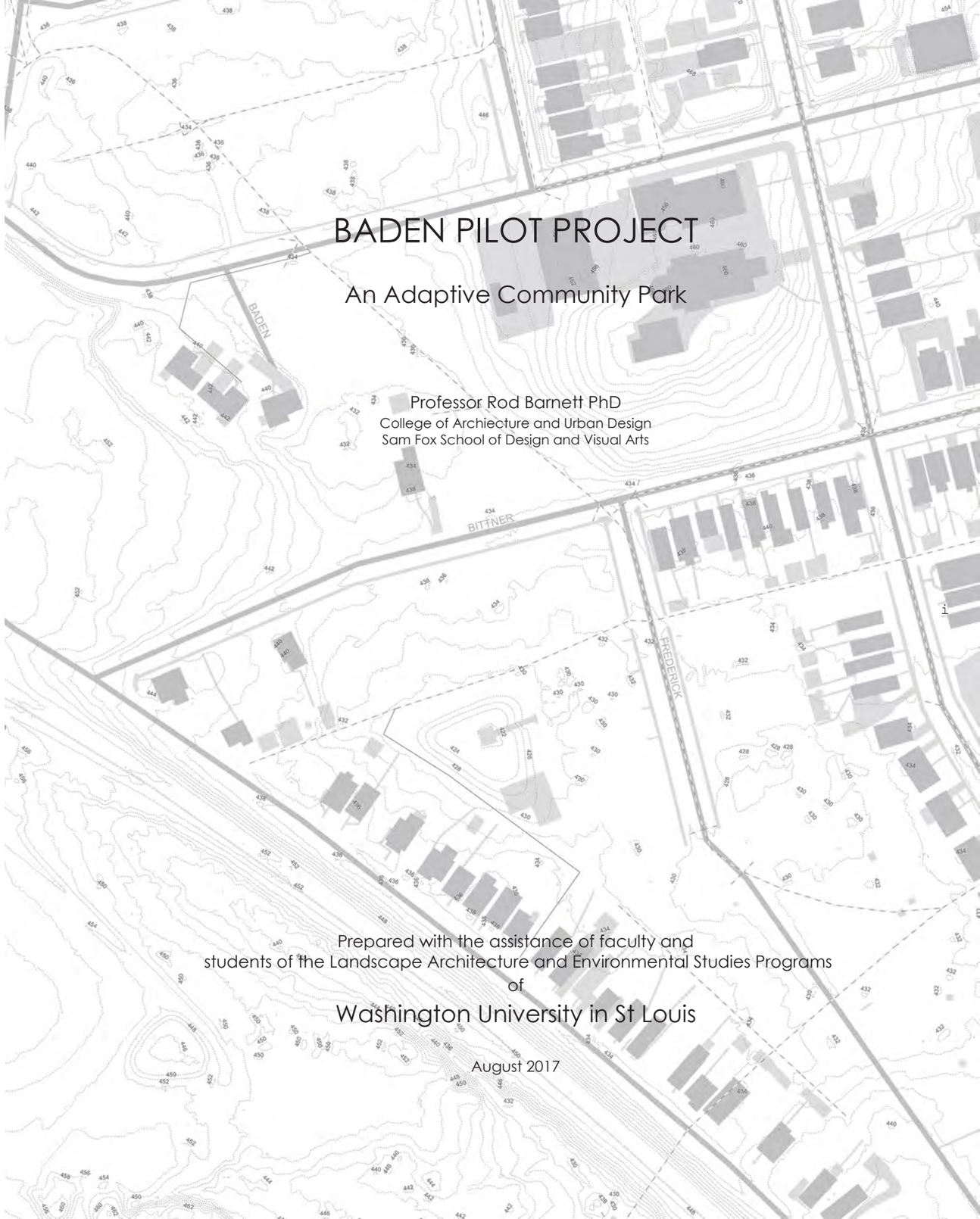

BADEN PILOT PROJECT

An Adaptive Community Park

Professor Rod Barnett PhD
College of Archiecture and Urban Design
Sam Fox School of Design and Visual Arts

Prepared with the assistance of faculty and
students of the Landscape Architecture and Environmental Studies Programs
of

Washington University in St Louis

August 2017


Belle Fontaine Park
New Bethlehem Cemetery
North Riverfront Park
Koeneman Park
St. John's Cemetery
Lions Park
Friedens Cemetery & Mausoleum
Mississippi River
Hickey Park
Baden Community Garden
Dickman Park
Vivian Astra Park
Doty Park
Gregory J. Carter Park
Busche Park
Walnut Park
Bellefontaine Cemetery
Penrose Park
Barrett Brothers Park
O' Fallon Park
Eugene Tink Bradley Park
Handy Park
0 500 1,000 2,000 3,000 4,000 5,000 Feet
Legend
Open Spaces in St. Louis
St. Louis Parks
St. Louis Parcels
St. Louis Co Parcels
Waterways

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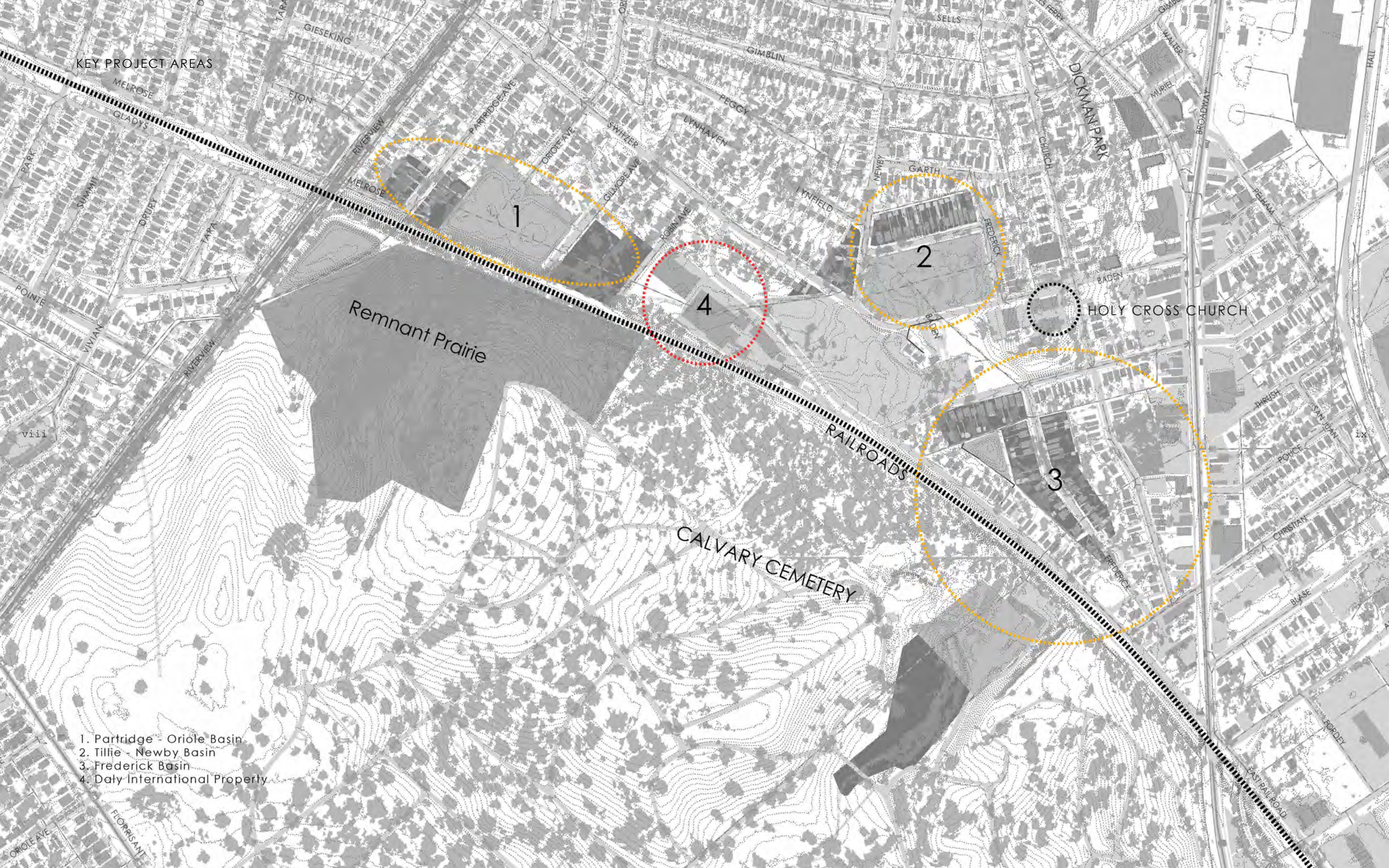
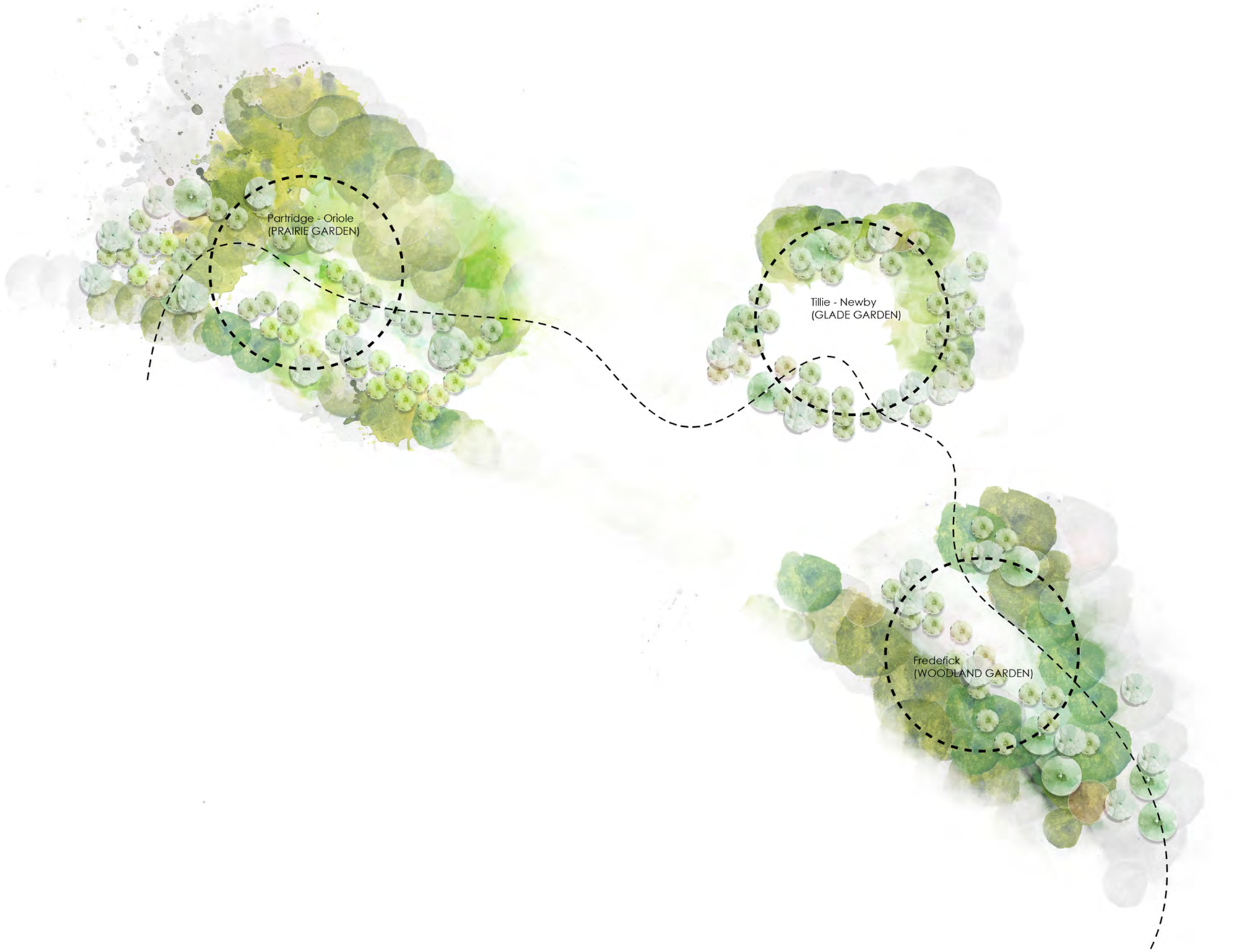

