & Chris Carson. Installed by Hoffman Brothers and Chapman's Nursery in 2013. These gardens capture runoff from the street & are maintained by volunteers. Rose Mallow, pictured.

Sample design: part shade

Black-eyed Susan
Rudbeckia hirta
part sun-part shade
height 2-3'
spread 1-1.5'
Blooms July-Sept

Coral Bells
Virginia Waterleaf
Early Meadow Rue
Blazing Star
Obedient Plant

Starry Soloman's Seal
Black-eyed Susan

Blue-eyed Grass
Canada Anemone

Blue Flag Iris
Blue Lobelia

Blue Lobelia
Gray's Sedge

Spiderwort
Wild Geranium

Slender Mountain Mint
Wild Geranium

Celandine Poppy
Nodding Wild Onion

Sample design: full shade

Wild Geranium
Geranium maculation
full sun-part shade
height 1.5-2'
spread 1-1.5'
Blooms April-July

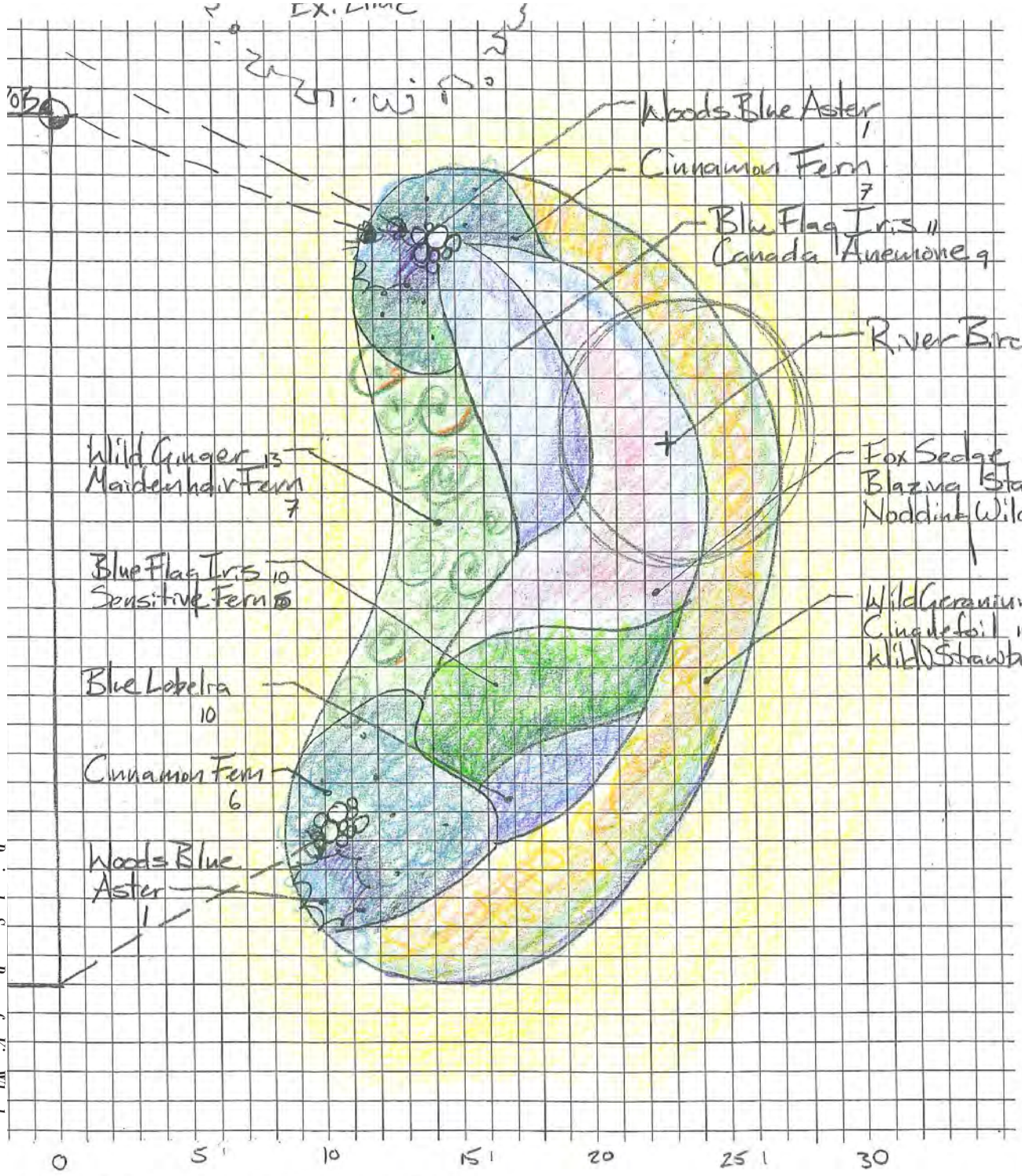
Photo credit: Jonathan Kittel

Pennsylvania sedge
Wild Geranium

Common Lilac
Swamp Milkweed

Blue Flag Iris
Prairie Dock

Sample design: Spart shade



LEGEND

- Point of Beginning
- Stormwater Conveyance from Roof

NOTES

1. Drawing is completed to the accuracy of the base information. Slight modifications may be necessary during installation.
2. Plants are subject to nursery availibility. Substitutions may be made.

North

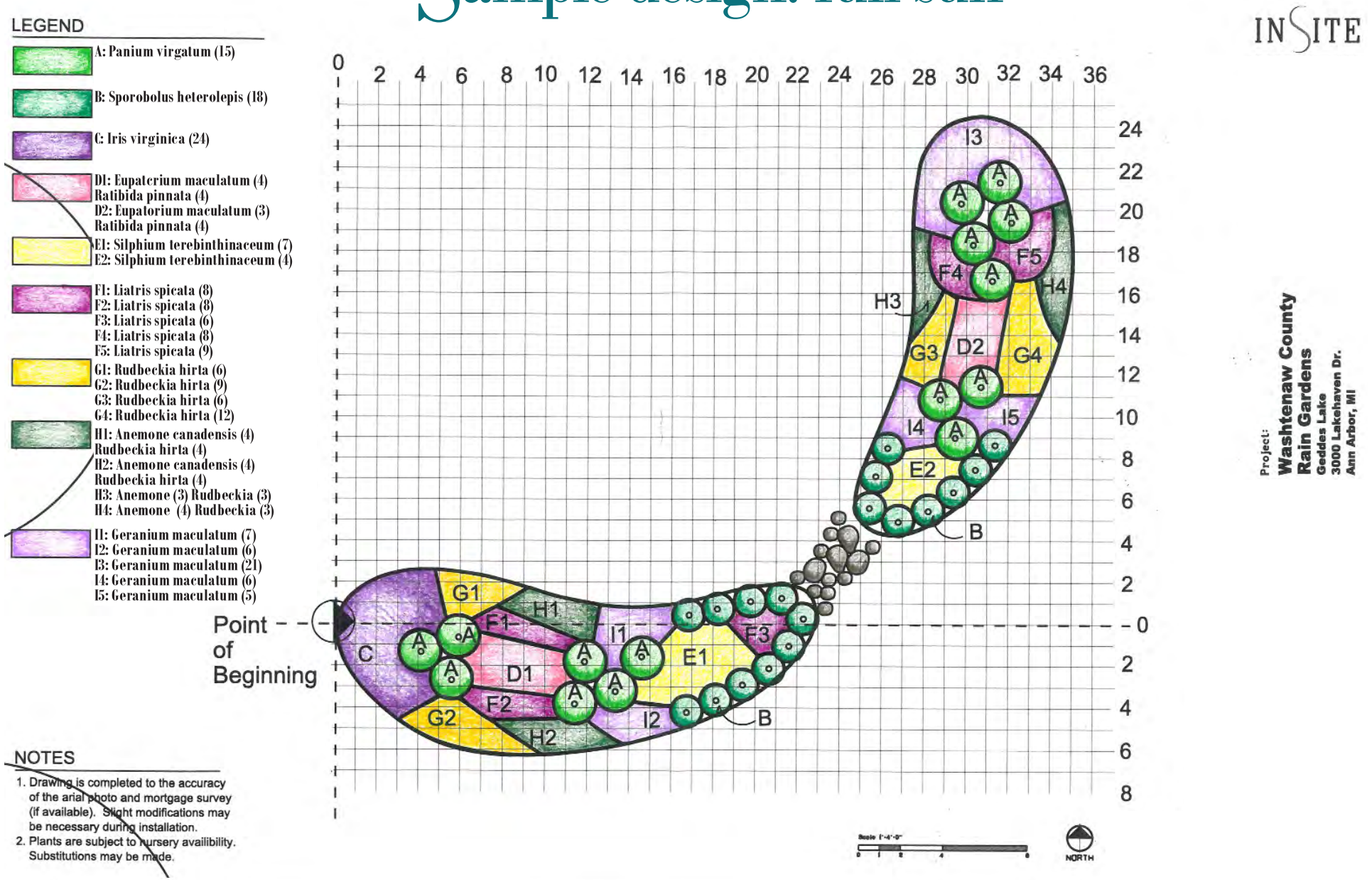
72 HOURS
BEFORE YOU DIG
CALL MISS DIG
800-482-7171
(TOLL FREE)

OWNER is responsible to field verify location of all underground utilities prior to any work

Scale 1"=4'-0"
0 1 2 4 8

Design by Susan Bryan for Kim Wheeler

Sample design: full sun



INSITE

Project:
Washtenaw County Rain Gardens
Geddes Lake
3000 Lakehaven Dr.
Ann Arbor, MI

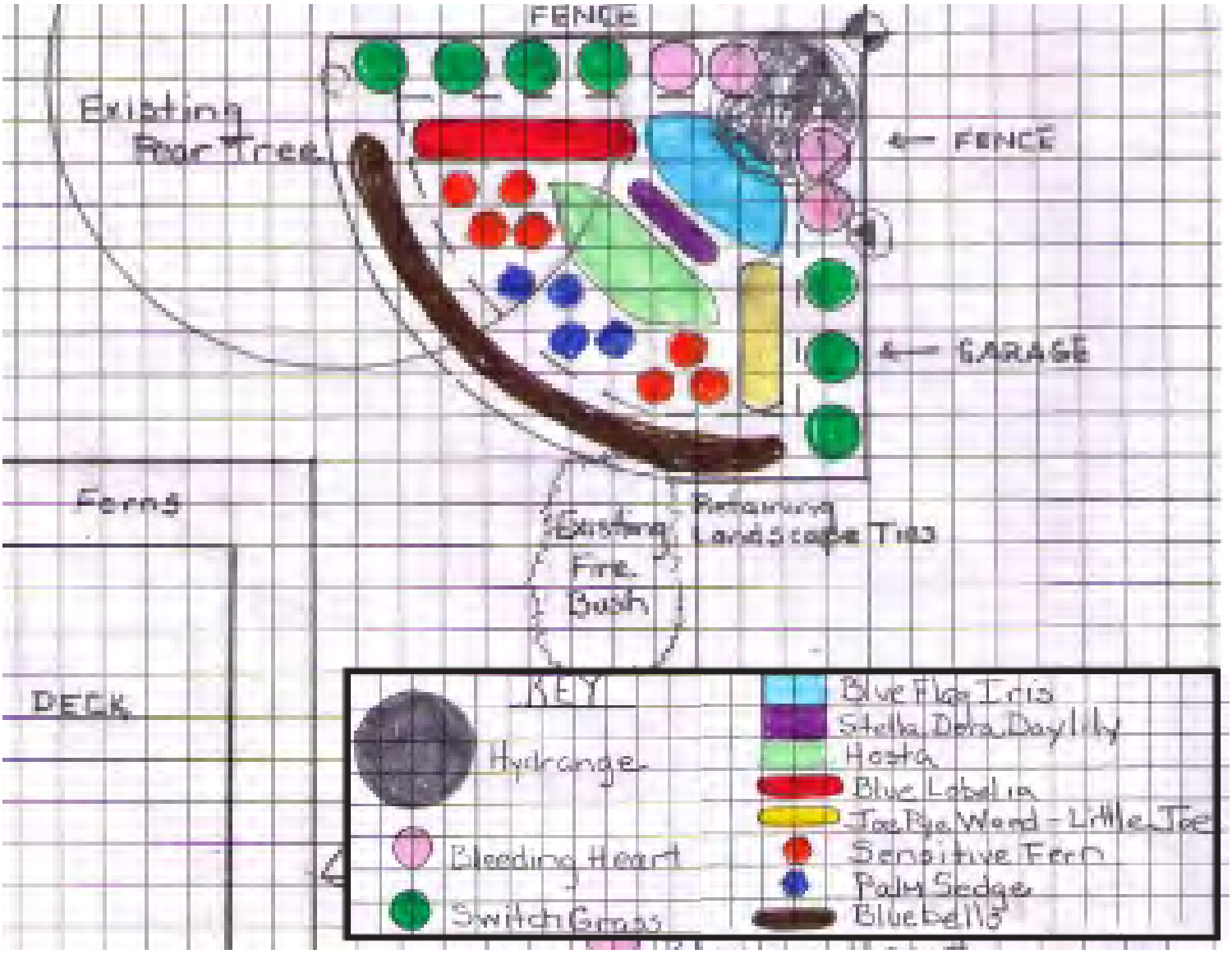
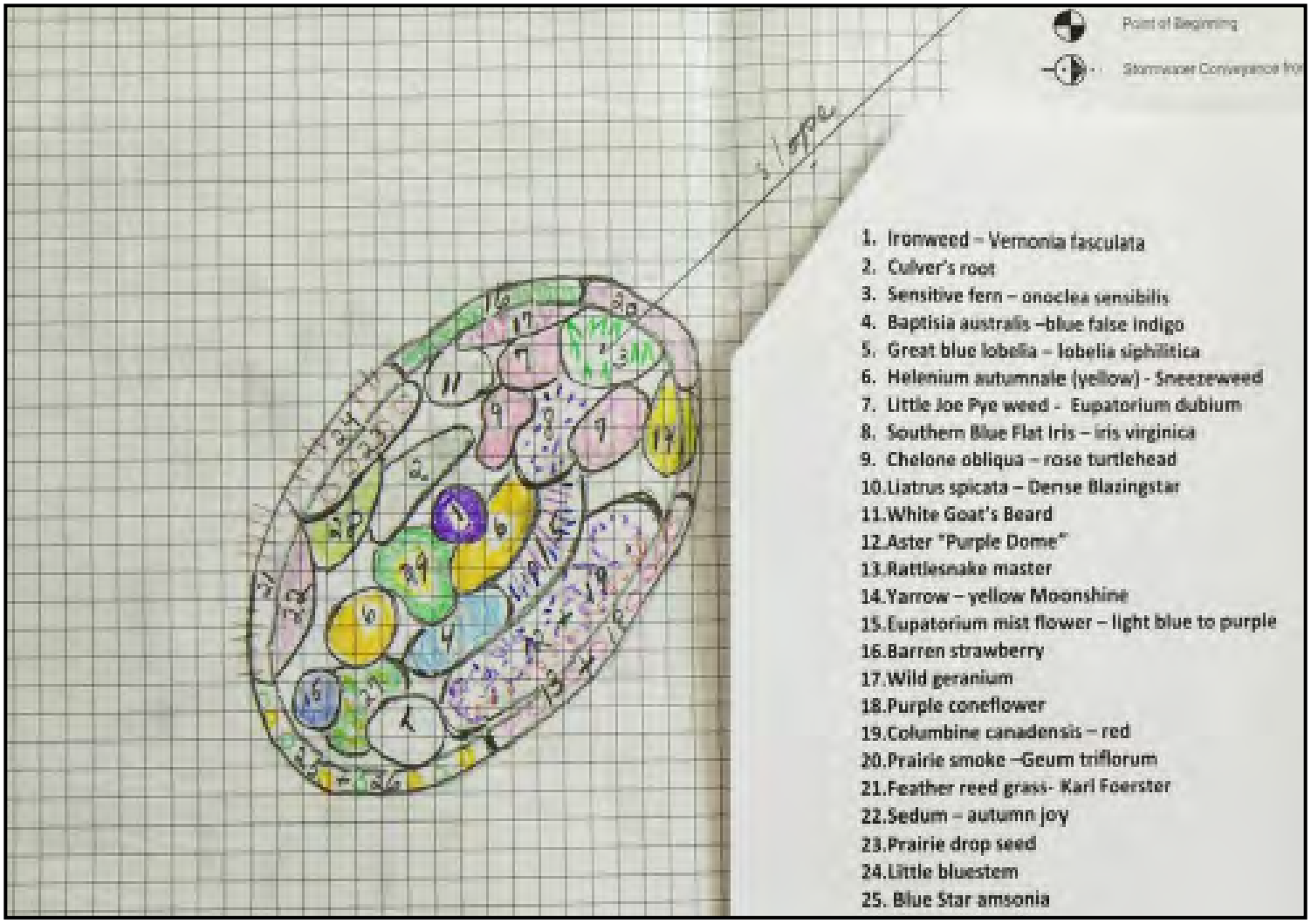