KEY PROJECT AREAS
1
2
3
4
Remnant Prairie
HOLY CROSS CHURCH
CALVARY CEMETERY
RAILROADS
DICKMAN PARK
MELROSE
GLADYS
ETON
GIESEKING
RIVERVIEW
PARTRIDGE AVE
ORIOLE AVE
SWITZER
GILMORE AVE
ROBIN AVE
PEGGY
LYNHAVEN
GIMBLIN
SELLS
NEWBY
GARTH
LYNFIELD
CHURCH
FREDERICK
BADEN
MURIEL
WALTER
BROADWAY
PELHAM
HALL
PARK
SUMMIT
DRURY
TARA
POINTE
VIVIAN
THRUSH
SAN JUAN
POUCE
CHRISTIAN
BLASE
FORDEY
EAST RAILROAD
FLORRISANT
1. Partridge - Oriole Basin
2. Tillie - Newby Basin
3. Frederick Basin
4. Daly International Property

LOCATION OF GARDENS



1.0 INTRODUCTION

1.1 Urban Vitality and Ecology Initiative

In 2014 the Urban Vitality and Ecology Initiative (UVEI) emerged as a collective effort between local environmental leaders, community-based organizations, and academic institutions to promote urban conservation and connect residents to urban nature in St. Louis. The UVEI was established in 2013 through a cooperative agreement between the City of St. Louis, the Missouri Department of Conservation (MDC), and the Missouri Botanical Garden (MBG), to achieve goals laid out in the City of St. Louis Sustainability Plan related to urban biodiversity conservation and urban green space enhancement.

From the beginning, partner engagement has been a key aspect of UVEI strategy. Realizing that many local organizations were already working on these issues, the UVEI sought to bring those organizations together to develop a coordinated strategy to achieve the greatest impact. In December, 2014, faculty at Washington University (WU) responded to the UVEI's request for interested research organizations to support long term monitoring and evaluation of urban biodiversity conservation, as well as to measure and assess the social and environmental effects of urban greening projects. In December 2014, UVEI leadership outlined three initial efforts that interested partners could become involved in:

1. A neighborhood-scale pilot project designed to test on-the-ground strategies to implement urban greening projects that meet triple-bottom-line objectives[1]
2. The St. Louis Butterfly project, or Milkweeds for Monarchs, which supports the creation of monarch butterfly conservation gardens throughout the City
3. Creation of an urban biodiversity inventory that would allow researchers and citizen-scientists to track urban biodiversity.

Over the next few months, interested WU faculty and staff held a series of meetings to determine how they could best align faculty expertise and interest with the needs of the UVEI. As a result, a multi-disciplinary research team came together to participate in the UVEI's pilot project.

1 "Triple bottom line" refers to framework to evaluate performance based on economic, social, and environmental objectives. This is in contrast to traditional evaluation frameworks, where decision-making is based on economic objectives.

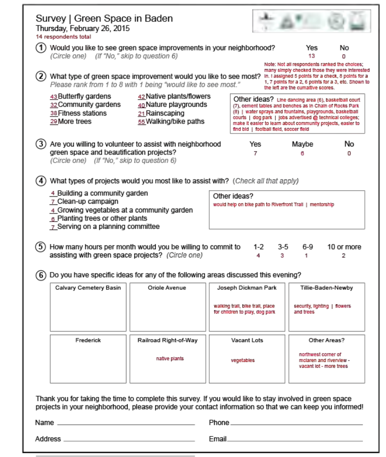
1.2 The UVEI Baden Pilot Project

The UVEI Baden Pilot Project was originally envisaged as a one-year project to quickly test an urban greenspace development strategy and to measure its impacts. In 2014 the UVEI identified nine areas throughout the City of St. Louis as potential pilot project areas (Fig.1.1). The Pilot Project Selection Criteria Table (Table 1.1) shows the priority objectives used to rank potential pilot sites. These selection criteria demonstrate the UVEI's mission to achieve social as well as environmental goals, and to reach underserved communities in particular in their efforts to rehabilitate neglected lands. Baden stood out from other potential sites because there was a near-term opportunity to become involved in enhancing the new greenspace that would be created as a result of a large buy-out by the Metropolitan St. Louis Sewer District (MSD), as well as the neighborhood's proximity to a singular ecological landmark: the Calvary Cemetery Remnant Prairie.[2]

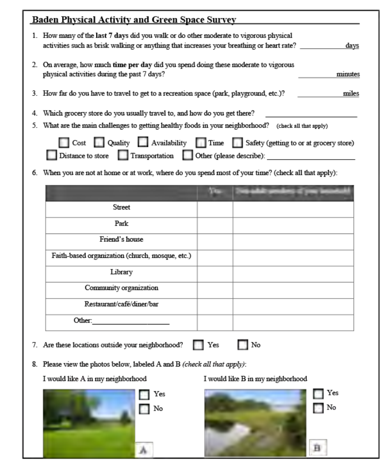
Fig 1.1. Urban Vitality & Ecology (UVE) initiative Pilot Project areas in the City of St. Louis

2 As the only piece of land in the City that has remained undeveloped since its settlement in 1764, the prairie remnant is an important piece of St. Louis' ecological heritage. Initially, highlighting its significance and finding opportunities to connect residents to this important ecological site was one of the key reasons Baden was selected as a pilot site.

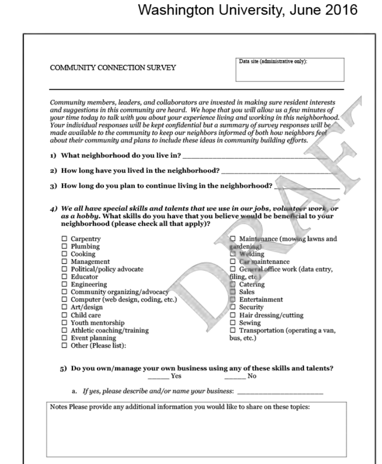
Table 1.1. The Public Health Survey


Survey | Green Space in Baden
Thursday, February 26, 2015

green space survey summary,
UVEI partners, February 28, 2015


Baden Physical Activity and Green Space Survey

physical activity and green space survey,
Brown School of Public Health,
Washington University, June 2016


COMMUNITY CONNECTION SURVEY

community connection survey,
Olin Business School,
Washington University, to come fall 2016

Thus, in 2014 an opportunity arose to create new greenspace in Baden to meet triple bottom line sustainability goals. From the outset, the UVEI was interested in working with the Metropolitan St Louis Sewer District (MSD) to enhance the engineering design of MSD stormwater detention facilities. These facilities are designed to protect against flooding and reduce overflow of the combined system during large storm events. (The sewer system challenges and resulting buy-out are described in more detail in 2.3 The Metropolitan St. Louis Sewer District.) Often, as in the case of Baden, detention sites are relatively large areas (over 5 acres) of urban greenspace. While current practice is to fence off detention sites and plant them with lawn grass, the opportunity exists to develop these areas as an ecologically rich community amenity.

In Baden, chronic basement backups led to an MSD buy-out of 102 properties in order to expand two existing detention facilitates and create a third. Because the buy-out area was within easy walking distance of an existing city park and across the railroad from the Calvary Cemetery Remnant Prairie, there was a clear opportunity to create a strategic and holistic plan to develop the site into a green network capable of meeting triple bottom line objectives.

The initial scope of the Baden Pilot Project was to:

1. Complete a comprehensive baseline assessment for the project area to allow for evaluation of project impact
2. Initiate modest near-term projects that engage the community and start a conversation about high quality green space
3. Continue to collaborate with community partners, MSD, and other stakeholders on longer-term design opportunities with future stormwater detention facilities in the neighborhood.

In 2015, WU became a partner in this pilot project. A full list of partners of the UVEI Baden Pilot Project is included below in Table 1.2.

Table 1.2. Partners of the UVEI Baden Pilot Project

Organization	Description	Key Team Members
Urban Vitality and Ecology Initiative (UVEI)	A collaboration between St. Louis leaders in environmental and planning agencies, including the City's Office of Sustainability, the Missouri Department of Conservation, and Missouri Botanical Garden. Their mission is to improve triple-bottom line sustainability in St. Louis City and better connect residents to urban nature. The Baden Pilot Project was the first of two pilot project currently being conducted by the UVEI.	*Core Team Members:* **Catherine Werner**, *Sustainability Director St. Louis City* **Rebecca Weaver**, *UVEI Coordinator* **Laura Schatzman**, *UVEI Landscape Architect* **Laura Gin,** *UVEI GIS Analyst* **Tracy Boaz**, *MDC Regional Supervisor* **Deb Frank**, *MoBot Vice President/Shaw Nature Reserve & Sustainability* **Sheila Voss,** *MoBot Vice President/Education* **Don Roe**, *Planning & Design Agency Director*
Metropolitan St. Louis Sewer District (MSD)	As part of their citywide efforts to reduce combined sewer overflow during storm events, and in response to chronic basement backups in the Baden neighborhood, MSD bought out over 80 homes in the neighborhood for the purpose of constructing 3 stormwater retention basins.	**Bruce Litzsinger,** *Engineering Dept-Planning Division* **Christine Palmer,** *Civil Engineer (Cityshed Mitigation Program specialist)* **Lance LaComb,** *Public Information Manager* **Gary Moore,** *Planning Program Manager* and *WU Adjunct Instructor*
Riverview West Florissant Development Corporation (RWFDC)	RWFDC helps to improve housing and quality of life in neighborhoods in the north corridor through programs such as a youth enrichment center and a summer beautification program.	**Toni Cousins,** *CEO* **Jan Quince**, *Administrative Assistant* **Detra Harris,** *BESC Program Director* **Ciera Cruesoe**, *BESC Program Assistant*
Revitalization of Baden Association (ROBA)	ROBA is a resident-led organization that formed in 2016. Their mission is to empower residents to address the challenges and needs of the community.	**Melton Henderson,** *President* **Starr Butler,** *Secretary*
Our Lady of the Holy Cross Church (OLHC)	OLHC is an historic church located in the center of the MSD buy-out area. OLHC leaders and parishioners have been actively engaged in UVEI efforts in Baden.	**Father Vince Nyman,** *Parish Pastor* **Lynda Brand,** *Parish Secretary*
City of St. Louis Board of Aldermen	The Board of Aldermen is the elected legislative body of the City of St. Louis. As representative of Ward 2, Alderwoman Flowers has been an active UVEI partner throughout the Baden Pilot Project.	**Dionne Flowers,** *Ward 2 Alderman*
City of St. Louis Neighborhood Stabilization Team	The mission of the Neighborhood Stabilization team is to empower residents to sustain a quality neighborhood environment. Neighborhood Improvement Specialists serve as the link between residents and the City, and are tasked with identifying and addressing physical and behavioral issues in their area.	**Barbara Graham,** Ward 2 Neighborhood Improvement Specialist
University of Missouri–St. Louis (UMSL)	In partnership with the UVEI, Prof. Andrew Hurley collected oral histories through his Place Stories Project from two UVEI pilot project sites, including Baden.	**Andrew Hurley,** Professor of History

1.3 WU Participation in the UVEI Baden Pilot Project

A cross-school team of environmentally focused faculty came together in 2015 to participate in the UVEI Baden Pilot Project. Specifically, WU's role in the UVEI Baden Pilot Project has included the following research: a baseline assessment of environmental conditions, including collecting and analyzing information on vegetation, soils, and mosquitoes; a neighborhood-wide public health survey to evaluate resident perceptions of walkability, greenspace, and physical activity levels; and design research to create the adaptive open space plan presented in this report.

WU work on these projects was advanced through several community-engaged problem-based courses, including: Prof. Rod Barnett's spring '16 graduate design studio, which developed concept designs for open space in Baden (see section 5.0); an Olin Business School Center for Experiential Learning (CEL) practicum team, supervised by Daniel Bentle and Prof. Glenn MacDonald, which augmented the design research by creating a tool to explore cost-references for key elements of the proposed open space strategy (see Section 6.0); Prof. Beth Martin's spring '16 Sustainability Exchange course, which began compiling data collected into a report of baseline data; Prof. Scott Krummenacher's Spring '16 Environmental Justice course, which inventoried and mapped existing community assets; and Prof. Amy Eyler's public health research undertaken with research assistant Nishita D'Souza.

WU collaborators, including faculty and staff researchers, instructors, and community engagement specialists, as well as graduate research assistants, are listed in Table 1.3.

This report does not provide a full account of WU research and involvement in the UVEI Baden Pilot Project. Rather, the adaptive open space strategy described here is a synthesis of this collective body of research, as well as on-going input from and engagement with project partners (Table 8.1).

Table 1.3. WU collaborators

Name	Title	School/Institute	Role in Project
David Fike	Director, Environmental Studies; Associate Professor, Earth & Planetary Sciences	Arts & Sciences	Researcher–environmental baseline: soil geochemistry (N, P, K, C)
Kim Medley	Director	Tyson Research Center	Researcher–environmental baseline: mosquitoes
Rod Barnett	Professor & Chair, Landscape Architecture	Sam Fox School of Design & Visual Arts	Studio instructor; Researcher–landscape architecture
Beth Martin	Senior Lecturer, Environmental Studies	Arts & Sciences	Instructor– Spring '16 Sustainability Exchange
Scott Krummenacher	Lecturer, Environmental Studies	Arts & Sciences	Instructor–Environmental Justice course; Advisor–political science
Daniel Giammar	Professor, Environmental, Energy, and Chemical Engineering	School of Engineering & Applied Science	Researcher–environmental baseline: soil geochemistry (metals)
Gary Moore	Adjunct Instructor, UMSL/WU Joint Undergraduate Engineering Program	School of Engineering & Applied Science	Instructor–spring '16 hydrology course
Eleanor Pardini	Assistant Director, Environmental Studies; Research Scientist & Lecturer, Biology	Arts & Sciences	Advisor–environmental baseline: vegetation survey
Amy Eyler	Assistant Dean for Public Health, Associate Professor	Brown School of Social Work and Public Health	Researcher–public health walkability survey
Rachel Folkerts	Research Assistant, ENST	Arts & Sciences	Project Manager & Research Assistant
Daniel Bentle	Assistant Director, Center for Experiential Learning	Olin School of Business	Instructor–fall '16 interdisciplinary practicum
Liz Kramer	Assistant Director, Office for Socially Engaged Practice	Sam Fox School of Design & Visual Arts,	Advisor–community engagement & partnerships
Nishita D'souza	MPH Candidate, Spring 2017	Brown School of Social Work and Public Health	Graduate Research Assistant–public health walkability survey
Jenni Harpring	Assistant Director for Civic Engagement	Gephardt Institute for Civic and Community Engagement	Advisor–community engagement & partnerships
Stefani Weeden-Smith	Assistant Director for Campus and Community Partnerships	Gephardt Institute for Civic and Community Engagement	Advisor–community engagement & partnerships
Barbara Levin	Program Coordinator, Alliance for Building Capacity	Brown School of Social Work and Public Health	Advisor–community engagement & partnerships
Micah Stanek	Lecturer, Landscape Architecture	Sam Fox School of Design & Visual Arts	Graduate Research Assistant–landscape architecture
Alisa Blatter	MLA Candidate, Spring 2017	Sam Fox School of Design & Visual Arts	Graduate Research Assistant–landscape architecture
Shuying Wu	MLA Candidate, Spring 2018	Sam Fox School of Design & Visual Arts	Graduate Research Assistant–landscape architecture

1.4 WU Funding Support

WU participation in the UVEI Baden Pilot Project was made possible by funding support from WU's School of Arts & Sciences, the International Center for Advanced Renewable Energy and Sustainability (I-CARES), the Ferguson Academic Seed Fund (FASF), and the Gephardt Institute for Civic Engagement.

Support from the FASF was crucial to the creation of the adaptive open space strategy presented here. In addition to supporting Prof. Barnett's design research, FASF funding made possible the Brown School neighborhood walkability survey and the creation of the CEL cost-reference tool.

1.5 Goals and Objectives: Landscape Design Research

While the details of the proposed adaptive Open Space Strategy will be described in Section 6, *The Research Proposal*, it will be useful to outline its primary components here.

We began this project with the *overall goal* to develop an open space plan that could ameliorate historic, inequitable spatial practices through the strategic creation of greenspace. We aimed to achieve this by:

1. developing design concepts for the future greenspace in Baden through Prof. Rod Barnett's spring '16 landscape architecture studio course; and
2. using those concepts as a starting point, create an implementable design and design recommendations.

In order to create a rigorous and implementable design, we sought out and synthesized perspectives from multiple stakeholders, including: MSD, the UVEI, and Baden residents and community leaders; as well as data and information from varied academic disciplines, including: ecology, soil science, political science, public health, business, and history. This report presents the information gathered through the design research process, as well as the resulting adaptive open space strategy.

1.6 Project Timeline

The overall approach had a three-phase modus operandi, aligning with the spring, summer and fall semesters of the contributing academic programs.

Phase One
Project scoping
Baseline data
Surveys
Community engagement

Phase Two
Landscape architecture studio with 6 MLA students:
Site and contextual analysis (hydrological, historical, ecological, demographic, circulatory)
System design
General open space plan
Basin design

Phase Three
Community workshop
Community feedback
Engage the Center for Experiential Learning
Survey results
Conceptual diagram
Open space plan: maps, diagrams, designs, renders
Documentation
Report

2.0 BACKGROUND

The adaptive open space plan presented in Section 6 is an attempt to apply the principles of ecological urbanism to the on-the-ground reality of Baden, and by doing so create an enduring community amenity. The opportunity for the UVEI, community stakeholders, and WU to rethink greenspace in Baden came about because of a large MSD buy-out in the neighborhood that began in 2014. Here, we begin untangling the complex conditions in Baden by outlining the reasons for MSD involvement in Baden, and taking a closer look at neighborhood and its present community.

2.1 The Metropolitan St. Louis Sewer District

2.1.1 The System

MSD's service area is large, encompassing approximately 525 square miles, including all 62 square miles of St. Louis City and 462 square miles (approximately 90%) of the County (Fig 2.1). In fact, this system is the 4th largest sewer system in the nation.[3] The current population served by MSD is approximately 1.3 million. One of the challenges facing the organization with respect to its green infrastructure ambitions is that for such a large system its budget is relatively small. MSD owns and operates the overall water management system, which consists of wastewater, stormwater and combined collection sewers, pumping stations, and wastewater treatment facilities in its service area[4]. It also currently owns and operates seven wastewater treatment facilities that serve the Mississippi River watershed. The Bissell Point plant in Baden is one of the two largest treatment facilities.

MSD provides its services within the three major watersheds located in the MSD's service area including the Mississippi River watershed, the Missouri River watershed and the Meramec River watershed (Fig 2.2). In addition, MSD provides a variety of other services, including sanitary sewer maintenance, stormwater sewer maintenance, and floodwater control.[5]

Sewers maintained by MSD range in age from less than a year old to more than 150 years old. Approximately, 524 miles are more than 80 years old and 311 miles are more than 120 years old. There are two types of sewer within MSD's service area: a sanitary sewer system and a combined sewer system (CCS). Sanitary sewers accommodate only household and industrial waste. Combined sewers carry sanitary waste as well as rainwater and surface water runoff.

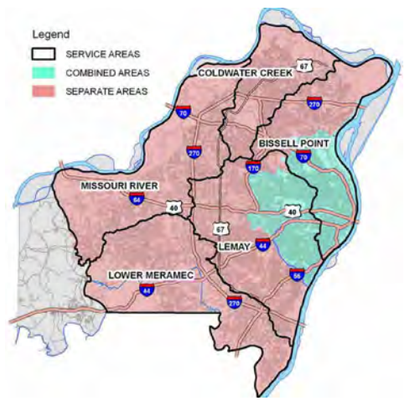


Fig 2.1. MSD's service areas

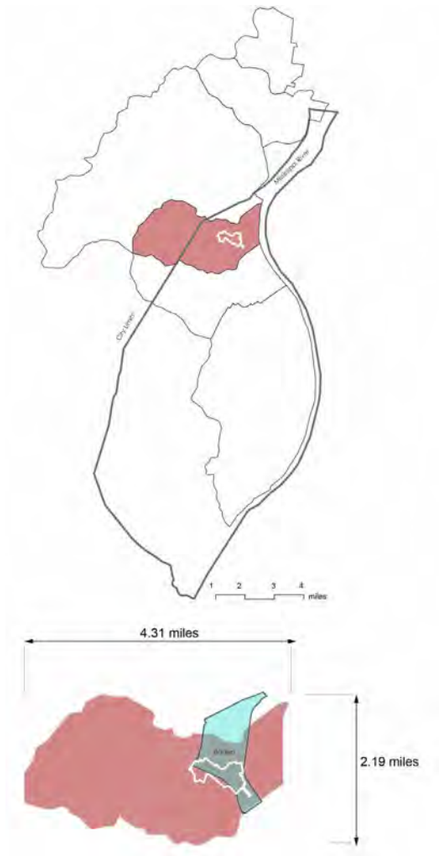


Fig 2.2. Baden watershed

3 http://www.stlmsd.com/sites/default/files/education/448849.PDF
4 http://www.stlmsd.com/what-we-do/stormwater-management/phase-ii-stormwater-management-plan
5 http://www.stlmsd.com/what-we-do/stormwater-management/phase-ii-stormwater-management-plan

2.1.2 Combined Sewer Overflow (CSO)

Normally, this system works well. Water from homes, businesses, industries, and streets drains into the vast underground network of pipes and travels to the treatment facilities. There, the water is cleaned and can be safely discharged into the Mississippi and its tributaries. During periods of heavy rainfall, however, more water enters the sewer system than the treatment facilities can handle, which causes water to backup throughout the sewer system. In the worst cases, that backed up wastewater ends up in people's basements and floods their streets. To help control this problem, sewer overflow points, or *combined sewer overflows (CSOs)* are built into the system. These act as pressure release valves, allowing water flooding the system to bypass water treatment facilities and exit the system quickly. While allowing water to discharge at overflow points does help prevent major sewage backup throughout the St. Louis area, the problem with having untreated sewage enter our rivers at overflow points is clear - it leads to significant downstream pollution.

This pollution problem is not unique to St. Louis. CSOs are common in the United States. According to the Environmental Protection Agency (EPA), 40 million people in over 860 communities are served by combined sewer systems and face challenges with CSOs.[6] That scale of wastewater discharge into our waterways poses a significant threat to public health. To address this widespread problem, the EPA has been working with municipalities and sewer districts for decades to control CSOs in communities throughout the US, including the St. Louis area. MSD is obligated to address the issues of CSOs in the Baden community.