Photo credit: Sallie Richie

Photo credit: Susan Bryan

Sample design: part shade

Top: Master Rain Gardener, Sallie Richie's design
Left: Yard before rain garden construction
Right: Completed rain garden with Master Rain Gardener, Sallie Richie



Sample design: full sun

Top: Master Rain Gardener, Helen Prussian's design and plant list
Bottom Left: Yard before rain garden construction. Footprints in snow outline rain garden border.
Bottom Right: Completed rain garden with Master Rain Gardener, Helen Prussian

Photo credit: Helen Prussian

Photo credit: Susan Bryan

1

Transfer your drawing to your site

1) Translate the dimensions of your rain garden onto the ground by first laying out tape measures that act like the grid paper.

2) Draw the edge of the garden on the ground by placing flags in the measured locations from your 'point of beginning'.

3) Paint the garden border on the grass with spray paint, or use lime or string.

2

4) Rototill sod, use a sod-cutter, or kill the grass by laying down cardboard and mulch.

5) Dig a shallow depression with a level bottom.

6) With the soil dug out to create the depression, build a berm on the downhill side to hold the water within the garden like a bowl.

7) Add a notch to the downslope berm for overflow water to go to a safe location. The notch will determine the water depth within the rain garden.

3

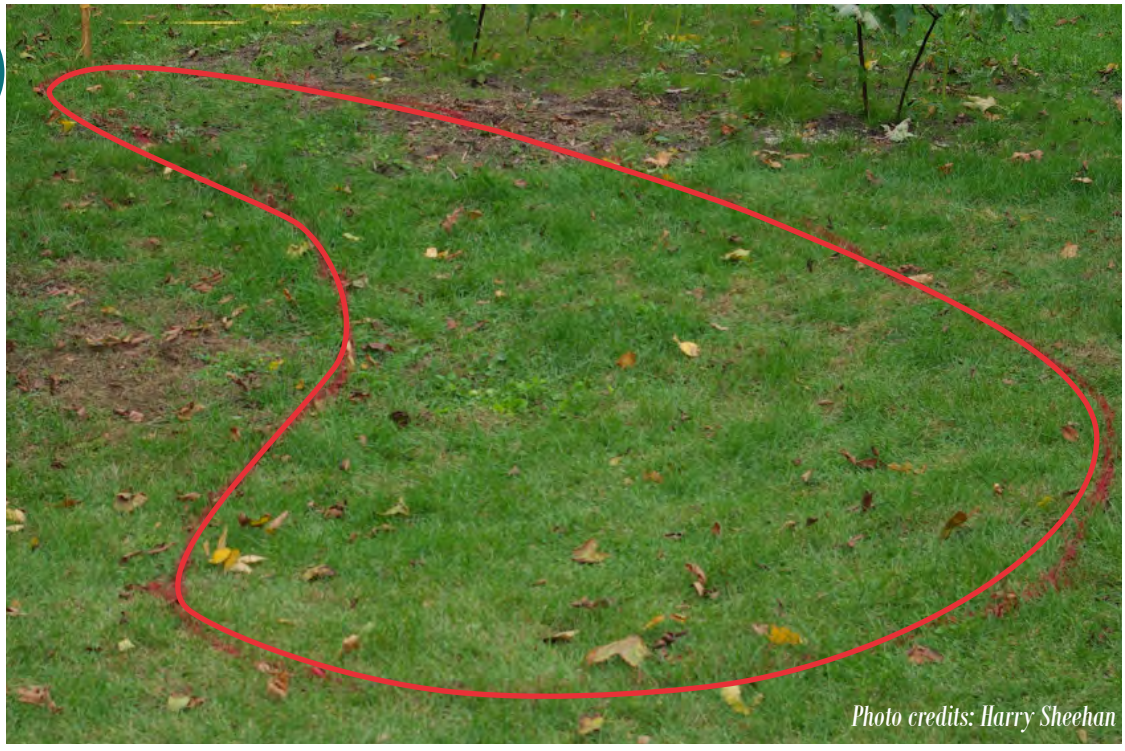


Photo credits: Harry Sheehan

Drainage
With an Underground Pipe

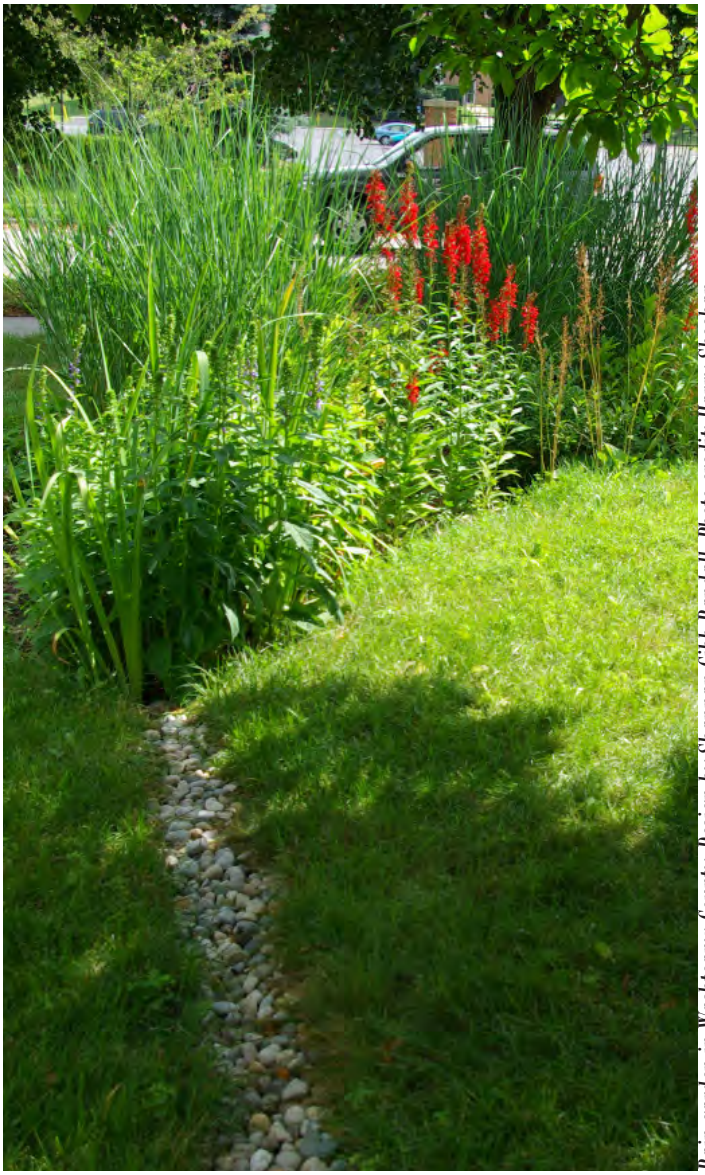
1) Sometimes it is necessary to direct water to the rain garden underground with a pipe. The pipe will need to run downhill to the rain garden.
2) The pipe should outlet above where the water will pool. The emergency overflow notch will be below the elevation of the bottom of the pipe. This way water won't sit in the pipe.
3) Use a non-perforated pipe with a 4" diameter. Either corrugated black plastic or PVC works. Don't use perforated pipe near the house. PVC is better for long runs (>20'), but is more expensive.
4)The end of the pipe can end with a grate (shown) or with a pop-up.
5) Place a few stones where the pipe outlets in the garden to reduce erosion.

Rain garden in Dexter, Michigan. Photo credit: Susan Bryan

Drainage
Over Land

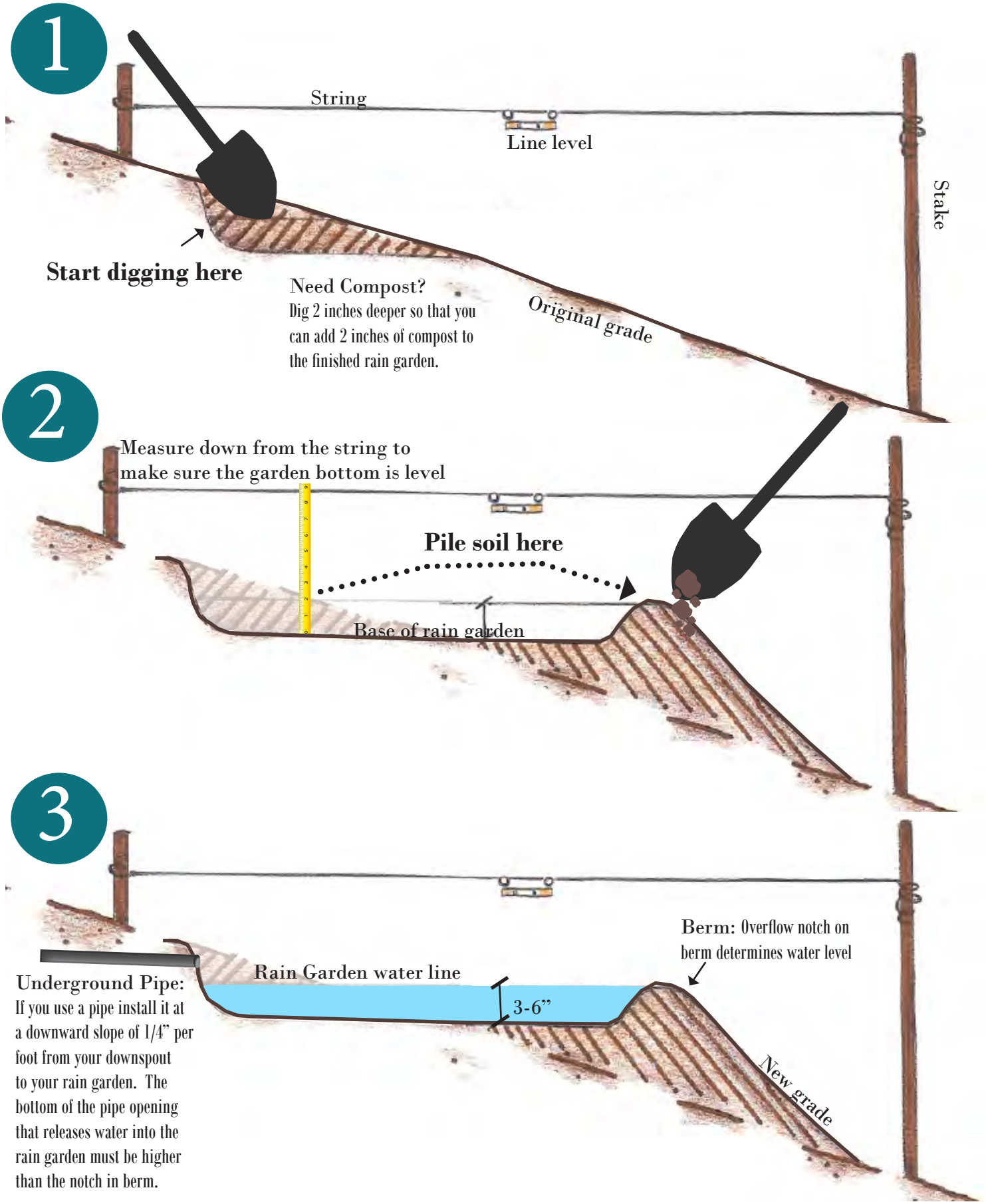
1) Water will run overland to your rain garden if it is downhill from your downspout to your rain garden. Check with a hose to make sure water will flow there.
2) Often water will infiltrate into the ground while moving along the channel.
3) Your drainage channel can be made of stones, native plants or simply be a lowered grassy pathway.