In 2012, the Metropolitan St Louis Sewer District entered into a legal agreement with the EPA, the State of Missouri, and the Missouri Coalition of the Environment to address the wastewater discharge problem. The agreement requires that MSD spend $4.7 billion by 2035 to control wastewater discharge to the Mississippi and its tributaries. MSD is addressing the issue by removing overflow points from the separate sanitary sewer system. In the combined sewer system, it is not always possible to remove overflow points, but other methods of reducing overflow in the CSO are possible. Two of the methods that are most relevant to the situation in Baden are creating *detention basins*, and incorporating *green infrastructure*.

Detention basins, or holding ponds, reduce overflow within the sewer system by temporarily holding excess water during period of heavy rainfall. A detention basin is designed to hold large flows of water, particularly surface runoff from paved urban areas, for a short time and slowly release that water into the sewer system through an opening at the lowest point of the basin.

Green infrastructure is very different method of stormwater control than detention basins. While detention basins temporarily hold stormwater in a specific location and slowly release it into the sewer system, the goal of green infrastructure is to decrease the amount of rainfall entering the sewer system at many dispersed points, and thus reduce overall volume. Green infrastructure refers to a set of practices that include green roofs, collecting water in rainbarrels, disconnecting downspouts, porous pavements, and rain gardens. Both detention basins and green infrastructure are part of MSD's long-term plan to control CSO discharge and pollution in St. Louis.

2.1.3 MSD & Baden

Since its installation in the early 1900s, the brick-vaulted sewer system has backed effluent into the basements of houses during precipitation events that exceed five inches of rain. This situation has occurred more often than its designation as a 20-year storm event facility implies. This is why MSD recently bought 102 properties in the neighborhood and is currently demolishing them in a three-phase process. Once the land is cleared, MSD plans to construct three detention basins to mitigate basement backups in the neighborhood and flooding within the larger sewer system. The UVEI identified this as an opportunity to add social and environmental value to MSD's efforts by encouraging the creation of a greenspace that can manage stormwater, provide habitat for native plants and animals, and meet community needs and desires. Together with the residents and local leaders, the UVEI has begun the work.

The necessity of MSD's efforts to better manage stormwater is clear. Reducing CSO discharge will not only improve public health by reducing pollution into the Mississippi and its tributaries, but will also improve the long-term quality of life in Baden by reducing costly and unpleasant basement backups. Of course, every environmental management project occurs in a specific place with its own people, history, challenges, and opportunities.

6 https://www.epa.gov/npdes/combined-sewer-overflow-frequent-question

2.2 Baden

This culturally significant, structurally intact neighborhood is located between the Norfolk and Western Railway in the south and the Friedan Cemetery in the north (Fig 2.3). Its main street, Broadway, defines its western edge. Between Broadway and the Mississippi River, a once-thriving industrial zone remains along in the river flats. Baden grew up around the Wabash Railroad, which served the Midwest from Buffalo, NY to Kansas City, MO for over a hundred years beginning in the mid-nineteenth century. In 1876, when Baden became part of the City of St. Louis, there were about 400 people living there amongst stores, wagon shops, four schools, four churches, and a post office known as the Baden Station (Wayman 1978).

Baden is a small neighborhood; its residents live within a mile of each other, in houses mostly built in the early to mid-20th century. The range of housing types shows the influence of its early German settlers, particularly in the north of the neighborhood (Fig 2.4-2.7), and the more austere nature of the workers' housing in the lower-lying areas to the south. The Church of Our Lady of the Holy Cross, built in 1869, is perhaps the most iconic example of the beautiful German-style brickwork that residents take pride in to this day.

From the early 20th century through the 1980s, Baden was by all accounts a thriving community. In Lee Khroll's *Baden Remembered*, one resident describes growing up in mid-twentieth century Baden as "one of the greatest things that could happen to a person." Another recalls Baden as "heaven on Earth." For many in those days it was a lively, comfortable neighborhood (Groth 2011).

Children attended Baden School (or perhaps Ebenezer Lutheran School on Church Rd), families walked to the Baden Public Library in the weekends, and crowds gathered to watch local parades on Broadway. Those people who lived close to the railroad track also lived close to the Calvary Cemetery right across the rail corridor. Teenagers could cross the lines, moving along well-worn pathways through tangled trees and bushes. Some folk married in the Lutheran Church on Halls Ferry Rd, others in Our Lady of Mt Carmel.

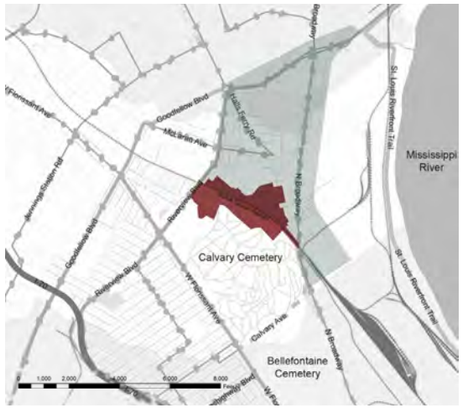


Fig 2.3. Main roads around Baden

Just a few decades ago, Baden was an extremely walkable community. In the mid-twentieth century, the district contained over 100 businesses within one square mile, many concentrated along Broadway.

Fig 2.4. Single storey family houses in N. Baden

Fig 2.5. Demolition process

Fig 2.6. Detention basin fence

Fig 2.7. Aride street

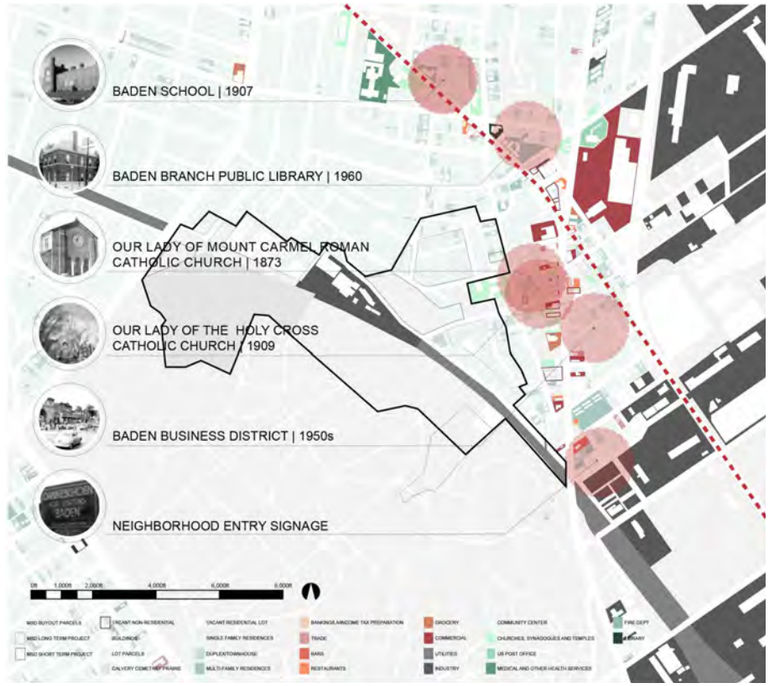


Fig 2.8. Anchor institutions around Baden

Parents could take their kids from church to Broadway for a soda at Deppies, and then home again. Families and friends could walk together to school, church, the library, the doctor's, the movies and stores, and perhaps to dinner at the Baden Hotel on Friday night. In the 1950s, Dickman Park, then located where the properties on Dickman Park Road are today, had two tennis courts, a swimming pool, a wading pool, and softball fields.

Recently, Baden has changed significantly. Between 1970 and 2010, the demographics of the neighborhood flipped from predominately white (98%) to predominately American American (92%) (Hurley History Packet). There are other significant statistics. In 2015, median household income in Baden was $30,298, which is 45% less than the citywide median income of 55,340.[7] In 2013, 60.9% of Baden residents had completed high school, compared to 88.7% of Missouri residents,[8] and 83.3% of St. Louis residents.[9] As of 2010, there were 2,831 occupied housing units in Baden (81% occupancy rate), and 617 vacant units. (While significant, the neighborhood's vacancy rate [17.9%] is somewhat lower than the citywide rate [19.3%].[10])

Today Broadway contains mostly boarded up buildings; where dozens of businesses once lined this street, currently eight businesses comprise the Baden Business Association. Dickman Park, now located next to Our Lady of the Holy Cross Church, is seen by the kids as a field and not a park. Many residents feel that their streets are no longer safe for children to roam and children are not seen sledding between the alleys on Sells and Newby, as they did in past times.[11] There are no longer secret spots for fishing in Calvary Cemetery, or an ice cream shop down the street to satisfy a sweet tooth on a hot summer day.

The demographic shift experienced in Baden, and the decline that followed, reflects larger trends within St. Louis and across the country. In *Mapping Decline: St. Louis and the Fate of the American City* (2008), Colin Gordon describes how decades of institutional racism, evidenced through local, state, and federal policies – and especially practices like residential security ratings within the realty industry – segregated

7 "Baden Neighborhood in St. Louis, Missouri (MO). Detailed Profile," accessed July 26, 2016, http://www.city-data.com/neighborhood/Baden-Saint-Louis-MO.html.
8 Ibid.
9 "St. Louis City, Missouri."
10 "Census Results." US Census Bureau, 2010. http://dynamic.stlouis-mo.gov/census/neighborhood.cfm?cyear=2010.
11 In the 2016 neighborhood walkability survey conducted by WU public health researchers, 39% of respondents indicated that they felt it was unsafe to walk in the neighborhood during the day; 71% of respondents indicated they felt it was unsafe to walk in the neighborhood at night (See section 4.2.2).

African Americans to the north side of St. Louis city and county and resulted in white flight from the city and into the suburbs.

The effects of these policies and practices continue to manifest visibly in 2017. All St. Louisans are familiar with the Delmar Divide: a visible line that separates the city into north and south, black and white. The built environment of North City – its streets, buildings, and parks – is unmistakably worse than that of South City. But the more important outcome is that the well-being of its residents is decidedly worse. The most significant indicator is not so much that residents of North St. Louis can expect to make less money than residents elsewhere, but that a child in Clayton can expect to live 18 years longer than a child born in the JeffVanderLou neighborhood in north St. Louis (Purnell, Camberos, and Fields 2015, 27). The zip code in which Baden lies–63147–has some of the worst health outcomes of any zip code in the St. Louis region.[12]

These facts illustrate only a few of the many profound effects that institutional racism continues to have on the St. Louis region. Fortunately, there does seem to be a silver lining. The research team has seen and heard hope from many of Baden's residents who have stayed, or moved in, for their love of their neighbors, or church, or the beautiful brick homes, and who still believe in the potential of the neighborhood to become a beloved place again. They have a conviction that the unhappy statistics presented above are not the end of the story. There is also a silver lining in the willingness the team has seen from many institutions and individuals – including the City of St. Louis, the Metropolitan St. Louis Sewer District, the Missouri Botanical Garden, the Missouri Department of Conservation, Washington University, Riverview West Florissant Development Corporation, Alderwoman Flowers, and Our Lady of the Holy Cross Church – to form partnerships and take collective action to change the story.

So far on-the-ground improvements have been modest, but nonetheless significant. In 2015, the Missouri Botanical Garden (MBG) and Riverview West Florissant Development Corporation (RWFDC), in partnership with the UVEI, created a community garden. MBG provided professional staff to organize and serve as a resource for local gardeners, as well as to train youth participating in STL Youth Jobs to work in the garden. Today that garden is thriving and residents are beginning to see it as a catalyst for change in their neighborhood. In 2016, Alderwoman Flowers led the installation of a walking trail around Dickman Park. In addition, leaders at Our Lady of the Holy Cross are working with UVEI partners to design and implement a landscape plan for the church grounds. Their goal is to create a community gathering space that combines cultural amenity and natural habitat.