Rain Garden by Don Schwartz & KC Runciman Landscapes.
Photo credit: Susan Bryan



Rain garden in Washtenaw County. Design by Shannan Gibb Randall. Photo credit: Harry Sheehan

Digging the Rain Garden



Soil Amendments

1) Dig the rain garden 2 inches deeper than the final intended depth, reserving the topsoil on a tarp. Is there any topsoil left in the hole? If not, dig another 6" and replace with the topsoil you just dug out. Leave it 2" deeper than final depth, to make room for the compost.

2) Lay 2 inches of compost down in the rain garden bottom & sides. Till compost into soil and then cover with 2 inches of hardwood shredded mulch.

3) How many cubic yards of mulch and compost do you need? Determine how much compost and mulch is required to cover the garden with the following calculation:

(A * 0.00617) = material in cubic yards

where A = area in square feet of garden. This can be calculated by counting the squares on your base plan drawing

Calculation can be used for either compost or mulch material and is for depths of 2".

Planting

If you have plants in your garden that are adapted to both wet & dry conditions, you can transplant them into the rain garden. If you are buying plants, it is recommended to buy plants in pots because seeds are often washed away. Live plants have root systems that can resist the movement of water.

To Plant: dig a hole deep enough that the roots can hang vertically. If the roots are root-bound, break them up. Place the plant deep enough so that the entire root ball is covered but the base of the stem is above the soil. Fill the hole and pat firmly to remove any air space.

Too wet to plant? Place the mulch first. Mulch can soak up some water, and make it less muddy. Don't worry - the plants like it wet.

Watering: Keep soil around plants moist for a few weeks and in times of drought. When to water? Test the soil by sticking your finger into the soil. If your fingertip touches moist, but not soaked soil, you are watering the correct amount.

Rain garden at Eastern Michigan University housing. Design by SGR. Photo credit: Shannan Gibb-Randall.

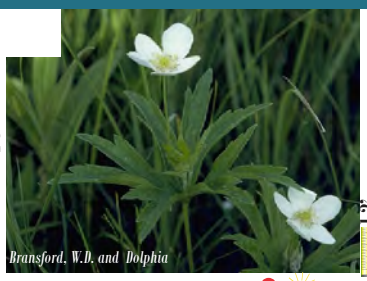
RAIN GARDEN PLANTS

These are the top twenty Michigan plants used successfully in Washtenaw County rain gardens. The first two rows (in blue) should be planted on the sides of your rain garden, where it is moist. The bottom three rows (in green) should be planted on the bottom of your rain garden, where it is the most wet.

New england aster *Aster novae-angliae*

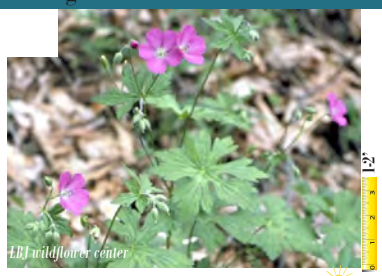
Blooms: September - October

Canada anemone *Anemone canadensis*



Blooms: May - June

Wild geranium *Geranium maculatum*



Blooms: May - June

Goldstrum black-eyed susan *Rudbeckia fulgida*

Blooms: July - September

Ninebark *Physocarpus opulifolius*

Blooms: May - July

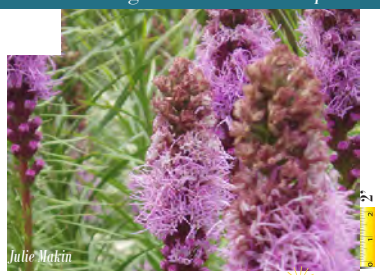
Redbud *Cercis anadensis*

Blooms: May

Wild strawberry *Fragaria virginiana*

Blooms: May - June

Kobold blazing star *Liatris spicata*

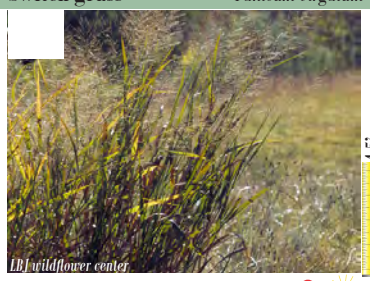


Blooms: July

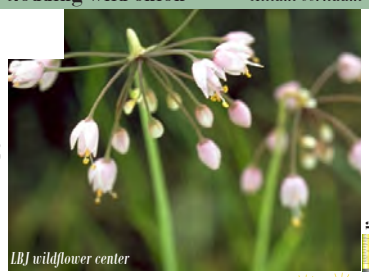
Purple coneflower *Echinacea purpurea*

Blooms: July - August

Switch grass *Panicum virgatum*

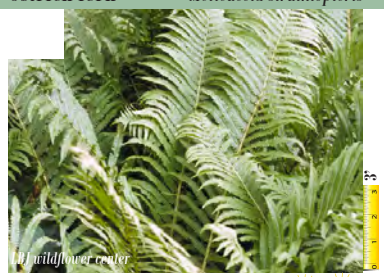


Nodding wild onion *Allium cernuum*



Blooms: September - October

Ostrich fern *Metteuccia struthiopteris*



Goldfinger potentilla *Potentilla fruiticosa*

Blooms: June - July

Fox sedge *Carex vulpinoidea*

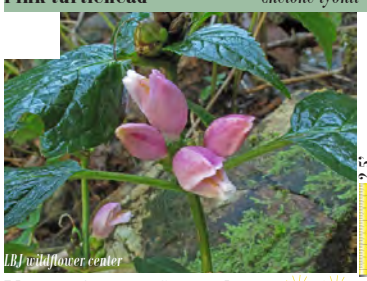
Red-osier dogwood *Geranium maculatum*

Blooms: May - June

Rose Mallow *Hibiscus moscheutos*

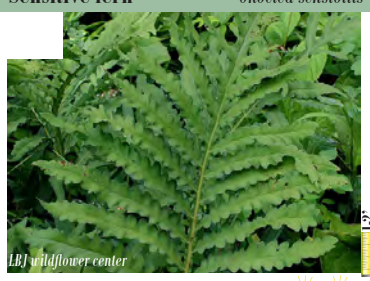
Blooms: August - September

Pink turtlehead *Chelone lyonii*

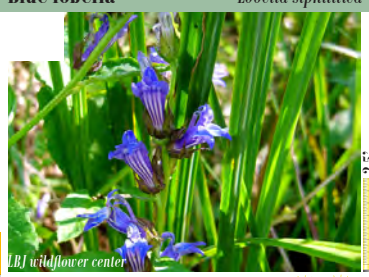


Blooms: August - September

Sensitive fern *Onoclea sensibilis*

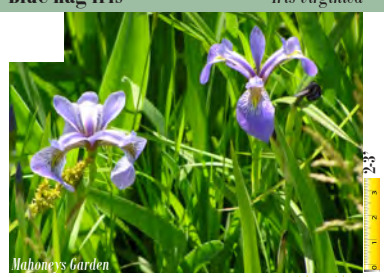


Blue lobelia *Lobelia siphilitica*



Blooms: July - September

Blue flag iris *Iris virginica*



Blooms: May - June

Legend full sun | part sun | aggressive spreader

Common invasives

Refrain from buying, planting or allowing these common invasives to grow. Weed them out!

Yellow Iris
Iris pseudacorus

Purple Loosetrife
Lythrum salicaria

Garlic Mustard
Alliaria petiolata

Autumn-Olive
Eleagnus umbellata

Dames Rocket
Hisperis matronalis

Phragmites
Phragmites australis

RESOURCES TO BUILD A RAIN GARDEN

Michigan native plant producers

Local nursery's and organizations that specialize in Michigan native plants:

Native Connections
Jerry Stewart
17080 Hoshel Road
Three Rivers, MI 49093
Phone: (269) 273-2894
Email: info@nativeconnections.net
www.nativeconnections.net

The Native Plant Nursery LLC
Greg Vaclavek
PO Box 2292
Ann Arbor, MI 48107
Phone: (734) 677-3260
Email: plants@nativeplant.com
www.nativeplant.com

Hidden Savanna Nursery
Chad Hughson
18 N. Van Kal Street
Kalamazoo, MI 49009
Phone: (269) 352-3876
Email: info@hiddensavann.com
www.hiddensavanna.com

Michigan Wildflower Farm
Esther Durnwald
11770 Cutler Rd.
Portland, MI 48875-9452
Phone: (517) 647-6010
Email: wildflowers@voyager.net
www.michiganwildflowerfarm.com

New Leaf Native Plant Nursery
Ypsilanti, MI
Phone: (734) 330-7175
Email: newleafplantnursery@gmail.com
www.facebook.com/newleafplantnurseryypsi

Ypsi Native Plant Nursery
Ypsilanti, MI
Email: info@ypsilantinativeplantnursery.com
www.ypsilantinativeplantnursery.com

Wildtype Native Plant Nursery
Bill Schneider
900 North Every Rd.
Mason, MI 48854
Phone: (517) 244-1140
Email: orders@wildtypeplants.com
www.wildtypeplants.com

Washtenaw County Conservation District Native Plant Expo & Marketplace
Spring - Washtenaw Farm Council Grounds
Saline, MI
www.washtenawwcd.org

Matthaei Botanical Gardens Wildflowers & Native Plant Sale
Late Summer/Early Fall
1800 N. Dixboro Rd
Ann Arbor, MI 48105
www.mbgna.umich.edu

Additional Resources

Michigan Native Plant Producer's Association
Members adhere to strict sourcing and ethical guidelines. They provide nursery-grown native plants and seed from Michigan genotypes.
www.mnppa.org

Wildflower Association of Michigan
Encouraging the preservation and restoration of Michigan's native plants and native plant communities. Hosts an annual conference in March.
www.wildflowersmich.org

You can also ask at your local nursery for native plants!

Free plants

Every community has plant exchanges - usually hosted by garden clubs. Mature gardeners want to give their perennial splits to you - instead of composting them! Find your local exchange - and share your own plants!

Rain Garden Plant Exchanges

Spring - together with the plant sale distribution.
Fall - at Pioneer High School West entrance.
Washtenaw County Rain Garden Program. Contact Susan Bryan. bryans@washtenaw.org

Wild Ones Native Seed Cleaning/ Exchange

Second Wednesday of January,
6:45-8:30pm at Matthaei Botanical Gardens room 125.

Old West Side Ann Arbor Garden Club Spring Plant Exchange

In May. Grace Shackman gmshackman@comcast.net

Wild Ones Native Plant Exchange & Sale

Second Wednesday of May, 6:00-8:00
www.wildones.org/chapters/annarbor/

Need native plants? Have extras to share? Join the Wild Ones at our annual plant exchange.

Arbor Seeds Plant Exchange

June - 1575 Knight Rd in Scio Twp. Linda Ridley lridl734@gmail.com

Please come even if you have no plants or seeds to exchange – we always have lots! Please label your plants. A permanent marker on masking tape works well. Information about what the plant prefers and how fast it spreads is also helpful. If you have plants to share but can't come on the day, you can drop them off at my house ahead of time if you'd like.

Novi Spring & Fall Perennial Exchanges

Saturdays in May & September from 9 AM -Noon at Fuerst Park (SE corner of Taft Road and 10 Mile Road) in Novi.

Give away plants you have too many of!
Get new ones for free! The best way to garden.

Carex vulpinoidea Fox Sedge. Photo credit: Lady Bird Johnson Wildflower Center

Cornus amomum, Silky dogwood. Courtesy of Ladybird Johnson Wildflower Center

Compost vendors

1 cubic yard of farm compost or topsoil weighs approximately 1 ton

Pickup truck capacities: most 1/2 ton pickup trucks and short bed pickup trucks have a volume capacity to hold 1.5 cubic yards but most don't have the weight capacity to safely haul more than 1 cubic yard. 3/4 and 1 ton pickup trucks have the capacity to hold up to 2 cubic yards.

Coverage for spreading compost, topsoil or mulch:

1 cubic yard @ 1" depth covers 324 square feet
2" depth covers 162 square feet
3" depth covers 108 square feet
4" depth covers 81 square feet

Or use the calculator on the link below to estimate how many cubic yards you need:
gardenplace.com/content/calculator/mulch_calc.html

City of Ann Arbor Compost

Bulk municipal compost and mulch are available for sale year round for $18/cubic yard loaded and Mulch is $14/cubic yard. Free self-loaded for AA residents. Compost delivery is available.

4150 Platt Road, Ann Arbor 48108
(734) 489-4518 | www.wecarecompost.com

July-March:
Monday-Friday from 7am-4pm

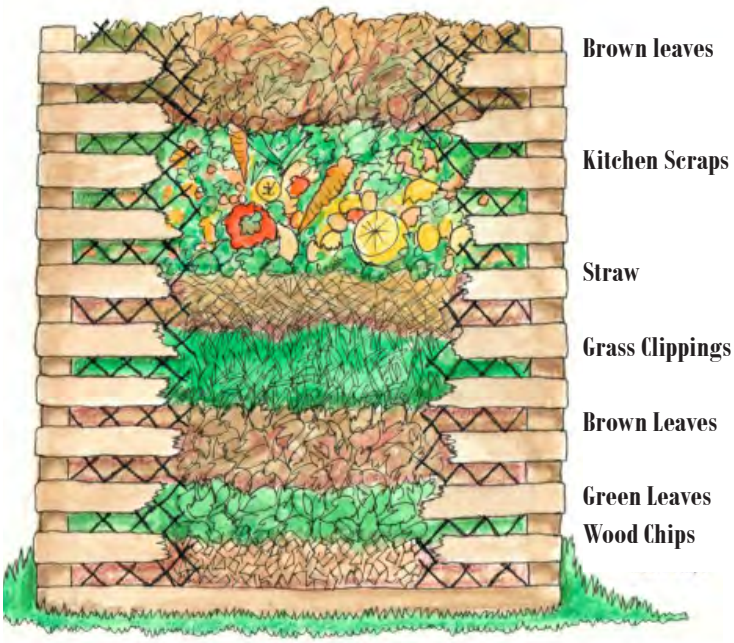
April-June:
Mon-Friday from 8am-4pm &
Saturdays 7am-noon

Ypsilanti Township Compost Site

One-Stop Location for recycling, refuse & compost. Compost is $12/cubic yard and Mulch starts at $8.50/ cubic yard. Free for Ypsilanti Township residents.