Also in 2016, residents got together to form a neighborhood association, the Revitalization of Baden Association (ROBA), with support from the St. Louis Association of Community Organizations (SLACO). While still a very new organization, ROBA's members are dedicated to their mission is to empower residents to address the challenges and needs of the community. Baden is turning a corner. Its leaders are ready to reclaim its heritage and revitalize its buildings and landscape. And from what we have seen through this project, the many institutional partners involved in this effort are ready to help. The timely development of the adaptive open space plan reported in this document is will support that work.

2.3 Early Histories: the landscape

2.3.1 An Interzone

The landscape systems of Baden were - and continue to be - produced by environmental and social forces that came together and mixed into a unique physical condition (Schroeder 1997, 13). This condition still bears the characteristics of an interzone, an in-between ecology that ecologists call an ecotone - a transitional ecology consisting of features that are found wherever two or more ecosystems overlap. Geologically, the region was formed by an encounter between the uplifted Ozark dome and the Illinois basin (Schroeder 1997, 13). Biologically, it shares the tallgrass prairie ecosystem of the Great Plains to the west, and the deciduous forest biome that extends to the Appalachians in the east (Ladd 2016). Hydrologically, the St. Louis area is bound together by the great river systems of the Missouri, the Mississippi and Illinois Rivers.

2.3.2 Geological

Three hundred million years ago the region was covered with a vast ocean, evidenced by the limestone and dolomite deposits that form the bedrock of St. Louis, including the Baden area. The City of St. Louis was founded on a plain between the Ozarks to the southwest and the Illinois Basin to the east. The Ozark dome consists of Precambrian rock structures dated at 1.5 billion years. They were full of useful metals and early industrialists took great advantage of these. The Illinois plains however, are covered with wind-borne loess, providing the fertile agricultural soils, on top of Paleozoic fossil fuel-bearing rocks that have been used since the founding of St. Louis to provide energy to power the city. Between these two ancient formations runs the Mississippi River, bestowing plentiful (if muddy) water and transportation links to the wider world. The limestone and dolomite that the city stood upon enabled building and roadworks, and the shales and clays interbedded within them gave the city the bricks from which most of its buildings were constructed (Schroeder 1997, 15–17). The gateway to the west was self-sufficient, because of this geological condition.

A critical intervention in the evolution of Missouri's natural landscape system was the advent (during the last one million years) of vast "continental glaciers that overrode the region and utterly transformed it" (Schroeder 1997, 20). Ice borne material from the north was deposited across the region and smoothed out the contours of the landscape. As they retreated, the glaciers created a fluvial terrain of meltwater lakes and rivers that cut into the deposited surface materials and carried silt into lowlands and across the wide riverflats formed by fluctuation in river stages.

The sinkholes, underground cave systems and general karst formations that are found often with dolomites and limestones, however, caused hydrological headaches for the city's administrators: "a landscape blocked with stagnant ponds created drainage problems that only a system of sewers could solve" (Corbett 1997, 107). From the 1830s well into the 20th century St. Louis' municipal drainage engineers tried to install a drainage system adequate to a city whose population growth and concomitant physical expansion continuously outstripped the financial means to pay for carrying its waste and stormwater into the Mississippi River. Fifty years of experimentation with sewerage technology (including where, how and at whose cost) finally issued in the type of combined sewer and waste water system that was installed in Baden in the second decade of the 20th century. As in Baden, most of the trunk sewers were laid along the beds of existing natural waterways, and the lateral sewers that fed into the trunks were where citizens crammed detritus of all sorts (Corbett 1997, 116). It was not until 1970 that the MSD (created in 1954) opened the first of two major water treatment plants that would clean the sanitary and toxic waste from water before it entered the Mississippi. This, the Bissel Point Wastewater Treatment Plant, is located 3.5 miles southwest of Baden, and the trunk sewer constructed in the Baden subwatershed feeds directly to it. The trunk was built to solve the waste-dumping that locals enjoined because there was no other way to get rid of it. Thus, the problems experienced throughout the 1900s by the people of central, south and west St. Louis city - basement backups and street flooding - were brought to Baden (see Section 3.3). The state-of-the-art, 15 ft vaulted brick sewer installed on the bed of Gingrass Creek simply could not cope (Fig 2.9).

Fig 2.9. Vaulted brick sewer arch

2.3.3 Tallgrass Prairies

The new landscape left after the glacial retreats supported a different kind of biota and new natural plant communities (Ladd 2009, 48). These biota co-evolved with humans. Thousands of years of "deliberate wildland aboriginal ignitions ... resulted in the contemporary matrix of fire-dependent natural communities," especially the tallgrass prairie systems and deciduous woodlands, glades and savannahs. Eventually the central tallgrass prairie eco-region spanned 110,000 miles and six states. The approximately one thousand species of prairie plants' deep roots channeled water deep into the soil where it was held, rather than shedding or discharging it surficially, making this biotic system, with its faunal communities, a particularly appropriate model for urban ecological refurbishment, such as that recommended in this report for the Baden neighborhood. The remnant prairie mentioned earlier - the last in St. Louis - is located right across the railroad tracks from the Baden site (Fig 2.10).

12 https://www.stlouis-mo.gov/government/departments/health/documents/upload/City-of-St-Louis-Community-Health-Assessment-2012-3-2.pdf, pp 29-33

Fig 2.10. Remnant prairie in Calvary Cemetery

2.3.4 Indigenous Settlements

The Cahokians

Drained by the Mississippi and Missouri Rivers the tallgrass prairies supported a huge variety of species from large mammals (primarily bison) to wild onions (Ladd, D. 2009: 47-58), amongst which dwelled the tribes of the Mississippian Indian complex of societies that took advantage of the rich biodiversity. The Cahokian people were part of the Mississippian culture. No doubt the site attracted the Cahokians because of its location in the marshy Mississippi river flats where the soil was high in nutrients ideal for cropping, and the bluffs were covered with bottomland forest vegetation. The Cahokians established a sophisticated network of settlements that thrived through the practices of agriculture and supplementary hunting. The most tangible evidence of their existence is the mounds that they built throughout the landscapes of what are now St. Louis and East St. Louis, on both sides of the Mississippi River. The region was occupied by these people for around 500 years.

The Missouria

Prior to the founding of St. Louis in 1764, a number of Indian tribes were settled, in a semi-sedentary fashion, along the south bank of the Missouri River. The Missouria, Osage, Ioway and Otoe tribes were part of a larger culture group, the Oneata, that, having developed independently from woodland cultures in the upper Midwest around 1000AD, were contemporaneous with the Mississippian culture that gathered around the Cahokia sites (Dickey 2011). At the time of the founding of St. Louis, one group, the Missouria ("the people of the river's mouth"[13]), hunted and roamed across the lands on both sides of the Missouri from the river's mouth on the Mississippi right across to the foothills of the Rocky Mountains. This vast area is regarded by ecologists today as a transition zone where eastern forests merged with western prairies. The rivers and their tributaries were a mosaic of bottomland forest, wet prairies and marshland (Hurley 1997).

2.3.5 The European Advent

Beyond this zone, in "extensive meadows full of buffaloes"[14] the Missouria hunted "wild cattle", or bison, in the summer (after planting their corn in the fertile river flats in spring). When the French entered their territory and began trading furs, and building settlements such as Sainte Genevieve on the western banks of the Mississippi, the Missouria were eager to enter into reciprocal relations (Dickey 2011). In 1777 the Osage and Missouria accounted for nearly 60% of the profits of the St. Louis fur trade, having produced eighty packs of tanned deer skins, one pack of beaver pelts, and two packs of bear skins. But the complicated interactions with the French, the British and the Spanish ended in disaster for the Missourians and their life amongst the species of their edge condition ended quickly[15]. Around 1700AD the Missouria numbered somewhere between 7,000 and 10,000 individuals. This population began declining precipitously after contact with Europeans for the usual reasons - small pox, influenza, cholera - and by 1771 the number of Missourians had dropped to about 1,000. By 1804 fewer that 400 remained. The last full-blooded Missourian Indian is said to have died on the Otoe Reservation in Oklahoma in 1907. Some members of the Otoe-Missouria community of Red Rock, Oklahoma, continue to identify their lineage as Missouria (Dickey 2011).

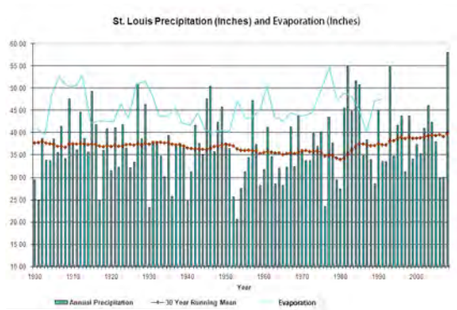
In the early 18th century French trading companies built trading towns along the Mississippi in the central basin, to support the fur trade that was developing, thus linking the Missouri Indians with upper class milliners in the cities of Europe. St. Louis was founded and settled by Auguste Chouteau, who laid out a grid street plan and a market area. Farming and trading were the commercial backbone of early St. Louis and, after the British defeat in the revolutionary war, more French creoles moved in. The population expanded to towns such as St Charles and Florissant, near the area that was eventually to become Baden. By 1800 most of St. Louis' population lived outside the village itself.

2.3.6 The Nineteenth Century

After the Louisiana Purchase (1804) and, particularly pursuant upon the war of 1812, the growing population required more and more land, and the satellite towns continued to spring up. In 1837 German immigrants settled in an area along the route between St. Louis and San Carlos el Principe, the old Spanish Fort at the mouth of the Missouri River, taking advantage of the well-traveled route to establish businesses. Known initially as Germantown, the settlement was incorporated into St. Louis City in 1874. But there was a local African-American population, whose children were served by the Aldridge School, also known as Colored School #11. Although described at first by settlers as "that swampland at the foot of the river bluff," Germantown developed quickly into farms and vineyards, with the immigrant community taking advantage of the fertile soils, plentiful water, and strategic location on the causeway to the northern districts. The 19th century saw the development of three cemeteries, two of which (Calvary and Bellefontaine) were designed according to the latest extramural cemetery principles, based on the English landscape style, with internal roads, tree farms and gravesite alignments all following the natural contours of the grounds.

In 1869 the cornerstone was laid (of local dolomite) for Our Lady of the Holy Cross; the church was finished in 1876, constructed entirely of bricks fired from the clay soils found in abundance in the limestone fields on which Baden was laid out. A new waterworks was developed at Bissell Point in 1871, on the site of the current treatment station, to deliver water to the city. Also constructed of local stone and brick, the Bissell Point Plant was a coal-burning, steam powered pumping station that was soon superseded by the Chain of Rocks plant that opened in 1887, immediately joined by another "high service" finishing plant nearby. The Baden area was growing. Industrial plants such as the St. Louis Car Company and the Gast Brewery provided employment, and Broadway developed into a busy commercial center. By the turn of the 19th century, with its library, industry, gas service, and granite-paved mainstreet, Baden was heading towards its prime. This moment came, for many, when the Broadway Business District listed over 100 businesses in the Holy Cross 75th Anniversary Magazine that was published in 1947.

Table 2.1. Precipitation in St. Louis approximately equal to the combined evaporation from the surface and from the vegetation



2.4. Timeline

See Table 2.2 on pages 17 and 18 for a Timeline that places Baden within its deep histories.

2.5 Existing Hydrology

Rainfall in the St. Louis area averaged 37.89 inches per year over the period from 1870 to 2015, although in more recent years the average has been 41 inches. (Despite seasonal rainfall being greatest in early summer, overall precipitation in St. Louis is approximately equal to the combined evaporation from the surface and evapotranspiration from vegetation (Table 2.1). The Baden sub-watershed spreads across the boundary of North St. Louis and St. Louis County (Fig 2.11). At over 4,000 acres it encompasses sections of several adjoining city neighborhoods. The project area is located at the bottom of this sub-watershed, which bottlenecks at the eastern end where the original natural waterway, Gingrass Creek, came together with another historical stream on the path to the Mississippi River. MSD's stormwater system is predicated on this natural hydrological pattern (Fig 2.12).