2600 E. Clark Rd (Between Ford Blvd. & Ridge Rd)
(734) 482-6681 | www.ytown.org/compost-site

April to November:
Monday-Friday from 8am-4pm
Saturday 9am-4pm
December to March:
Saturday ONLY from 9am-4pm



Build your own compost with kitchen food scraps and yard waste. Graphic courtesy of landscapeforlife.org

City of Ypsilanti Compost

Ypsilanti City Residents may obtain up to 4 free passes per year to utilize the Ypsilanti Township compost facility on Clark Road. Passes are available at the Department of Public Services (14 W. Forest Ave., Monday-Friday from 8 am-4 pm) and must be obtained prior to each visit to the facility. Proof of residency will be required. Contact (734) 483-1421 for more information.

Tuthill Farms & Composting

Farm Compost is $30/cub yard or Supersoil compost topsoil blend is $25/cubic yard. Wood Mulch is $25/ cubit yard. Delivery available.

10505 Tuthill Road South Lyon, MI 48178
(734) 449-8100 | www.tuthillfarms.com
May to December:
Monday - Saturday from 7am-5pm

Chelsea Compost

The Transfer Station has unscreened compost for $12.50/cubic yard, and topsoil for $25.00/cubic yard. Woodchips are available for $10.00/yard during certain times of the year.

8025 Werkner Road
(734) 475-7955
Wednesday, Thursday & Friday from 9am-4:30pm
Saturdays from 9am-4pm

Rain Garden Contractors

Contractors on this list are certified Master Rain Gardeners, or have installed at least one rain garden, which was inspected by Washtenaw

Business Name	Contact Name	Phone	City/State	Email
Appel Environmental Design	Mike Appel	(734) 395-1060	Ann Arbor, MI	appel@umich.edu
PlantWise Native Landscapes	David Mindell, Anna Snoeyink	(734) 665-7168	Ann Arbor, MI	info@plantwiserestoration.com
Michigan Hardscapes	Dan Morris	(734) 365-3094	South Lyon, MI	GTO123498@charter.net
Feral Flora	Matt Demmon	734-255-2783	Ann Arbor, MI	matt@feral-flora.com
ArborServe	David Dye	(734) 649-1307	Ann Arbor, MI	david@arborserve.com
Creating Sustainable Landscapes, LLC	Drew Lathin	734-717-8000	Novi, MI	Drew@CreatingSustainableLandscom
Aaron Hammer Gardens	Aaron Hammer	734-678-7813	Ann Arbor, MI	hammer.aaronj@gmail.com
KC Runciman Landscapes	Fred Knight	734-429-5200	Ann Arbor, MI	info@kcrunciman.com
New Leaf Landscaping	Jeff Findley	703-618-9458	Chelsea, MI	jeffreefindley@gmail.com
Serge Van der Voo Landscapes	Serge Van der Voo	734-368-1219	Ann Arbor, MI	svdvoo@gmail.com
Elemental Design at BLOOM! Garden Center	Drew Laird; Gavin Gillespie	734-426-6600 x203	Dexter, MI	drulaird@gmail.com; drew.bloom.ed@gmail.com; gnivag@gmail.com
IronWoodStone	Jarrod Hendrickson	(734) 646-7982	Ann Arbor, MI	jrrdhnd@gmail.com
Superior Gardens	Lori Brandt	(734) 717-6277 (734) 662-4605	Ann Arbor, MI	superiorgardens@hotmail.com
Ritch Harrison	Ritch Harrison	269-650-6488	Plainwell, MI	Richard.Harrison@Borgess.com
Dan McQueer	Dan McQueer	734-944-5664	Bridgewater, MI	mcqueerd@ewashtenaw.org
Cynthia Overmyer	Cynthia Overmyer	734-665-1792	Ann Arbor, MI	cmyer@umich.edu
Native Plant Nursery	Greg Vaclavek	(734) 677-3260	Ann Arbor, MI	plants@nativeplant.com
Gabrielle Tazzia	Gabrielle Tazzia	734-277-3558	Ann Arbor, MI	gtmidwife@yahoo.com
Halcyon Earth & Sky	Janee Kronk	810-923-7771	Lakeland, MI	kronkrevolution@gmail.com
Martha Hill	Martha Hill	734-662-1329	Ann Arbor, MI	hillm@umich.edu
RainScapes	Eric Wagner	734-476-7502	Ann Arbor, MI	ewag3972@gmail.com
Erica's Natural Gardening	Ellen Lamphiear-Fadiman, Dorothy Nordness	734-276-4189	Ann Arbor, MI	ellenlamphiear@msn.com; dorothyk@isr.umich.edu
Amazing Landscapes	Vincent Smith	734-606-9773	Ann Arbor, MI	wowniceyard@gmail.com
Jackie Richards	Jackie Richards	733-858-8140	Ypsilanti, MI	stormyweather4293@gmail.com
Natalie Hockamier	Natalie Hockamier	616-451-2732	Grand Rapids, MI	natt718@yahoo.com
Nature & Nurture	Erica Kempter, Mike Levine	(734) 662-4826 (734) 368-2610	Ann Arbor, MI	info@natureandnurture.org
Tom Kenny	Tom Kenny	734-665-6942	Ann Arbor, MI	
Native Connections	Jerry Stewart	(269) 580-4765	Three Rivers, MI	jerry@nativeconnections.net

as of December 2019

County staff and was installed correctly.

	Website	Services	Master Rain Gardener?	Number of rain gardens built	equipment
	www.appelenvironmental.com	design, digging, planting, burns, maintenance		102	backhoe
	www.plantwiserestoration.com	design, digging, planting, maintenance, burns, invasive plant control	MRG	84	shovels
	MIhardscape.com	digging, planting	MRG	63	backhoe
	www.feral-flora.com	design, digging, planting, burns, maintenance	MRG 2017	61	shovels
	www.arborserve.com	design, digging, carpentry	MRG 2011	42	industrial strength rototiller
capes.c	CreatingSustainableLandscapes.com	design, digging, planting, maintenance		61	shovels, backhoe
	aaron-hammer.squarespace.com	design, digging, planting, maintenance	MRG 2014	34	shovels
	www.kcrunciman.com	design, digging, planting, maintenance		24	backhoe
	http://newleaflandscaping.com	design, digging, planting, maintenance	MRG 2014	21	backhoe
	http://www.vlandscapes.com/	design, digging, planting, maintenance	MRG 2012	11	backhoe, shovels
	http://bloom-gardens.com	design, digging, planting, maintenance	MRG 2015	7	backhoe, shovels
	www.IronWoodStoneDesign.com	design, digging, planting, maintenance	Award-winner 2016	5	backhoe
		digging, planting		5	shovels, sod cutter
		design, digging, planting, maintenance	MRG 2016	3	shovels
		design, digging, planting	MRG 2013	3	shovels
		design, digging, planting	MRG 2011	3	shovels, backhoe available
	www.nativeplant.com	native plant nursery, design, planting		3	shovels
		design, digging, planting, maintenance	MRG 2016	3	shovels
		design, digging, planting, lakeshore plantings	MRG 2015	3	shovels
		design, planting, maintenance	MRG 2012	2	shovels
		design, digging, planting	MRG 2017	2	backhoe
		design, digging, planting, maintenance	MRG 2012	2	shovels
	instagram.com/wowniceyard	design, digging, planting, maintenance	MRG 2018	1	backhoe
		design, digging, planting, maintenance	MRG 2015	1	shovels
		design, digging, planting, maintenance	MRG 2016	1	shovels
	www.natureandnurture.org	design, digging, planting, maintenance		18	shovels
		design, digging, planting	MRG 2011	1	shovels
	nativeconnections.net	digging, planting		1	

ADDITIONAL INFORMATION

Rain Barrels

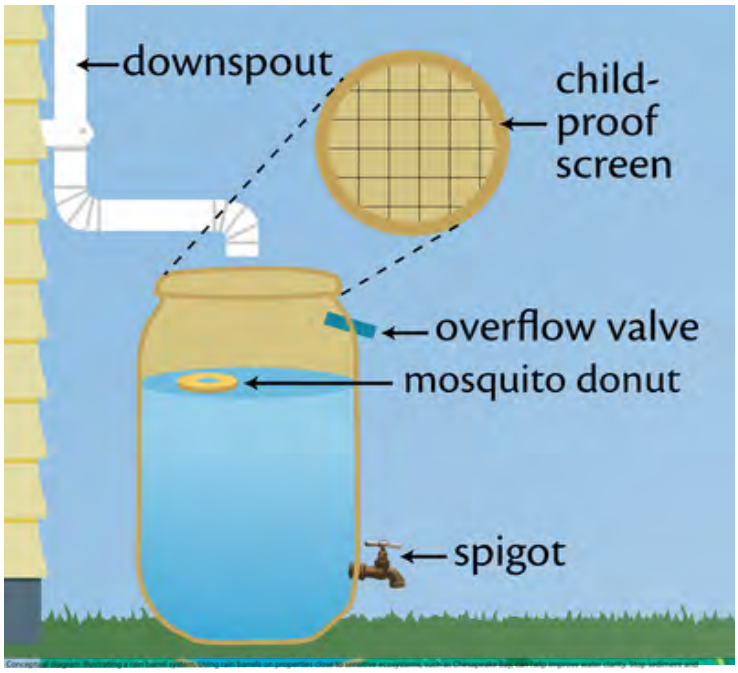
What is a Rain Barrel?

A rain barrel collects and stores rainwater from your rooftop to use later for things like lawn and garden watering. Water collected in a rain barrel would normally flow through your downspout, onto a paved surface and eventually into a storm drain.

Why use a Rain Barrel?

Rain barrels help lower water costs by storing approximately 1,300 gallons of water during peak summer months. Using stored rainwater on your garden or lawn instead of directing rooftop runoff to the storm drain network helps recharge groundwater naturally. Rain barrels reduce water pollution by limiting stormwater runoff, which can contain pollutants like sediment, oil, grease, bacteria and nutrients. Rain barrels are inexpensive and easy to install.

Automatic diverter. Courtesy of rainbarrelsandmore.com



Graphic by Caroline Wicks courtesy of www.climateactiontool.org

Rain Barrel information courtesy of the Washtenaw County Conservation District. More information available at: www.washtenawcd.org

Available through the Washtenaw County Conservation District

- Barrels have a screw-on top with holes for water entry and aluminum screen to keep out leaves, debris and mosquitoes.
- They have a shutoff valve that can connect to a hose or to fill a watering can
- Recommended placement is 12" high using an optional pedestal, cement blocks or other materials.
- Barrels are designed to leave outside all year around.

Automatic Diverters are also available for connecting rain barrels to downspouts. When it rains, some water will flow from the diverter, through the hose to the barrel and some water will also continue to flow down the lower section of the downspout. When the rain barrel is full, then all the water will flow down the downspout. A 55 gal. rain barrel will take about 1 hour to fill with a Diverter installed (15-20 minutes without). Using the Diverter eliminates the need for an overflow hose to be connected to the barrel and routed to an overflow location. Sizes are available to fit 2"x 3" or 3"x 4" downspouts and hose is included.

A^2 Stormwater Credit

If you live in Ann Arbor, you can take steps to reduce your stormwater bill by building a rain garden. Rain gardens reduce stormwater runoff at the source. This is the best way to create a healthy watershed.

If you are a one or two family residential customer, consider using up to three of these optional stormwater credits. Credits include:

Make your Home a RiverSafe Home Partner

Save $1.40/quarter. Review Washtenaw County's online RiverSafe Home information and take the survey. The survey is also available by mail by phoning (734) 222-6833. Participants also receive a RiverSafe Home plaque to display. There is no cost to enroll at: www.washtenaw.org/riversafe. Once you have completed the survey, please email storm@a2gov.org with your address to receive the credit.

Install Rain Barrels on your Downspouts

Save $2.03/quarter, total, for one to five rain barrels. Rain barrels are sold locally at many garden centers and online. Check www.a2gov.org/storm for announcements of periodic local rain barrel workshops and bulk sale opportunities, as available.

Create a Rain Garden, Cistern, or Drywell

Limited to one of these options per property to save $3.17/quarter. In addition to being beneficial for the watershed, rain gardens can be a very attractive landscaping feature.

To Request a Credit or Additional Information

Contact storm@a2gov.org and please indicate the size of the feature, and the percent of your roof runoff that is captured by the feature in your email to storm@a2gov.org.

Requirements for Credit:

At least 50% of your property's roof area (at least half of your home's downspouts) should drain to the rain garden OR the rain garden must capture runoff from impervious area on your property that is equal to 50% of your roof area.

Size:

1) Minimum 130ft^2 & 3" to 6" deep throughout
2) Must have vegetation to absorb runoff. Native perennial are preferred to encourage infiltration

Infiltration:

Water should infiltrate within 24 hours

Other Recommendations

Garden should be kept at least 15 ft away from foundations and should overflow safely. Overflows should not go directly to a sidewalk, steep slope, retaining wall, or to a neighbor's property.

Rain garden in southeast Ann Arbor. Design by Susan Bryan. Installed by Matt Demmon. Photo credit: Susan Bryan

DESIGN CHECKLIST

Here are some questions to ask yourself as you start your design.

Why do you want a rain garden?

- ☐ To have the coolest new thing in gardening
- ☐ Want to do something good for the environment
- ☐ Like to see wildlife in the garden
- ☐ Spend time on the river so want to keep it clean
- ☐ To solve a basement flooding issue.
- ☐ To solve an ice-on-the-sidewalk issue.
- ☐ To dry up a wet spot in the garden.

Do you have a location(s) in mind?
Describe_____

Whom do you prefer do the work?

- ☐ Do it all myself or with family/friends
- ☐ Use a rain garden contractor
- ☐ A combination - they dig it, I plant it

How tall would you prefer the plants in your garden to be? _____

Do you like grasses?_____

How much do you like to weed?

- ☐ Every day
- ☐ Once a week
- ☐ Twice a year

Yes / No

☐ ☐ Is there a well on the property?

Where is it? _____

☐ ☐ Is there a septic system?

Where is it? _____

☐ ☐ Does runoff drain to street storm sewers?

☐ ☐ Or swales?

Where are the: underground utilities? phone, cable, electric, gas, water, sewer, GeoThermal system, other:
_____

Yes / No

☐ ☐ Did you call Miss Dig? 811

☐ ☐ Is there a basement?

Where do the roof gutters & downspouts drain to? ___
_____

Where do the paved areas drain to?_____
_____

Sketch the paved areas, the roof and where the downspouts go:

How long does it take an 18" deep hole, filled with water, to drain? (percolation test):_____
_____

Soil (circle): Sandy, Loamy, Clay, Mixture, Unsure

Does the property currently have any of the following:
Yes / No

☐ ☐ Flooding in basement
Where?_____

☐ ☐ Erosion
Where?_____

☐ ☐ Wet areas after a large storm
Where?_____

Are there any other upcoming projects? Remodeling, gardening, etc? Should this project wait for any of those projects to be completed?

Yes/No

☐ ☐ Is your rain garden within Ann Arbor city limits?

Make sure you apply for your stormwater credit!

Created by: Roger A. Moon; Washtenaw County Master Rain Gardener 2012

CONSTRUCTION CHECKLIST

All done with your design?
Get ready to dig - step-by-step

1) Complete your rain garden design and plant list.

2) Decide where will you buy / borrow supplies.

3) Draw your rain garden outline on the ground. (paint, hose, or flags)

4) Assemble tools and supplies for construction.

5) Dig connection from water source to rain garden location
• Dig a trench for the pipe - from the downspout to rain garden location. Keep it as shallow as possible, to reduce the depth of the rain garden. (shovel or trench digger)
• Or, if it is overland flow, test it (hose or rainfall), so you know the water will arrive at the rain garden.
• Temporarily disconnect water source from the rain garden, while you dig.

6) Site Preparation
• Cut the grass to the lowest level possible.
• Remove grass (sod cutter or flat shovel). Save sod for use in the berm, or repair grass in other locations.

7) Dig basin
• Dig the basin. Pile the soil to form the berm. Or, put the soil in other locations in your yard. (shovel / backhoe, wheelbarrow)
• Remove additional 2 inches of soil for replacement with compost.
• Create berm. It can be as tall as you want, as long as you know where your overflow will be.

8) Create overflow
• Create a notch in the berm for the overflow.
-This notch defines how deep the water will pool.
-The notch elevation should be equal to, or lower than, the elevation of the bottom of the inflow pipe.

9) Finish basin
• Measure basin bottom to ensure it is generally level. (line level, or level on a board)
• Add 2" compost. Spread and mix compost with existing bottom soil. (rototiller or shovel). Spread & mix compost on berm too.
• Finish shaping basin for final depth. (rake) Shape gentle berm slopes - not cliffs.
• Spread mulch on basin and berm.

10) Connect water source
a. Re-connect downspout to trenched-in pipe.
b. Place rocks to control erosion where the water flows into the garden.

11) Stand back and admire!
-E-mail Susan so she can admire it too – and give you a t-shirt or sign!

Tools

Sod Cutter
Rototiller
Tarp
Spade
Flat shovel
Pick / Maddox
Rake
Marking paint / string / stakes
Line level / level
Tape measure
Planting trowel or spade

Materials

Compost, in cubic yards
Hardwood mulch, in cubic yards
Pipe: 4" pvc or 4" corrugated black
Connectors for pipe to downspout
Rocks for erosion control at inlet
Edging – brick / rock / plastic
Deer deterrent / barrier
Plants

Washtenaw County Water Resources Commissioner's Office
Evan Pratt, Water Resources Commissioner
705 N. Zeeb Rd., PO Box 8645, Ann Arbor, Michigan 48103
734-222-6860 | www.washtenaw.org/drains

www.MasterRainGardener.org
Join the Master Rain Gardener group on Facebook.
Take the Master Rain Gardener Class www.washtenaw.org/MRG

Written by Susan Bryan
Edited by Heather Rice, Sarah Kalikow
Most rain garden designs by InSite Design Studio, or Master Rain Gardeners
Graphic design, illustrations, and uncredited photos by Catie Wytychak, 2020

Washtenaw County Rain Garden Plant List

Jun-15

This list is not meant to be exhaustive, but rather a record of the plants that have worked in the Washtenaw County Rain Garden program. See list at end for discussion of plants that were not successful.

MNPPA = Native plants can be obtained from any members of the Michigan Native Plant Producers Association: www.mnppa.org. WA = Widely Available. Any nursery in your area would probably carry this plant

Native? N=Native, **C**=Cultivar of a Native ("Nativar"), **NFH**=Not from around Here | **Sun/Shade: Sn**=sun, **P**=part sun, **Sh**=Shade | **Moisture: D**=Dry, **M**=Medium, **Ms**=Moist, **W**=Wet

FULL SHADE **Scientific Name**	**Common Name**	**Bloom Color**	**Height**	**Bloom Time**	**Plant Spacing**	**Deer Resistant?**	**Native?**	**Source**	**Size**	**Sun/ Shade**	**Mois-ture**	**Habitat**	**Soil**	**Comments**
Actaea rubra	Red Baneberry	White	12-36"	May	12" o.c.	Y	N	MNPPA	2" pot	Sh	M, Ms			good for woodland setting, not espeically showy, best massed for a nice texture, poisonous
Caulophyllum thalictroides	Blue Cohosh	Green	24"	April	12" o.c.	Y	N	MNPPA	quart	Sh	Ms			good for woodland setting, not terribly showy, but interesting foliage and berries for those who like diversity
Hydrophyllum virginianum	Virginia Waterleaf	Lavender	1-1.5'	May-June	10" o.c.		N	MNPPA	quart	Sh	M, Ms, W			not espeically showy, best massed for even texture, can take water
Part Shade to Shade														
Adiantum pedatum	Maidenhair Fern	n/a	12"		12" o.c.	Y	N	MNPPA	3" pot	P, Sh	M, Ms			short plant, beautiful lacey texture. Resents the dry.
Aquligea canadensis	Columbine	Red/Yellow	12-36"	May	12" o.c.	Y	N	MNPPA	2" pot	P, Sh	D, M, Ms	Butterfly		delicate texture, great for woodland setting
Asarum canadense	Wild Ginger	Maroon	8"	May	12" o.c.	Y	N	MNPPA	quart	P, Sh	M, Ms			good low, facer plant with interesting heart-shaped leaves that form a contrast texture, straight native species, but WT not cultivating at this time
Asclepias incarnata	Swamp Milkweed	Pink/Purple	3-4'	July	12" o.c.	Y	N	MNPPA	2" pot	P, Sh	M, Ms, W	Butterfly	Clay	when full grown, a little leggy-looking and needs plants in front, good for clay
Carex grayii	Gray's Sedge	n/a	18"	May/June	18"	Y	N	MNPPA	2" pot	P, Sh	M, Ms	Butterfly		interesting seed heads if get close
Carex sprengelii	Sprengel's Sedge	n/a	18"	May/June	18"	Y	N	MNPPA	2" pot	P, Sh	D, M, Ms	Butterfly		clumper, good for drier edges, seed heads shoot up 2-3'
Lobelia cardinalis	Cardinal Flower	red	3'	July-Aug	12" o.c.		N	MNPPA	2" pot	P, Sh	M, Ms			a little picky, likes moist best, narrow form, can be short lived but will re-seed if happy, aesthetically best used with shorter plants around
Matteuccia struthiopteris	Ostrich Fern	n/a	36"	n/a	18" o.c.	Y	N	WA	gallon	P, Sh	M, Ms			doesn't like to dry out, can be aggressive if happy, good for clay
Osmunda claytoniana	Interrupted Fern	n/a	12-24"	n/a	12" o.c.	Y	N	WA	gallon	P, Sh	M, Ms, W		Clay	tall, similar to Ostrich Fern, but holds up better in the late summer
Phlox divaricata	Woodland Phlox	Blue	.5-1'	April-June	8" o.c.		N	MNPPA	2" pot	P, Sh	M, Ms			use sparingly in woodland setting with great soils, foliage goes dormant in summer so plan for companions
Solidago flexicaulis	Zig Zag Goldenrod	Yellow	2-3'	Aug.-Oct.	12" o.c.	Y	N	MNPPA	2" pot	P, Sh	D, M, Ms			aggressive, but fills in large areas in the shade, delicate late season color for shade
Solidago rigida	Rigid Goldenrod	Yellow	3-4'	July	12-18" o.c.	Y	N	MNPPA	2" pot	P, Sh	D, M, Ms, W		Clay	subtle for a goldenrod, great for clay, leggy, so put a facer plant in front
Stylophorum diphyllum	Wood Poppy	Yellow	1-2'	April-June	10" o.c.		N	MNPPA	2" pot	P, Sh	M, Ms			good for spring in woodland setting, but can be aggressive
Thalictrum dioicum	Early Meadow Rue	Pale Green	1.5-2'	April-May	10" o.c.		N	MNPPA	2" pot	P, Sh	M, Ms			great plant for delicate texture in woodlands setting--beautiful with iris, but not a bottom of the rain garden plant
Sun to Part Sun														
Allium cernuum	Nodding Wild Onion	Lt. Lavender	12"	Sept-Oct	12" o.c.	Y	N	MNPPA	2" pot	Sn, P	D, M, Ms			good short, neat plant for front
Anthyrium filex-femina	Lady Fern	n/a	24"-36"	n/a	24" o.c.	Y	N	WA	gallon	Sn, P	M, Ms			beautiful fern
Aster dumosis 'Woods Light Blue'	Woods Blue Aster	Lavender	1-2'	Aug-Oct	18" o.c.		C	WA	gallon	Sn, P	D, M, Ms	Butterfly		very compact, florific aster with prolific lavender flowers
Aster laevis	Smooth Aster	Lt. Blue/Lavender	4-5'	Sept-Oct	12-18" o.c.		N	MNPPA	2" pot	Sn, P	D, M, Ms			when full grown, is leggy-looking--can be trimmed to 6" in June for bushier growth, plant something in front
Aster novae-angliae	New England Aster	Deep Purple	4-5'	Sept-Oct	12-18" o.c.		N	MNPPA	2" pot	Sn, P	D, M, Ms	Butterfly		is leggy-looking--can be trimmed to 6" in June for bushier growth (plant something in front) good for drawing beneficial (predatory) insects
Aster novae-angliae 'Purple Dome'	New England Aster Purple Dome	Deep Purple	1.5-2'	Sept-Oct	18" o.c.		C	WA	gallon	Sn, P	D, M, Ms			more compact, florific version of the species w/ deep purple flowers, can be prone to fungus
Carex hystericina	Porcupine Sedge	n/a	2-3'	June-Oct.	12-18" o.c.	Y	N	MNPPA	2" pot	Sn, P	Ms, W	Butterfly		good workhorse for all settings, provides nice texture if massed
Chelone lyonii 'Hot Lips'	Hot Lips Turtlehead	Pink	2-3'	Aug-Sept	18-24" o.c.		C	WA	gallon	Sn, P	D, M, Ms	Butterfly	Clay	good for clay, neat and long blooming, combines beautifully with joe pye weed
Echinacea purpurea	Purple Coneflower	Pink/Lavender	3'-3.5'	July-Aug	12-18" o.c.		N	MNPPA	2" pot	Sn, P	D, M, Ms		Clay	good for clay, good butterfly plant
Echinacea purpurea 'Magnus'	Magnus Purple Coneflower	Pink/Lavender	2.5'-3'	July-Aug	12-18" o.c.		C	WA	gallon	Sn, P	D, M, Ms		Clay	good for clay, more compact and full than straight species, good butterfly plant
Echninacea purpurea 'Snowcone'	Snowcone Cone Flower	White	2.5-3'	June-Aug.	12-18" o.c.		C	WA	gallon	Sn, P	D, M, Ms			good for clay, good butterfly plant
Eupatorium 'Phantom'	Joe Pye Weed--Phantom	Dusky Pink	4-5'	Aug.-Sept.	24"o.c.		C	WA	#2 pot	Sn, P	D, M, Ms			shorter version of following straight species
Eupatorium maculatum	Joe Pye Weed	Dusky Pink	5-6'	July-Aug	24" o.c.		N	MNPPA	2" pot	Sn, P	D, M, Ms			really tall and dramatic, draws beneficial insects
Liatris spicata	Blazing Star	Pink/Purple	3-5'	July	10" o.c.		N	MNPPA	2" pot	Sn, P	M, Ms		Clay	a clumper, flower spike can get quite tall, needs facer plant in front, nice color for that time of season, can take clay
Liatris spicata 'Kobold'	Kobold Blazing Star	Pink/Purple	2'	July	12-18" o.c.		C	WA	gallon	Sn, P	M, Ms		Clay	a clumper, a great cultivated version of the species, full form w/ multiple flower spikes, can take clay
Monarda punctata	Horsemint	White-Pink	18-30"	July-Aug	12-18" o.c.	Y	N	MNPPA	2" pot	Sn, P	D, M, Ms		Sand	has showy, dramatic bracts, can get a little spindly, prefers sandy soils, self sows, bee attractor, salt tolerant
Penstemon digitalis	White Beardtongue	White	3-4'	June	18" o.c.	Y	N	MNPPA	2" pot	Sn, P	D,M,Ms			fills the void of blooming native plants in June,good for clay, but can look a little leggy--needs a facer
Physostegia virginiana	Obedient Plant	Pink	2-3'	Sept-Oct	18" o.c.	Y	N	MNPPA	2" pot	Sn, P	D, M, Ms			good plant for late season color, can be aggressive (use with someone who is not much of a weeder and doesn't like space between plants)
Potentilla simplex	Common cinquefoil	Yellow	6-12"	May-June	18" o.c.	Y	N	MNPPA	2" pot	Sn, P	D, M	Butterfly		good native groundcover under drier parts of the garden, can spread into lawn (make sure OK with owner)
Ranunculus hispidus	Swamp Buttercup	Yellow	1'	May	18" o.c.	Y	N	MNPPA	quart	Sn, P	M, Ms, W			spreader, aggressive in the right soils. Only available in limited quanities in 2014.
Rudbeckia hirta	Black-eyed Susan	Yellow	1-3'	July-Oct	12" o.c.		N	MNPPA	2" pot	Sn, P	D, M, Ms	Butterfly		short-lived, but aggresively self sows, not especially neat, and can look tired when it is done--best used with native lover, good for clay
Rudbeckia fulgida 'Goldsturm'	Goldstrum Black-eyed Susan	Golden Yellow	2'	July-Sept.	18" o.c.		C	WA	gallon	Sn, P	D, M, Ms		Clay	long-blooming, but people either love it or hate it, can spread fast if it's happy, good for clay
SHRUBS														
Cornus sericea	Red-twig Dogwood	White	5-8'	May-June	6' o.c.		N	MNPPA	1 gallon	Sn, P	D, M, Ms, W	Butterfly		can get big, but has great red winter stem color (trim 1/3 each year to promote best red color), best with groundcover underneath
Cornus sericea 'Flaviramea'	Yellow-twig Dogwood	White	5-8'	May-June	4' o.c.		C	WA	3 gallon	Sn, P	D, M, Ms, W	Butterfly		can get big, but has great chartreuse winter stem color, best with groundcover underneath
Nyssa sylvatica	Blackgum	White	30'-60'	May-June	na		N	MNPPA	5 gallon	Sn, P	D, M, Ms, W			beautiful fall color
Rhus aromatica 'Gro Low'	Gro Low Fragrant Sumac	n/a	2-3'	n/a	3' o.c.	Y	C	WA	#3 pot	Sn, P	D, M		Clay	good woody edge plant--not especially showy, but a 'workhorse' with good fall color, good for clay, salt tolerant
Sambucus candensis	Elderberry	White	5-10'	June-July	5' o.c.	Y	N	MNPPA	1 gallon	Sn, P	D, M, Ms, W			takes a wide variety of conditions, a little loose in character, there are several cultivars out now worth exploring
Viburnum dentatum	Arrowwood Viburnum	White	5'-12'	May-June	7' o.c.		N	MNPPA	1 gallon	Sn, P	M, Ms, W			native is a large shrub, with beautiful dark leaves.
Viburnum dentatum 'Blue Muffin'	Blue Muffin Arrowwood Viburnum	White	3-4'	May-June	3' o.c.	Y	C	WA	3 gallon	Sn, P	D, M, Ms, W			nice smaller alternative to straight native Viburnum dentatum, neat and round, beautiful blue berries
Viburnum dentatum 'Chicago Lustre'	Chicago Lustre Arrowwood Viburnum	White	5-7'	June	4' o.c.	Y	C	WA	3 gallon	Sn, P	D, M, Ms, W			a little larger than the previous, a very hardy plant
Viburnum lentago	Nannyberry	White	5-7'	June	7' o.c.	Y	N	MNPPA	1 gallon	Sn, P	M, Ms, W			straight native, so a large shrub