The Baden neighborhood is located approximately one mile from the Mississippi River. Historically, the neighborhood was drained mainly by Gingrass Creek (Fig 2.13), which ran along its southern border. When the sewer system was constructed along the creek bed to transport sewerage and stormwater to the Mississippi River in the early 1900s, the stream was incorporated into the combined system. Houses built on the natural flood plain of Gingrass Creek became susceptible to localized overflow from the combined sewer system (CSS) during periods of heavy rainfall (Miller et al.). The lowest points in the Baden

Fig 2.11. Baden sub-watershed spreads across the boundary of North St. Louis and St. Louis County

13 Sometimes Missouria is translated as "the peoples of the dugout canoes."
14 A description of the lands between the Missouri and Mississippi Rivers from a "Map of the British and French Dominions in North America" by John Mitchell of London, England, (1755).
15 Among the species present to the Missourians in the 18th century were cottonwoods, elms, hackberries, sycamores, silver maples, pecans, woodpeckers, trumpeter swans, sandhill cranes, ruffed grouse, passenger pigeons, bald eagles Carolina parakeets, prairie chickens, bobwhite quail, beavers, otters, minks, muskrats, turtles, frogs, mussels, fish, bulrushes, horsetail, cattails, water lilies, bluestem prairie grass, turkeys, black bear, deer, elk, mountain lions, gray wolves and bobcats.

Table 2.2. Baden timeline

MILLIONS OF YEARS					
-4500	-500	-60	-2	0	+?
PRECAMBIAN	PHANEROZOIC	CEROZOIC	QUATERNARY	ANTHROPOCENE	
volcanic mountains occur and erosion continues	shallow seas deposit sediments region covered by vast ocean		glaciation occurs; shale, limestone dolomite, sandstone form humans appear	global geological and biophysical patterns influenced by human activity	

-12,000	**HOLOCENE** Boreal forest Human settlement; game hunting		**SETTLEMENT** 1600 – 1900		**GROWTH** 1900 - 2017
-12,00 to -800	Temperate deciduous forest Multiple human settlements Widespread use of fire	1600s	French settlement of the area around St Louis Smallpox and infectious diseases reduce Indian population	1902 1907 1908	Missouri Portland Cement Company Baden Public School Gas service installed
-8,500 to -4,500	Grasslands expand Wetlands are displaced	1670	Indians trading with French	1910	Broadway paved with granite setts
-4,000 to -1,000	Groundwater levels increase Indians become sedentary hunter-gatherers Plants are domesticated Increased use of fire Bottomlands cleared	1763 1764 1767 1768 1770 1780 1798	Pierre Laclede lands near what is now Walnut St Settlers begin to locate in St Louis St Louis founded as a trading post, laid out by Chouteau Spanish obtain dominion. Population: 300 Common fields begin to be established Indians attack St Louis Population St Louis: 500	1915 1928 1930 1931 1938 1939 1947 1960 1968 1970 1994	Sewer system installed Chain of Rocks Filter Plant Public Library established Holy Cross School Baden Chamber of Commerce Dickman Park 100 business listed in 75th anniversary magazine David Hickey park Baden pumping station phased out Bethlehem Cemetery relocated White flight RWFDC established
-1,000 to 200	Sedentary agriculture Large villages Field clearing, deforestation Missouri landscape becomes a mosaic of ancient natural systems and new ecosystems responding to agriculture, hunting, building of shelters	1804 1818 1821 1833 1835	Louisiana Purchase; Lewis and Clark Expedition US Surveys of Baden-Riverview Missouri admitted to the Union German settlement of Baden City acquires waterworks		
1,000	Corn agriculture widely established Wooden houses Bottomland systems become patchwork of forests and fields	1849 1851 1854 1855 1862	Indian tribes sign treaties and cede their lands to the State Bellefontaine Cemetery Bethlehem Cemetery Calvary Cemetery North Missouri Railroad built through Baden	2003 2015	Detention basin construction at Partridge-Oriole Community Gardens Demolition of houses for detention basin installation
1500	Descendants of MIssouria tribes migrate from northern great lakes	1869 1872 1876 1878 1888 1898	Friedan's Cemetery Cornerstone laid for Holy Cross Roman Catholic Church First Protestant Church: Ebenezer Lutheran Irish Church: Our Lady Of Carmel Our Lady of the Holy Cross Population of Baden: 400 Baden becomes part of St Louis Aldridge School New waterworks at Baden (Chain of Rocks) St Louis Car Company moves to Baden	2016	ROBA formed UVEI / WashU / MSD Project

neighborhood are shown in Fig 2.12. They occur along the historic streamway.

The Baden neighborhood sub-watershed nowadays drains runoff from the impermeable surfaces of a suburb developed in the early 20th century. This surface water discharges into the CSS that runs along the old bed of Gingrass Creek. In times of normal precipitation (Fig 2.14) the CSS removes water to the wastewater treatment facility at Bissell Point prior to discharging it into the Mississippi River. In periods of moderate to high rainfall, the overflow bypasses the treatment facility and is discharged straight into the Mississippi River. If the level of the Mississippi is higher than the discharge outfall pipe the water backs up the system and floods the basements of houses in the low-lying areas of the Baden neighborhood.

2.5.1 Basin Catchment

The basins to be designed by the MSD will be located along the Gingrass Creek path (Fig 2.12). They are calibrated to mitigate flooding to the 100-year storm event level. The MSD proposal currently calls for three basins surrounded by safety fences (Fig 2.17). The first basin is located at the end of Oriole St, between Partridge Avenue and Gilmore. It is referred to in this report as the Partridge Basin. The second basin is proposed for the area between Frederick and Newby Streets crossed by Tillie Avenue. It is referred to as the Tillie Basin. The third basin will be located on either side of Frederick Avenue (which will be removed) south of Bittner. This basin is known as the Frederick Basin. (Fig 2.17).

Within the Baden sub-watershed there are five MSD catchment areas. Stormwater within each catchment area will be diverted to the three basins. The total catchment area (pervious and impervious surfaces) available to the basin areas within the constraints of existing trunk lines is 203 acres (Fig 2.15). The 102 residential parcels bought by MSD for basin construction constitute a significant ratio of the residential density in the southern portion of the neighborhood (Fig 2.16). The table below shows the percentage and size of pervious surfaces that could direct water to the basins (these being surfaces that permit water to soak into the ground and travel down hill to the basins, such as lawns and gardens).

Fig 2.12. MSD's stormwater system is predicated on the natural hydrological pattern

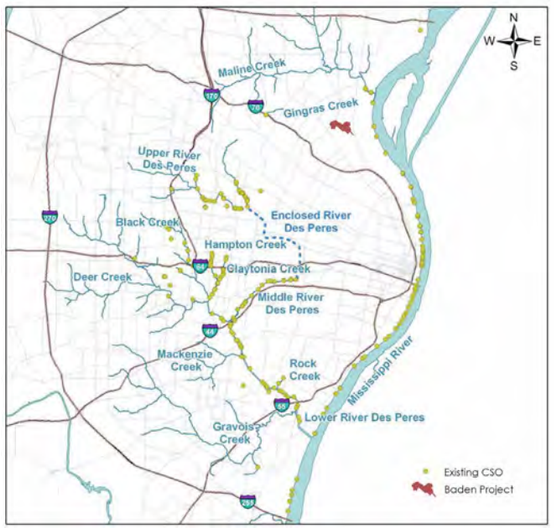


Fig 2.13. Location of CSOs in St. Louis

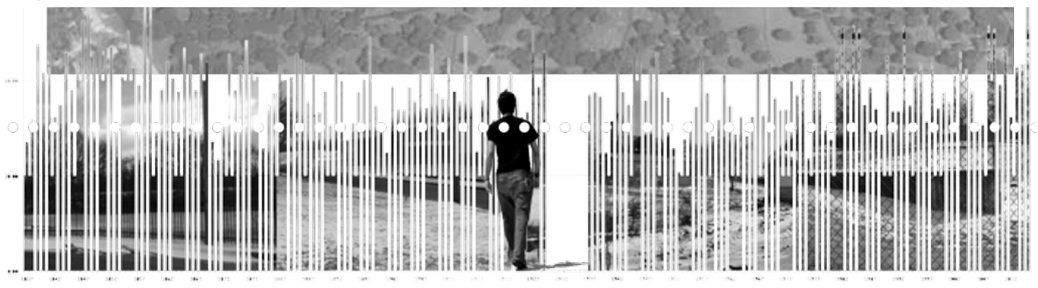


Fig 2.14. Actual annual precipitation in St. Louis, 1837-2015 (average shown as dotted line)

Fig 2.15. Combined stormwater and sanitary system

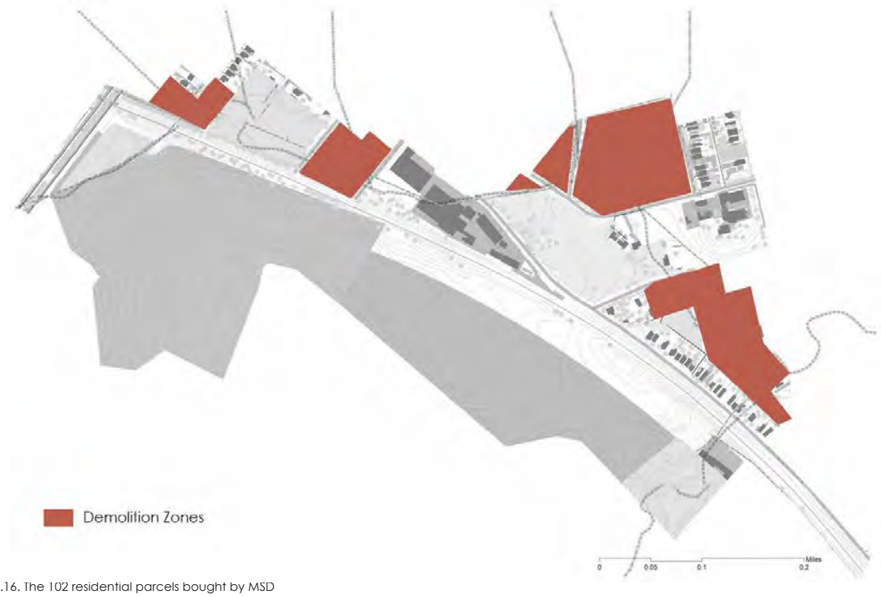


Fig 2.16. The 102 residential parcels bought by MSD

Table 2.3. Pervious acres of catchment for basin water

	catchment code	size of catchment	% of pervious	no. pervious acres
1	14F2-086C	60 acres	47.2%	28.32
2	14F3-082C	92 acres	54.68%	50.3
3	14F2-086C	13 acres	47.21%	6.13
4	14F2-110C	25 acres	59.5%	14.9
5	14F3-079C	13 acres	63.2%	8.2
TOTAL pervious acres of catchment for basin water capture				107.85

Existing basins

Future basins

1. Calvary Cemetery (North) Basin
2. Will be excess / vacant property
3. Oriole Ave detention basin site
4. Will be excess / vacant property
5. Will be excess / vacant property
6. FutureTillie - Baden - Newby detention basin site
7. Futher Frederick St detention basin site
8. Future Calvary Cemetery (South) detention basin site

Fig 2.17. Existing basins and future retention basin sites

Fig 2.18. MSD demolition package (by 12.31.16)