Full Sun													
Aster oblongifolius 'October Skies'	October Skies Aster	Lt. Blue/Lavender	4-5'	Sept-Oct	18" o.c.		C	WA	gallon	Sn	D, M	Butterfly	facer plant on drier edges
Baptisia australis	Baptisia or False Indigo	Blue	3-4'	June	3' o.c.		N	WA	#2 pot	Sn	D, M, Ms	Clay	good dramatic accent plant, really needs full sun, almost looks like a shrub, good for clay
Eryngium yuccifolium	Rattlesnake Master	White/Lt. Green	3'	July-Sept.	18"		N	MNPPA	2" pot	Sn	D, M, Ms		dramatic form, not for the faint of heart
Hibiscus moscheutos	Rose Mallow	Pink	4'-6'	Aug-Sept	32" o.c.		N	MNPPA	2" pot	Sn	M, Ms, W		Huge pink flowers, shrub-like
Panicum virgatum	Switch Grass	n/a	4-6'	Aug.-Sept.	3' o.c.	Y	N	MNPPA	2" pot	Sn	D, M, Ms, W	Butterfly	as long as it has sun, this plant really performs, but can be too floppy for some (use cultivars below if want neater appearance), can re-seed assertively
Panicum virgatum 'Cloud Nine'	Cloud Nine Switch Grass	n/a	5-7'	Aug.-Sept.	3' o.c.	Y	C	WA	2 gal. or #2	Sn	D, M, Ms, W		tall, neat and dramatic--this is a great plant, takes a while to look like something in the spring, best with low groundcover (fragaria virginiana, potentilla
Panicum virgatum' Shenandoah'	Shenandoah Switch Grass	n/a	3'	Aug.-Sept.	2.5' o.c.	Y	C	WA	gallon	Sn	D, M, Ms, W		shorter switch grass, beautifully highlighted with wine tinged foliage, takes a while to look like something in the spring, best with low groundcover (fragaria
Ratibida pinnata	Yellow Coneflower	Yellow	4-6'	July-Oct.	15" o.c.		N	MNPPA	2" pot	Sn	D, M, Ms		tall, use with someone into the native look
Silphium laciniatum	Compass Plant	Yellow	4-7'	July-Aug.	24" o.c.		N	MNPPA	2" pot	Sn	D, M, Ms, W	Clay	tall, use with someone into the native look, can spread aggresively if happy, good for clay
Silphium terebinthinaceum	Prairie Dock	Yellow	8' (flower)	Aug.	18" o.c.		N	MNPPA	2" pot	Sn	D, M, Ms		short broad foliage is great contrast plant, flower stalk is airy and tall (sometimes needs staking), good for clay
Solidago riddellii	Riddell's Goldenrod							MNPPA	2" pot	Sn	Ms, W		nice good-looking foliage, looks like a garden plant. Pretty yellow flowers the same time as Asters and Boltonia.
Sporobolus heterolepis	Prairie Dropseed	n/a	2'	Aug.-Sept.	1.5' o.c.	Y	N	MNPPA	2" pot	Sn	D, M, Ms		a great performer, but takes a while to get going, beautfiul fall texture, great for front edge of sunny garden, since it has neat winter presence, but can be
Verbena hastata	Blue Vervain	Purple	4-6'	June-Augusl	12" o.c.		N	MNPPA	2" pot	Sn	D, M, Ms		tall, nice deep color, best for native setting
SHRUBS													
Ilex verticillata	Winterberry	White	4-6'	June-July	3.5' o.c.		N	MNPPA	1 gallon	Sn	M, Ms, W	Acidic	needs acid soil (not clay!), makes it possible for companion female plant below to bloom and fruit
Ilex verticillata 'Jim Dandy'	Winterberry-Male	White	4-6'	June-July	3.5' o.c.		C	WA	5 gallon	Sn	M, Ms, W	Acidic	needs acid soil (not clay!), makes it possible for companion female plant below to bloom and fruit
Ilex verticillata 'Nana Red Sprite'	Winterberry-Female	White	2-3'	June-July	2.5' o.c.		C	WA	5 gallon	Sn	M, Ms, W	Acidic	needs acid soil (not clay!), amazing winter berries (needs male above--1 male for every 5 females)
Potentilla fruiticosa 'Goldfinger'	Goldfinger Potentilla	Yellow	3-4'	June-July	36" o.c.	Y	C	WA	3 gallon	Sn	D, M, Ms	Clay	long blooming flowers, good neat plant, may need hard pruning in a couple of years, good for clay, good for drawing beneficial (predatory) insects

All Light Levels		Bloom Color	Height	Bloom Time	Plant Spacing	Deer Resistant?	Native?	Source	Size	Sun/ Shade	Mois-ture	Habitat	Soil	Comments
Anemone canadensis	Canada Anemone	White	12"-20"	May-July	18" o.c.	Y	N	MNPPA	2" pot	Sn, P, Sh	M, Ms			groundcover, spreads quickly & fills in (can be aggressive--good for someone who doesn't want to weed), resents long periods of drought
Carex muskingumensis	Palm Sedge	n/a	2-3'	June-Oct.	12-18" o.c.	Y	N	MNPPA	2" pot	Sn, P, Sh	M, Ms, W	Butterfly		good workhorse for all settings, provides nice texture if massed
Carex stipata	Common Fox Sedge	Green	24"	May	12-18" o.c.	Y	N	MNPPA	2" pot	Sn, P, Sh	D, M, Ms			provides nice texture if massed
Carex vulpinoidea	Brown Fox Sedge	n/a	2-3'	June-Oct.	12-18" o.c.	Y	N	MNPPA	2" pot	Sn, P, Sh	D, M, Ms, W	Butterfly		good workhorse for all settings, provides nice texture if massed
Fragaria virginiana	Wild Strawberry	White	6-12"	May-June	18" o.c.	Y	N	MNPPA	2" pot	Sn, P, Sh	D, M, Ms			edible, great groundcover for spreading in between plants that are spaced far, can spread into adjoining lawn (check with owner), nice fall color
Geranium maculatum	Wild Geranium	Lavendar	12"-24"	May-June	12" o.c.	Y	N	MNPPA	2" pot	Sn, P, Sh	D, M, Ms			neat native that clumps, stays small and keeps leaves throughout season, nice fall color
Iris virginica	Blue Flag Iris	Lt. Blue/Lavender	2-3'	May-June	12-18" o.c.	Y	N	MNPPA	2" pot	Sn, P, Sh	M, Ms, W			great clean and neat foliage, nice flower, really tough--an excellent workhorse
Lobelia siphilitica	Blue Lobelia	blue purple	30"	July-Sept	12" o.c.	Y	N	MNPPA	2" pot	Sn, P, Sh	M, Ms			longer lived than sister cardinal flower, nice blue at end of the season, neat for native, good for drawing beneficial (predatory) insects
Onoclea sensibilis	Sensitive Fern	n/a	12-24"	n/a	12" o.c.	Y	N	WA	gallon	Sn, P, Sh	M, Ms, W			a short, neat fern for the sun, as long as not too dry, great combined with iris
Veronicastrum virginicum	Culver's Root	White	4-6'	July-August	12-18" o.c.		N	MNPPA	2" pot	Sn, P, Sh	D, M, Ms			nice bloom late in summer, can be aggressive if happy
SHRUBS														
Cercis canadensis	Red Bud	Pink	25'	May			N	MNPPA	1 gallon	Sn, P, Sh	D, M, Ms			great small native floodplaing tree, can be susceptible to wind damage
Itea virginica 'Henry's Garnet'	Sweetspire	White	4'	May-June	3' o.c.		C	WA	6 gallon	Sn, P, Sh	M, Ms			beautiful fall color, but susceptible to winter kill, need to prune off winter dead in spring

PLANTS TO TRY	These plants are untested in rain gardens - but seem like they might work. Would you plant one or two of these species, and then report back to us on how they turned out? Thanks!												
Actaea pachypoda	White Baneberry "Doll's Eyes"	White	1'-2'	May	12" o.c.	?	N	MNPPA	2" pot	Sh	M		A delicate little plant with lacy leaves. The berries really do look like "doll's eyes". Beautiful garden plant - does it work in rain gardens?
Agrimonia parviflora	Swamp Agrimony			July	3-4'	?	N	MNPPA	plug	Sn, P	Ms, W		Recommended by Greg Vaclavek, so probably grows fine in a rain garden. Is it pretty?
Osmunda cinnamomea	Cinnamon Fern	na	2'-3'	na	24" o.c.	Y	N	WA	gallon	P, Sh	M, Ms, W		A bit smaller than Ostrich Fern, and doesn't spread as aggressively as Ostrich Fern does. Does it do well in a rain garden? Is it pretty?
Eupatorium rugosum	White Snakeroot	White	2'-4'	Jul-Sep	24" o.c.	?	N	MNPPA	2" pot	P, Sh	M		Nice white flowers in shade, I hear it is a spreader. There is a cultivar 'Chocolate'. How does it do in a rain garden?
Senecio aureus	Golden ragwort	Yellow	2'-3'	spring	12" o.c.	?	N	MNPPA	2" pot	P, Sh	M, Ms, W?		a beautiful, well-kept looking little plant with big dark leaves, similar to hostas
Juncus tenuis	Path Rush	Green	1'-2'	late spring	12" o.c.	?	N	MNPPA	2" pot	P, Sh	M, Ms		A litle rush. Is it pretty enough to be a garden plant?
Aralia racemosa	Spikenard	White	2'-5'	Jun-Aug	5' o.c.	?	N	MNPPA	2" pot	P, Sh	M, Ms, W		Almost shrub-like in its size and shape. Beautiful, graceful limbs. Has purple clusters of berries in the late summer. How does it do in a RG?
Arisaema dracontium	Green dragon	Green	1'-3'	May-Jun	12" o.c.	?	N	MNPPA	2" pot	P, Sh	M, Ms, W		Small little woodland dragon, related to Jack-in-the-Pulpit.
Caltha palustris	Marsh Marigold	Yellow	1'-1.5'	Apr-Jun	12" o.c.	?	N	WA	gallon	Sn, P, Sh	M, Ms, W		Beautiful native, short with big yellow flowers in spring. Grows along pristine streams. How does it do in a rain garden?
Heracleum maximum	Cow Parsnip	White	4'-7'	Jun-Jul	6' o.c.	?	N	MNPPA	2" pot	Sn, P, Sh	M, Ms, W		Very big, tall plant. Dramatic! A good focal point. Resembles the toxic Giant Hogweed, but otherwise is very pretty. Pretty enough for gardens?
Coreopsis tripteris	Tall Coreopsis	Yellow	4'-7'	Jul-Sep	24" o.c.		N	MNPPA	2" pot	Sn, P	M		Tall, and stays upright. Good in dry sand, well-drained sand rain gardens, and possibly heavier soils - try it and see.
Tradescantia 'Sweet Kate'	Spiderwort - Sweet Kate	Purple	1'	June	12" o.c.	?	C	WA	gallon	Sn, P	M, Ms, W		Cultivar of spiderwort, very short, yellow chartreuse leaves in full sun. Cut back when the leaves go dormant.
Lilium michiganense	Michigan Lily	Orange	4'-5'	Jun-Aug	4' o.c.		N	MNPPA	2" pot	Sn, P	M		I have no idea if this would thrive in a rain garden, but wouldn't it be cool if it did?
Senna hebecarpa	Wild Senna	Yellow	3'-5'	Jul-Aug	18" o.c.	?	N	MNPPA	2" pot	Sn, P	M, Ms, W?	Butterfly	in the pea family, so yellow pea-like flowers
Pycnanthemum virginianum	Mountain-Mint	White	2'-4'	Jul-Sep	18" o.c.	?	N	MNPPA	2" pot	Sn, P	M, Ms, W?		We are pretty sure this works in rain gardens. Is it pretty enough to be a garden plant?
Helenium autumnale	Sneezeweed	Yellow	3'-6'	Aug-Sep	18" o.c.	?	N	MNPPA	2" pot	Sn, P	Ms, W	Butterfly	Nice flowers. Does it do ok in a rain garden?
Ranunculus hispidus	Swamp Buttercup	Yellow	1'	May	18" o.c.	Y	N	MNPPA	quart	Sn, P	M, Ms, W		Beautiful yellow flowers. Nice and short - a good ground-cover. Aggressive spreader in the right soils.
Solidago riddellii	Riddell's Goldenrod	Yellow	2'-4'	Aug-Sep	18" o.c.	?	N	MNPPA	2" pot	Sn	M, Ms, W?		This worked fine in a big bioretention area. Is it pretty enough to be a garden plant?
Scirpus atrovirens	Black Bullrush	Brown	3'-5'	Jun-Jul	18" o.c.	?	N	MNPPA	2" pot	Sn	Ms, W		Probably great for rain gardens - is it pretty enough to be a garden plant?
SHRUBS TO TRY													
Cephalanthus occidentalis	Buttonbush	White	6'-15'	Jun-Aug	na	?	N	MNPPA	5 gallon	Sn, P	Ms, W		Beautiful, glossy leaves. Often grows in the wild in a woodsy opening, on the edges of a vernal pond.
Cornus amomum	Silky Dogwood	White	3'-9'	Jun-Jul	na	?	N	MNPPA	gallon	Sn, P, Sh	Ms, W	Butterfly	A spreading shrub. Does it sucker and spread too much to be in a residential garden?
Hypericum kalmianum	Kalm's St. John's Wort	Yellow	1'-2'	Jun-Aug	2' o.c.	?	N	MNPPA	gallon	Sn, P	Ms, W		A nice little spreading shrub. We just have never tried it! Does it do ok in a rain garden situation?
Lindera benzoin	Spicebush	Yellow	5'-10'	Apr-May	8' o.c.	?	N	MNPPA	gallon	P, Sh	Ms, W	Butterfly	Beautiful shrub. How does it do in a rain garden?
Myrica gale	Sweet Gale	Green	3'-5'	June	5' o.c.	?	N	MNPPA	gallon	Sn, P	W		A small shrub, sweetly scented leaves, this plant is similar to the northeast's Bayberry
Ribes americanum	Wild Black Currant	White	2'-4'	Apr-May	5' o.c.	?	N	MNPPA	gallon	Sn, P	M, Ms, W		A small shrub; lacks prickles; edible berries can be used to make jelly, wine, or pie.
Salix discolor	Pussy Willow	Green	6'-20'	Mar-Apr	7' o.c.	?	N	MNPPA	gallon	Sn	W		The old-fashioned pussy willow with soft, furry flower buds. A big shrub/small tree.

TREES TO TRY												
Asimina triloba	Paw Paw	Purple	15'-30'	Apr-May	?	N	MNPPA	gallon	Sn, P, Sh	M, Ms, W		Huge leaves, produces yummy banana-flavored fruit after a decade or so. Beautiful tree - will it work in a rain garden?
Betula alleghaniensis	Yellow Birch	Yellow	40'-70'	Apr-May	?	N	MNPPA	5 gallon	Sn, P	M, Ms, W		Beautiful tree, not often planted.
Betula pumila	Bog Birch	Brown	5'-12'	May-Jun	?	N	MNPPA	5 gallon	Sn, P	Ms, W		Shrubby birch.
Carpinus caroliniana	Musclewood	Green	15'-30'	Apr-May	?	N	MNPPA	5 gallon	Sn, P, Sh	M, Ms, W		Beautiful small tree, "muscled" bark. Lives in floodplains, how about a rain garden?
Carya cordiformis	Bitternut Hickory	Yellow	50'-85'	May-Jun	?	N	MNPPA	5 gallon	Sn, P	M, Ms, W		Slow growing tree, yellow fall color.
Gymnocladus dioicus	Kentucky Coffee Tree	White	60'-85'	Jun	?	N	MNPPA	5 gallon	Sn, P	M, Ms, W		Pre-historic looking tree. Bulletproof in street-side locations. Seeds used by native americans as marbles.
Larix laricina	Tamarack	na	40'-75'	na	?	N	MNPPA	5 gallon	Sn, P	Ms, W		Yellow fall color, deciduous confer. How does it do in a rain garden?
Liriodendron tulipifera	Tulip Poplar	White	60'-110'	Apr-May	?	N	MNPPA	5 gallon	Sn, P	Ms, W	Butterfly	Yellow fall color, beautiful tree, big orange/green flowers in spring. How does it do in a rain garden?
Platanus occidentalis	Sycamore	Green	65'-100'	May	?	N	MNPPA	gallon	Sn, P	D, M, Ms, W		Huge tree, bark comes off in strips, leaving a white trunk.
Quercus bicolor	Swamp White Oak	Green	50'-80'	May-Jun	?	N	MNPPA	5 gallon	Sn	Ms, W	Butterfly	Big oak tree.
Quercus macrocarpa	Bur Oak	Green	40-70'	May-Jun	?	N	MNPPA	5 gallon	Sn	D, M, Ms, W	Butterfly	Big oak tree; the oak that the "arbor" in Ann Arbor was named after.
Quercus muehlenbergii	Chinquapin Oak	Green	50'-80'	May-Jun	?	N	MNPPA	5 gallon	Sn	D, M, Ms, W	Butterfly	Big oak tree, cool shaped leaves.
Staphylea trifolia	American Bladdernut	White	8'-18'	Apr-May	?	N	MNPPA	gallon	P, Sh	M, Ms		Beautiful shrub/small tree with lantern seed pods in the fall. Grows on riverbanks, but how does it do in a rain garden?
Thuja occidentalis	Northern White Cedar		30'50'		?	N	MNPPA	gallon	Sn, P	Ms, W		Evergreen tree! How does it do in a rain garden?

Plants that we have had issues with in the past

This list is here to discuss the problems and issues with plants that, on the whole, did not work very well within the context of Washtenaw County residential rain gardens

Scientific Name	Common Name	Comments
Aesclepias syriaca	Common Milkweed	Quite aggressive, but good for monarch habitat
Andropogon gerardii	Big Bluestem	Some people who are truly into natives like it, but generally it is too tall and to spindly for most, is use it--mass it in a big area
Campanula americana	Tall Bellflower	Too spindly for most
Chelone glabra	Turtlehead	Very sensitive to varying moisture levels, tends to flop, has conservative soil type range--not good for general rain garden use
Euaptirum perfoliatum	Boneset	Can be quite aggressive--use with caution, good for drawing beneficial (predatory) insects
Heuchera americana	Alum Root	Not showy at all, but if massed is OK for texture
Monarda fistulosa	Bee-balm	Gets an ugly fungus on it after it blooms
Ratibita pinnata	Yellow Coneflower	Very tall, if used needs to be in a big space, good for drawing beneficial (predat NPN
Sisrynchium angustifoium	Blue-eyed grass	A little sensitive--can get 'mowed' down by other plants in its area
Smilacena racemosa	Solomon's Plume	Needs to be massed in a big area, and planted close together to work--otherwise looks spindly
Smilacena stellata	Starry-false Solomon's Seal	Would have like to have used it, but had lots of problems with propogation
Solidago caesia	Blue-stemmed goldenrod	Super aggressive--beware!
Tradescantia ohiensis	Spiderwort	Looks nice when it blooms (only in the daytime), but then totally flattens to the ground when it is done blooming in June
Vernonia missurica	Ironweed	Very tall and thin, if used needs to be in a big space
Zizia aurea	Golden Alexanders	Clients found it too floppy and messy, but good for drawing beneficial (predatory) insects
Helianthus grosseserratus	Sawtooth Sunflower	very tall, nice late season color, can be aggressive. Not available.

Washtenaw County Rain Garden Program

www.ewashtenaw.org/raingardens

Master Rain Gardener training

Master Rain Gardeners are volunteers who have earned their Master Rain Gardener certificate - trained in designing and installing rain gardens. They volunteer to help out friends and neighbors to learn about, design and plant rain gardens. Recognize them by their t-shirts and nametags! Classes held every Feb/March in person, every July online.

Rain Garden Design Assistance

The Office of the Washtenaw County Water Resources Commissioner and staff work with several homeowners each year to design and install rain gardens on their property. The result is residents all over the county are happy with their new gardens, while the Huron River receives less fertilizers, chemicals and other harmful runoff.

Rain Garden Coordinator Susan Bryan 734-222-3814

PLANTS I WILL TRY OUT IN MY GARDEN:

LANDSCAPE MAINTENANCE PLAN

FOR THE BIRD CENTER OF MICHIGAN

2022

Compiled by Ashley Truitt and Audeline Kurniawan

for their University of Michigan Practicum Project

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Introduction

The first 2-3 years for naturalized gardens is the most important in terms of maintenance. Helping the native plants establish and thrive in their new environments is necessary for healthy growth and ensuring the success of the garden in the long-term. Weeds will take over root space, shade out seedlings of the native plants, and divert valuable nutrients away from both established and unestablished plants (UIC, n.d.). Weeding regularly will prevent those issues and also aerates the soil for easier watering and planting. Weeds can include common grasses that are growing where they are unwanted, like inside the garden bed.

General Guidelines

Overall, we recommend designating specific volunteers, part of a volunteer's shift, or planning volunteer days to help with these tasks, especially in the summer and for activities like pulling weeds, which would likely be too time consuming for clinic staff and interns. Please see below for more detailed information on each maintenance activity.

A) Watering Requirements

- ESTABLISHED PLANTS (ex: plants that were put in by Audi and Ashley)
    - Water thoroughly 1-2 times a week during droughts/very hot and dry conditions.
        - Ex: set the hose timer to 30 minutes per section that the sprinkler can reach and move the sprinkler to the next section once done.
    - Spring, Fall, and Winter - you can let the plants be!
- NEWLY PLANTED VEGETATION
    - Depends on the weather...
        - If HOT + DRY (peak summer weather) - water thoroughly 2-4 times a week for 1-2 months (or until weather cools down)
            - ALWAYS check the plants too - if they are drooping and crispy-looking, water them!
            - If the soil is TOO WET, slow down on watering.
        - If planting new vegetation in the Spring, you still need to water regularly (2-3 times a week) and then continue to water as needed through the summer.
    - TREES AND SHRUBS

        - Instead of using the sprinkler, use the hose and let a slow trickle of water go into the soil near the trunk of the tree (where the root base would be) for about 20-30 minutes.
        - Sometimes it helps to create a “trench” of dirt around the newly planted tree or shrub so the trickling flow of water from the hose can absorb in a more directed way to the roots.

B) Weeding

- Weeding the garden should take place at least twice a year, once in early summer and once in fall. This is to prevent weeds from seeding and thus producing more weeds.
    - June and September would be optimal times
    - Opportunity for a great volunteer event!
- Try to remove the entire plant and root system, especially if the weed is flowering or went to seed
    - Soil knives and gardening trowels will help with this
    - Thick gardening gloves are likely needed for thorny weeds such as Thistles
    - Pull tree seedlings as well - Maples and Eastern Cottonwood seedlings are the most common on this site.
- Collect weeds in a bucket or lawn bag and remove from the area
  ***Refer to the plant appendix at the end of this document for pictures of some common weeds*. **

C) Pruning

- When to prune woody plants (shrubs and trees): Late winter or Early Spring, before new growth occurs for the year.
    - ***note*: for the large Forsythia shrub in the backyard garden, if you need to prune it back, do so AFTER it flowers in the spring (late March to April) (Kidd, 2012)
- For pruning, always cut at a *node*, which means *right above a bud* (see diagram below)
    - This ensures the plant looks tidy and grows in a neat manner.
    - Always remember to step back and look at the overall plant shape before making a big cut.

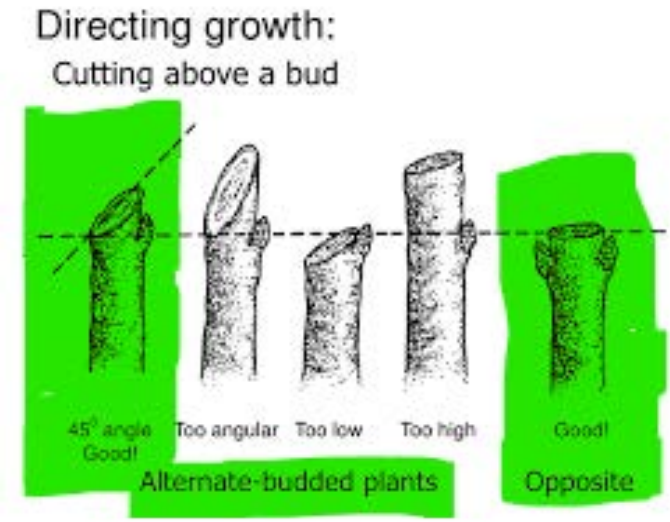

Figure 1. Diagram showing how to prune a woody plant correctly if it has alternating vs. opposite growth patterns. http://www.centralcoastwilds.com/news/2019/Fall-Pruning-Tips-and-Tricks.html

D) Perennial Care

- Don't cut back any perennials until ***AFTER*** the frosts are completely gone and temperatures are consistently in the 50's (April - May in Michigan).
    - This allows time for bees and butterflies to emerge from their wintering houses/hibernation (Bingham, 2021).
    - It also gives root systems underground protection from the cold during winter, as the dead stems, stalks, and leaves will catch snow and provide a layer of insulation.
    - When cutting back perennials, cut off the *flowering stalks* and leave a couple inches so that you can see where the plant is located. See plant pictures at the end of this document for detailed instructions.

E) Mulching

- Natural shredded hardwood mulch will break down over time and may need to be reapplied
    - Visually check once a year for the first 5 years (until 2026) to see if mulch has broken down and soil is visible
    - After 5 years, plants will be well established and mulch is not needed to retain moisture
        - If mulch is still intact, no more mulch is needed!
        - If soil is visible, time to add mulch!