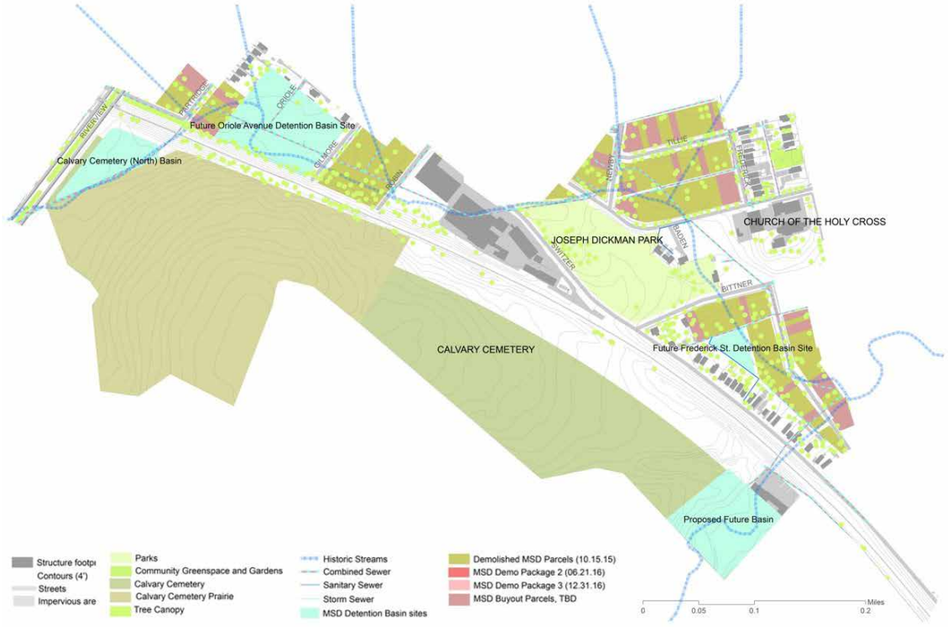


Fig 2.19. Demolition in progress

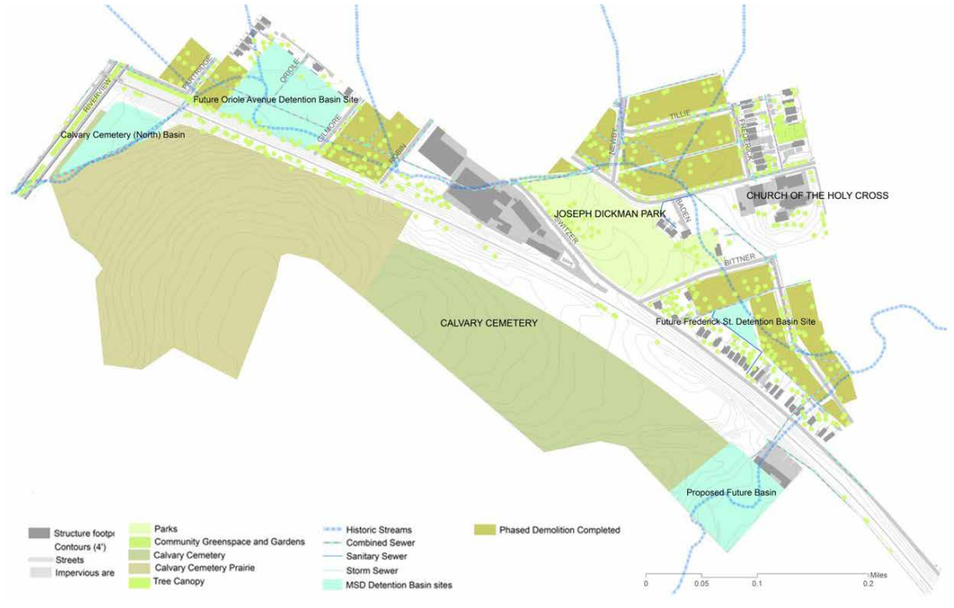


Fig 2.20. Demolition completed

Fig 2.21. Extended site condition

2.6 Site Description

2.6.1 Extent and Assets

The site identified in this report as the location of the UVEI Baden Pilot Project is a 90 acre tract bounded to the west by Riverview Boulevard, to the north by Baden Ave, Newby and Garth Streets, to the east by Church St and to the south by the Norfolk and Western Railroad, which runs between the study site and Calvary Cemetery (Fig 2.22). This terrain, defined largely by the MSD buy-out area, incorporates the three proposed MSD basins, Dickman Park, land belonging to the Church of Our Lady of the Holy Cross, and parcels owned by the Land Reutilization Authority (LRA). Additionally, a light industrial area adjacent to the railroad on Switzer is owned and occupied by Daley International and JRC. The map series (Fig 2.18, 2.19, 2.20, 2.21) shows the MSD basins, the phasing of the MSD buy-outs and demolition process and parcels owned by the LRA.[16]

The study site is in the Baden neighborhood. This neighborhood, one of the northernmost communities of St. Louis, is 1.06 miles in extent. Its boundaries are defined as the City Limits to Maline Creek in the north, Hall St at the east, southward along Hall St to Calvary Ave to Broadway Ave, northward on Broadway to the railroad, northward along the railroad to Riverview Blvd in the west, and then north along this boulevard to City Limits ("City of St. Louis Neighborhoods" 2010)> Key neighborhood assets and institutions include two city parks (Joseph Dickman and Hickey Park), and Herzog and Nance Elementary Schools. A middle school and a public high school are located outside the boundaries of the neighborhood. Yeatman Liddell Middle School is in nearby O'Fallon neighborhood, and the high school - Northwest Academy of Law - is in adjacent Walnut Park[17]. Other institutions are the Baden branch of the St. Louis Public Library and several churches. Of these Our Lady of the Holy Cross Catholic Church is within the project study area, next to Dickman Park.

Among the non-physical assets of the Baden community, the Riverview-West Florissant Development Corporation (RWFDC) is a non-profit organization that undertakes community development activities that include the provision of affordable housing, neighborhood improvement, and economic development. As such, the RWFDC is a critical partner of the UVEI Baden Pilot Project. Additionally, the recently-

Fig 2.22. Baden neighborhood footprint and transit systems

formed Revitalization of Baden Association (ROBA) has rapidly become a key player in the enrichment of the Baden community and a vital partner of the UVEI Baden Pilot Project. These organizations have been involved in several redevelopment efforts in the neighborhood, including the streetscape planned for Broadway, a remarkably well-preserved early-to mid-20th century urban corridor and the main business street of Baden (Cohen et al 2016: 9).

2.6.2 Biophysical Features

Understanding the existing conditions in a particular district or neighborhood is critical for its development as a resilient urban environment. Urban biodiversity depends in large part on the interactions between native plant species, and between these plants and insect, animal and bird species. All these plants and creatures derive their health and vigor from their interactions and they are all dependent on the geological and hydrological systems that sustain them. Analyses and surveys are therefore conducted to find out what existing conditions can enable ecosystem performance, and what challenges and impediments there are to environmental health and performativity. A team of Washington University researchers and students collected and analyzed a range of baseline information on environmental characteristics, including soil, vegetation, and mosquito surveys within the neighborhood. That data has been compiled and made available to partners through *the Baden Pilot Project: Baseline Report on Environmental Conditions*.

16 The LRA receives title to all tax delinquent properties not sold at sale, and also receives title to properties through donations. The St. Louis Development Corporation maintains, markets and sells these properties, thus making them available for future development (St. Louis MO Gov 2017).
17 The St. Louis Public School System contains many public charter and magnet schools and students may open-enroll to school outside of their neighborhood. While these are the closest schools to Baden, many students–particularly middle and high school students–attend other area schools.

2.6.3 Geology and Soils

a) Regional Geology

The city of St. Louis is situated on the eastern border of Missouri, 385-614 feet above mean sea level (USGS 2016). Three hundred thousand years ago, in the Illinoian period, the region was partially covered by glacial lobes extending on a North-South Line from the northern tip of St. Louis (ewgateway.org 2015). The melting of these glaciers flooded the area that is now North St. Louis County (see Section 3.2.2).

b) Site Geology

The surficial material of Baden consists of residuum from cherty limestone (clay and gravel) and can be up to 50 feet thick (DNR 2002). The Baden neighborhood is mostly underlain by the Pennsylvanian aged Desmoinesian Series, including the Cherokee Group and the Marmaton Group (Brill 1991). A thick succession of Paleozoic limestones and dolomites forms the bedrock of areas that are not underlain by the Pennsylvanian series. The limestones can lie at a depth of about 100 feet below the ground's surface (USACE 2005, 2.9–2.10).

c) Soils

The topography of Baden is rolling upland terrain featuring low hills made up of soils mainly of the Urban Land-Harvester-Fishpot association (USDA 1982). They are typically dark grayish brown, and consist of a friable silt loam layer about 1-inch-thick over 47 inches of multicolored silt loam fill material. These soils are nearly level to moderately steep and somewhat poorly drained on uplands, terraces, and bottomlands with high runoff potential. Because soils in association have high shrink-swell potential and tend to hold moisture well, they are subject to short-duration flooding and poor surface drainage. A soil association is made up of adjacent soils that have a proportional pattern. It usually consists of one major soil and at least one minor soil, and is named for the major soil. This association also makes up the majority of the city of St. Louis.

d) Hydrogeology

According to The Missouri Geological Survey's Water Resources Report (Miller et al 1974), Baden lies above the Group 1 (Post-Maquoketa) Aquifer. The upper boundary of Group 1 consists of Pennsylvanian rocks that are fairly impermeable. Since Group 1 contains the bedrock units above the Maquoketa Shale, it is very possible that these units behaved like a confining bed which would ultimately slow down the flow of water in and out of the aquifer. Baden is situated above an aquifer that is not favorable for the development of high-yield wells in bedrock aquifers because of the low yield of water to wells in this area (Miller et al 1974).

Summary of Key Biophysical Factors for the Baden Design

Despite its location in a normally porous karst field, the Baden site does not drain well, owing to a combination of two critical factors, the clay soils, and underlying bedrock. However, the receding glaciers left a friable layer of silt loam that, while not thick, is very fertile. The topography is characterized by shallow gradients that encourage the pooling of water, and the whole terrain lends itself to a design that acknowledges and expresses this underlying condition.

2.6.4 Vegetation

Dr Eleanor Pardini and Rachael Folkerts conducted two plant surveys within the project site, in order (a) to establish a baseline for native plant species that could flourish in the area, and (b) to identify invasive species that might mitigate against the establishment of a high-performance ecosystem.

Survey One

This was undertaken in the summer of 2015 along the railroad corridor by means of two 100m transects measured along both sides. The rail corridor was selected for investigation because it serves as a boundary between the neighborhood and the Calvary Cemetery. At the northwestern extremity of the cemetery, just across the railroad and adjacent to the study site, a remnant of pre-settlement prairie is preserved. This could be an important source of seeds for the establishment of native grasses in the project area. In addition, rail corridors themselves are effective instruments for the dispersal of seeds, both native and exotic. A presence/absence survey was conducted by Washington University personnel, assisted by high school students who worked in the Community Garden at that time. Fifty-six unique plants were identified, 49 to the species level, and 6 to the genus level only.[18]

18 See the WU Baseline Report (2017)

Survey Two

A second survey was conducted in the summer of 2016 in Dickman Park and in two adjacent vacant properties, one of which is owned by the LRA and one by the MSD. The survey was undertaken by WU personnel and high school students participating in the Shaw Institute for Field Training. Dickman Park was selected because of its strategic location in the study area, and the adjacent sites contained additional plant species not present in the park. The field team measured transects in three plots in Dickman Park and in one plot in each of the adjacent lots. In Dickman Park 15 unique plant species were identified, 11 to species level and 5 to genus level. In the LRA-owned plot 14 unique plants were identified, 10 to species and 4 to genus level. In the MSD-owned lot 25 unique plants were identified, 17 to species level and 8 to genus level.