- Natural mulch is best to use and can be bought in bulk from local landscaping companies or in bags from hardware stores (Home Depot or Lowes)
    - 8 cubic yards was used for the front yard garden, 3 cubic yards for the backyard garden
    - Mulch should be 2-3” thick
- Mulch can be be used to maintain a clear edge along the lawn, but not necessary

F) Fertilization

- Fertilization is likely **not necessary** for the next 5 years (until 2026)
- We conducted a soil test through MSU before planting to see if the soil needed any supplementation, see results below
- After 5 years, you could test the soil again, but it is likely the results would not change
    - https://homesoiltest.msu.edu/

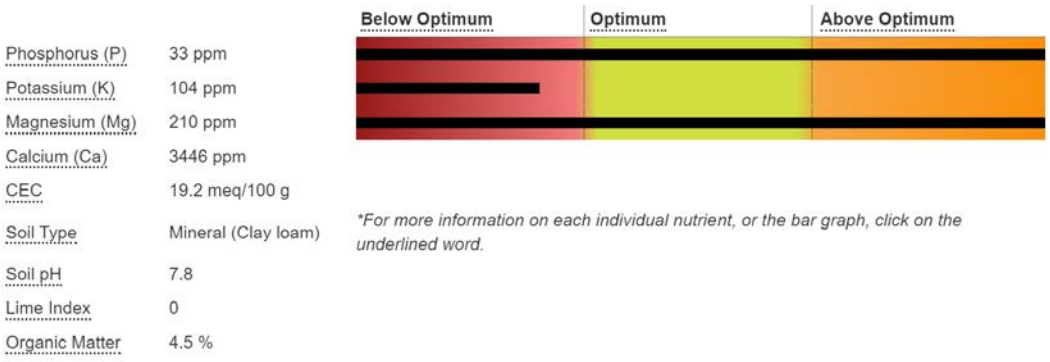

Figure 2. MSU Soil Test Results for 7800 Platt Road, Saline, MI.

G) Pest Management

- If a perennial is showing signs of disease like discoloring, dead spots, mildew, mold, fungus, or insect infestations, immediately prune the affected leaf or stem off and throw it in the garbage. Do not compost the infected piece, as it could spread from there (UIC, n.d.)

H) Bird Bath

- The water in the bird bath should be changed every 2-4 days. It is important to ensure the water stays free of insects, leaves, and algae.

First Year Management

- Cut back perennials in the spring as stated above
- Water plants if necessary - hot/dry spells in summer
- Weed the garden once in summer and once in fall
    - Could be a great opportunity for volunteer events

Long Term Management & Resources

In case of plant death due to disease, insects, severe drought, or other natural causes, here are a few places to look if the center wants to replace them (or for future landscaping projects):

Lodi Farms
Address: 2880 S Wagner Rd, Ann Arbor, MI 48103
Phone: (734) 665-5651

KBK Garden Center
Address: 6400 E Michigan Ave, Saline, MI 48176
Phone: (734) 944-8644

WildType Native Plant Nursery
Address: 900 N Every Rd, Mason, MI 48854
Phone: (517) 244-1140

New Leaf Natives
Address: 304 Jarvis St, Ypsilanti, MI 48197
Phone: (734) 330-7175

Feral Flora
Address: 3825 Nixon Rd, Ann Arbor, MI 48105
Phone: (734) 224-2080

Washtenaw County Conservation District - Native Plant Expo & Marketplace
*Check WCCD website for sale dates and locations (Spring sale is the main one, usually until mid-March or while supplies last)
https://store.washtenawcd.org/
734-302-8715

- To prevent weeds from the lawn from encroaching on the garden area, it is useful to dig an edge about 6” away from the garden’s outer edge, remove any vegetation in between the edge line and the garden bed, and mulch that now-empty strip. This could be done every couple years.
    - Please avoid plastic edging, as plastic will break down over the years and add chemicals to the soil, it can damage lawn equipment such as weed wackers and lawn mowers, the edging itself is easily damaged as well, and is difficult to remove if the garden needs to be changed.

Figure 3. Marked by the white arrow, mulch this empty strip after edging (with tools such as spades, shovels, and rakes) and removal of weeds and vegetation for a natural and beautiful garden border.
https://landscapesolutionsmi.com/the-best-landscape-edging-to-install-around-your-flower-beds/

- External Plant, Seed, and Insect Identification and Care Resources
    - Prairie Moon Nursery - link
    - Illinois Wildflowers - link
    - iNaturalist - link
    - Seek Phone App by iNaturalist - link
    - Insect Identification for the Casual Observer - link

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Phase I Front Yard Site Plan:

0 11.5′ 23′ 46′

1″=23′

N

Primary Blocks

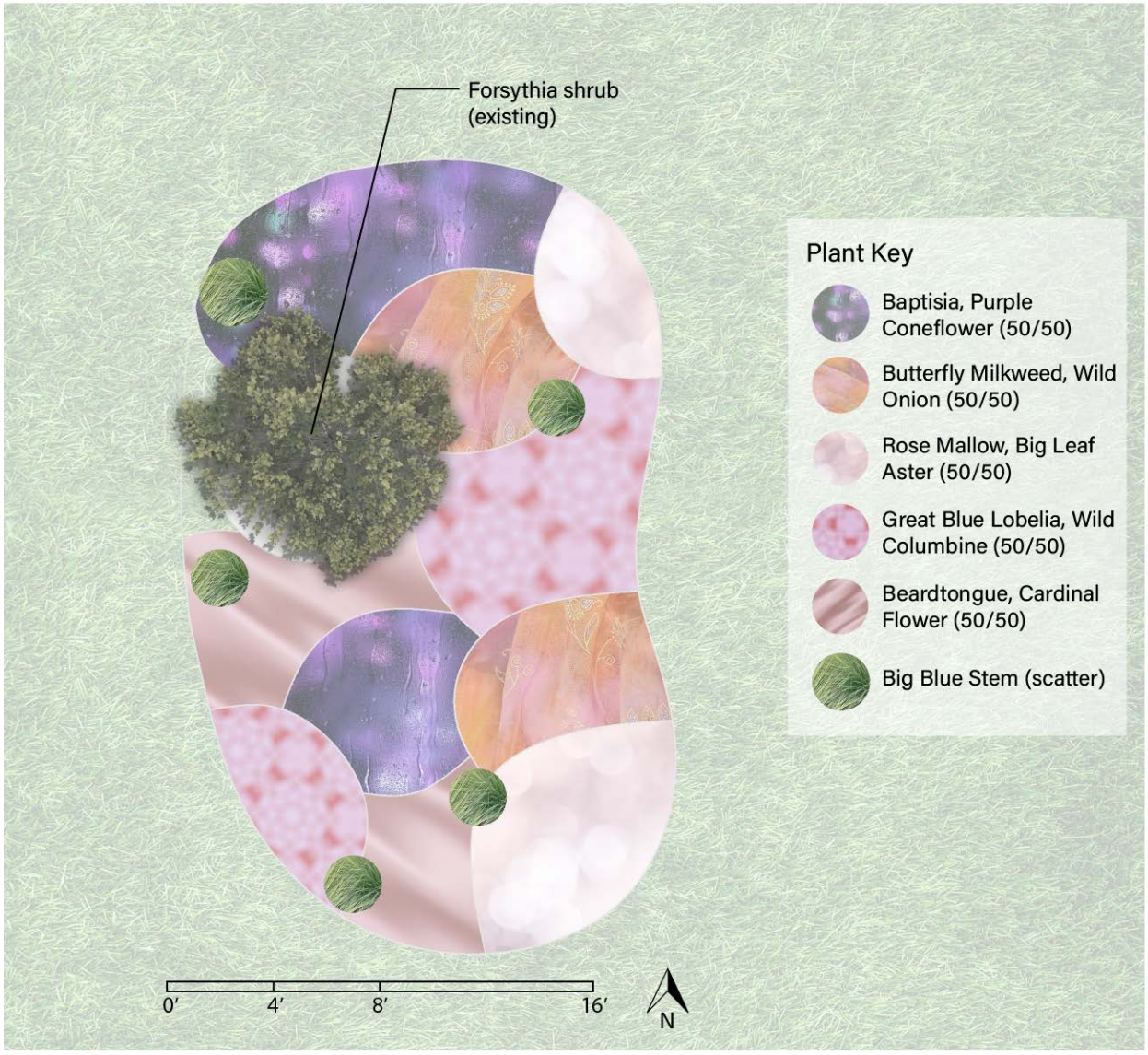
- PA- 50% Big Leaf Aster, 50% Prairie Blazingstar
- PB- 50% False Indigo, 50% Bee Balm
- PC- 50% Sweet Coneflower, 25% Butterfly Weed, 25% David's White Garden Phlox
- PD- 50% Wild Geranium, 50% White Wood Aster
- PE- 50% Sweet Woodruff, 50% Ostrich Fern

Matrix Blocks

- MA- 40% Columbine, 40% Golden Alexander, 20% Woodland Stonecrop
- MB- Wild Ginger
- MC- 25% Barren Strawberry, 75% Pale Purple Coneflower

Backyard Garden Bed Redesign

**Plants obtained from Washtenaw County Conservation District*



Appendix

Native Plant Profiles

Barren Strawberry - *Waldsteinia fragarioides*

A low spreading ground cover plant that needs little to no maintenance overall and usually remains pest-free.

Beardtongue - *Penstemon hirsutus*

Does not need regular maintenance.

Bee Balm - *Monarda bradburiana*

Cut stalks with the seed heads off in the spring (leave the leaf parts alone).

Big Blue Stem - *Andropogon gerardii*

This is a tall native grass that has nice fall color. Chop the whole thing down in early spring.

Big Leaf Aster - *Eurybia macrophylla*

Cut stalks with seed heads off in the Spring (if any are remaining) and leave the leaf parts alone.

Butterfly Weed - *Asclepias tuberosa*

You can cut the whole stalk down (leaves, flowers, and everything).

Cardinal Flower - *Lobelia cardinalis*

You can cut the whole stalk down (leaves, flowers, and everything).

Columbine - *Aquilegia canadensis*

This one will likely die off on its own, so no need to do anything.

David's White Garden Phlox - *Phlox paniculata* 'David'

Cut almost the entire stem down in Spring (leaving just a couple inches of stem above the ground).

Eastern Redbud - *Cercis canadensis*

This small tree likely won't need to be pruned for a while. Only if it begins to grow into the house or get in the way of the path to the backyard, then you can prune some branches off. Refer to pruning tips in Section C above. It has an *alternate* growth pattern.

False Indigo - *Baptisia australis*

If stems are still upright, you can prune them down in the Spring.

Golden Alexander - *Zizia aurea*

This one will likely wither away on its own.

Great Blue Lobelia - *Lobelia siphilitica*

This one will usually wither away after seeds are produced.

Hummingbird Summersweet - *Clethra alnifolia*

Small shrub that will likely not need to be pruned for a while. Prune away from the house or Redbud when it gets too large. Refer to pruning tips above.

Ostrich Fern - *Matteuccia struthiopteris*

This one will wither away on its own.

Pale Purple Coneflower - *Echinacea pallida*

Cut down the stems with the flowers/seed heads on them. Leave the leaves at the bottom alone.

Purple Coneflower - *Echinacea purpurea*

Cut down the stems with the flowers/seed heads on them. Leave the leaves at the bottom alone.

Prairie Blazingstar - *Liatris pycnostachya*

You may cut everything down (leaves and flowers are on the same stalk).

Rose Mallow - *Hibiscus moscheutos*

Cut dead stems down in early spring before blooming. Flowers will bloom for a short time and fade away rather quickly.

Serviceberry (‘Autumn Brilliance’) - *Amelanchier x grandiflora* ‘Autumn Brilliance’

Similar to the redbud, you will only need to prune branches off if they get in the way of the ramp up to the front door. Refer to Section C for pruning tips.

Sweet Coneflower - *Rudbeckia subtomentosa*

Only cut the flowering stalks down.

Sweet Woodruff - *Galium odoratum*

This groundcover can be left alone.

White Wood Aster - *Eurybia divaricata*

Can get bushy and a bit wild. Cut back to about 6” tall in Spring.

Wild Geranium - *Geranium maculatum*

Can cut the whole plant back in spring.

Wild Ginger - *Asarum canadense*

Spreading groundcover. Can be left alone.

Wild Onion - *Allium cernuum*

Will likely disintegrate on its own, no need to do anything.

Winterberry - *Ilex verticillata*

Prune back if it gets too bushy or big. Refer to Section C for pruning tips.

Woodland Stonecrop - *Sedum ternatum*

Low and compact, somewhat spreading groundcover. Can leave this one alone.

Common Weeds

Bindweed - *Convolvulus arvensis*

This is a vining plant that spreads aggressively. It wraps itself around neighboring plants.

Canada Thistle - *Cirsium Arvense*

Has sharp spines along the stem and leaves. It is important to remove before it goes to seed.

Crab Grass - *Digitaria sanguinalis*

Small clumped grass, has a deep root system.

Creeping Charlie - *Glechoma hederacea*

Aggressive spreader, important to manage or it will take over a garden.

Dandelion - *Taraxacum spp.*

Has a deep tap root. Make sure to remove before it goes to seed.

English Plantain - *Plantago lanceolata*

Has a deep tap root, important to remove as much of the root as possible or it will keep getting larger.

Lambsquarters - *Chenopodium album*

Small plant, easy to remove.

Nutsedge - *Cyperus rotundus*

Aggressive underground spreader. Remove as much of the root system as possible.

Purslane - *Portulaca oleracea*

Spreading plant, easy to remove but stay on top of it’s removal.

Common Invasive Species

Amur Honeysuckle - *Lonicera maackii*

Woody shrub with red berries that are nearly translucent. Holds leaves longer in the fall than other species. Remove entire plant - cut or dig out.

Common Buckthorn - *Rhamnus cathartica*

Small tree with black berries and thorns on branches (tip is pointy). Will spread aggressively, and is important to remove the entire plant. Birds eat the berries and cause further spread.

Garlic Mustard - *Alliaria petiolata*

Herbaceous plant that spreads aggressively. Pull entire plant and roots and put in trash bag. Do not add to compost - throw away with regular trash.
Young plants are edible!

Plant Image Sources

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