The results of the vegetation survey showed that of 85 unique plants identified, six were common to each of the locations. While all of these species are exotic/introduced, none of them are considered invasive. The highest percentage of native plant species (50-53.6%) was found along the railroad corridor, while the highest percentage of introduced or exotic plants was found in the LRA-owned property on Bittner St. The Missouri Botanical Garden publishes a list of invasive plant species in the greater St. Louis region. Two species that appear on this list were found along the railroad: *Lonicera mackii* (bush honeysuckle) and *Lonicera japonica* (Japanese honeysuckle). The majority of the plants identified in all locations surveyed were forbs, herbs and grasses.[19]

2.7 Mosquitoes

Members of the Baden Community have communicated their concern that the introduction of basins and ponds in their neighborhood would promote mosquito activity. Accordingly a mosquito survey was conducted to determine the presence of mosquitos in the study area. Eggs were collected over a 2-week period in the summer of 2015, and transported to the Tyson Research Center where they were reared into adulthood and identified. This study indicated a dominance of the invasive *Aedes albopictus* (Asian tiger mosquito).

2.8 Soil Geochemistry

In urban settings, soil geochemical and physical properties are typically highly spatially variable due to complex landuse histories. Often, native soils have been disturbed (graded, moved, mixed with non-native soils, and/or compacted) by construction activities (NSCEP 2011). Because of this pattern of movement and alteration such soils are often broadly characterized as degraded and poor quality.

Moreover, many urban soils are known to be contaminated with pollutants, typically from heavy metals and persistent organic compounds (Kumar and Hundal 2016: 2). This contamination usually results from historic land-use, such as the application of lead paint or the previous presence of automotive services on a parcel, and/or air deposition from nearby industrial sites. When repurposing vacant greenspace, special attention should be paid to soil quality to assure that its proposed use is appropriate, given its potential contamination characteristics. Because of the generally low quality of urban soils, the EPA and other agencies recommend testing soil to evaluate suitability for urban agriculture and/or green infrastructure, before redevelopment projects begin (EPA 2011).

Samples were extracted from the top 10 centimeters of soil, packed in ice and sent to various labs for analysis. The first set of tests was for nitrogen (specifically nitrate and ammonium), phosphorous, carbon and pH. A second series tested for 14 different elements/metals.

Overall, the results from soil testing showed:

- The Baden soils are consistent with what would be expected from Missouri soils (based on USGS maps)
- Three sampled sites showed levels of lead in excess of State guidelines.[20] Two of these were on the railroad corridor, and one was within a fenced MSD demolition site.
- Arsenic levels at several locations were higher than the risk-based values used in the testing, but all were within background values for Missouri soils (based on USGS soil survey maps).
- Approximately 50% of soil pH levels were found to be within the plant preference range of 6.0-7.2. Of those outside preferred levels, by far the largest number were more basic (>7.2) rather than more acidic (<6.0).
- The nitrogen analysis indicates low soil fertility. However the report states that the low values of nitrate and ammonia could suggest that much of the bioavailable nitrogen was lost during sample storage and preparation.

2.9 Conclusion

The information provided through this baseline environmental assessment has enabled the design team to proceed in a range of important areas on the basis of local evidence. There are biophysical challenges to overcome:

a. The development of the natural water system (Gingrass Creek and its sub-watershed) into an underground combined stormwater and sewer pipeline has made the area susceptible to overflow in periods of heavy rain
b. The soils drain poorly, so water run-off is rapid and high-volume in times of heavy rain
c. The presence of mosquito populations in standing water suggests mosquito numbers will grow with the development of more water bodies
d. The existing plant community is roughly 50% native, 50% exotic along the railroad. This ratio should be increased through the introduction of appropriate native plant species. The baseline environmental survey showed that Dickman Park contained fewer native plant species than either the railroad corridor or vacant lots surveyed.

19 Forbs and herbs are plants that do not contain significant amounts of woody tissue. Grasses share this characteristic; they are classified as grasses or grass-like because they have long, narrow leaves.
20 Ranked against the Missouri Risk-Based Corrective Action Guidelines established by the Missouri Department of Natural Resources.

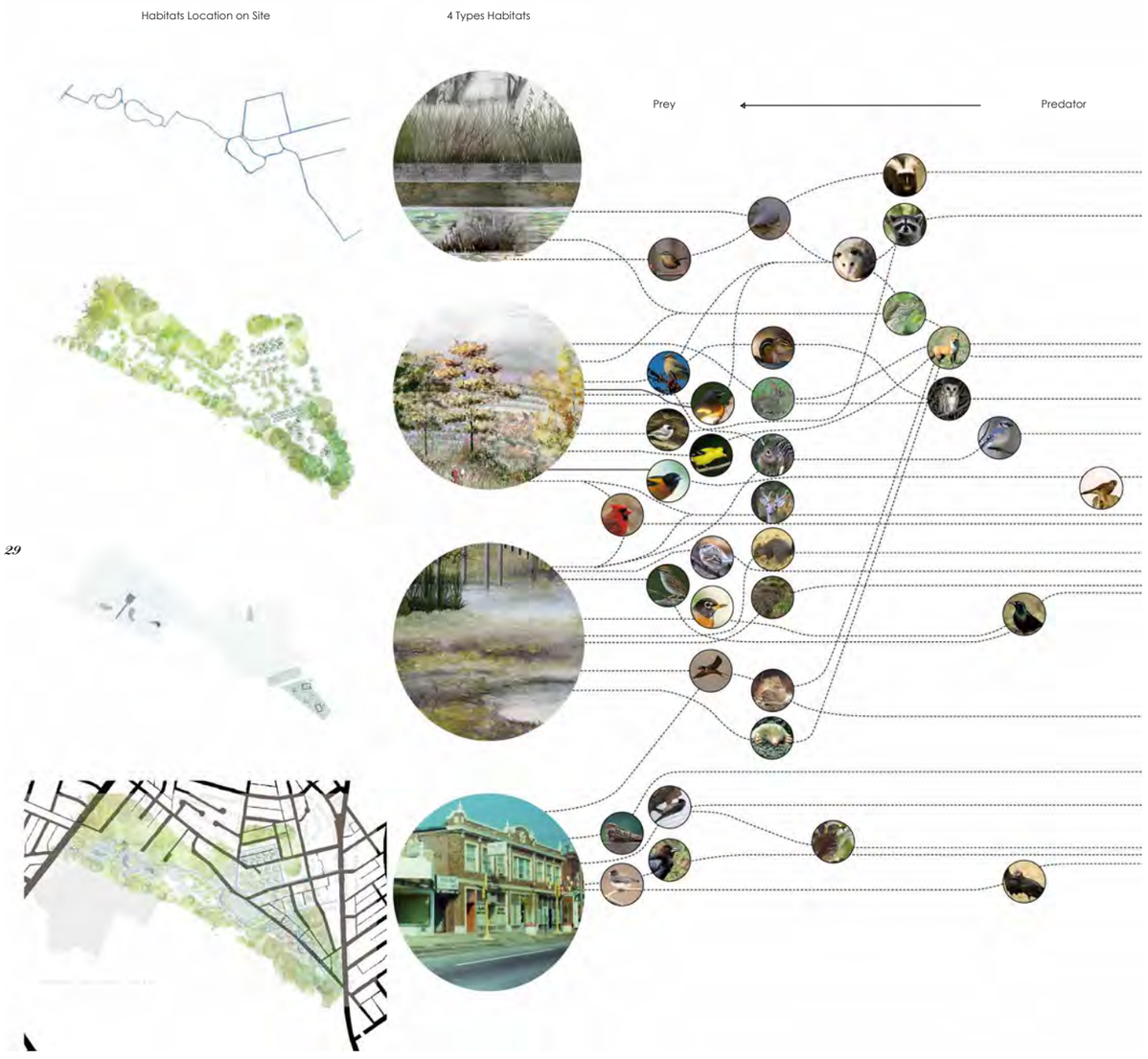
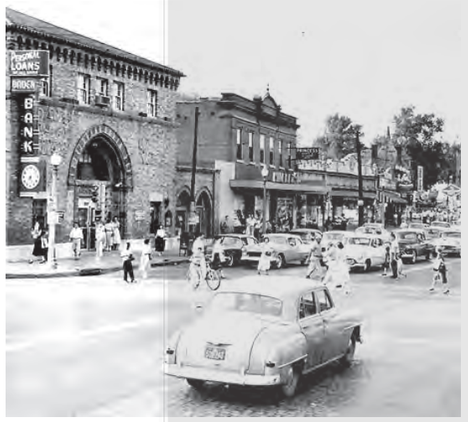


Fig 2.23 Biodiversity and open spaces around Baden. All the above species can be found in the Baden neighborhood

Baden School 1907

Science of German influence



Downtown Baden 1950s

Our Lady of Mount Carmel Roman Catholic Church

Our Lady of the Holy Cross Catholic Church

Present building of the Baden Branch Public Library

3.0 Community Engagement

3.1 The Purpose

The design process engages not only project partners, but also Baden residents. Meaningful community engagement is required in part because turning the Baden open space plan into a lively, beloved landscape will require more than institutional support from the UVEI, MSD, WU, or any other partner. Many studies show that the key to successful environmental enhancement projects is community participation (Orff, K. 2016 *Toward an Urban Ecology*. New York: The Monacelli Press: 13; Hirsch, Alison B. 2015 "Urban Barnraising: Collective Rituals to Promote Communitas." *Landscape Journal: Design, Planning and Management of the Land* 34/2: 113-126). Throughout this project, the UVEI and WU team sought to involve the hands and minds of Baden's residents, and hope to encourage their dedicated stewardship.

However, it is not primarily for the sake of the collective landscape that dedicated green stewardship benefits our communities. Studies also show that as neighbors invest their time and energy in cultivating, activating, and finally living in their landscape, they develop stronger and more meaningful relationships with the land *and* with each other. Those connections in turn enhance the sense of community, of shared ownership and responsibility for the neighborhood environment. Ultimately, residents engaged as dedicated green stewards can help to make their neighborhood more beautiful, more lively, and more connected.

The process of creating the landscape together is therefore understood as an act of collective transformation, restoration, and healing. Through conversations and interviews conducted by Washington University researchers, we have seen that many residents are deeply upset by the slow physical deterioration of their landscape. In recent decades, buildings like the historic Aldridge School have become run down, for instance, and one business after another has left Broadway, an evacuation of retail and services that gives residents no choice but to travel outside the neighborhood to get even the most basic goods. While residents in the 1950s recall walking frequently around the neighborhood, today 39% of residents think it is unsafe to walk during the day and 71% think it is unsafe to walk at night (Brown School Public Health survey). The concomitant depreciation of home values has caused some to lose a lifetime of wealth. The effects of this decline are by no means confined to Baden. Many residents feel that the north side has been forgotten.

For many residents, however, this is not the end of the story. In an interview, a longtime resident told research assistant Rachel Folkerts that she stays in Baden because she is a fighter, and she believes her community is worth the effort. A committed corps of residents and local leaders, including Alderwoman Dionne Flowers, leaders at Our Lady of the Holy Cross, the staff at Riverview West Florissant Development Corporation, the Baden Branch of the St. Louis Public Libraries, and members of the Revitalization of Baden Association and the Baden Business Association, are working to rebuild and revitalize their neighborhood.

This will take a long time, perhaps several decades. It requires a long-term commitment on the part of UVEI and its implementation partners. If Baden residents are actively involved in creating and implementing that vision, it is more likely to be successful. More importantly, if this project is to become part of a greater, collective endeavor to lift St. Louis's neglected north side from disposability to essentiality, it must become a work of empowerment. In the process of creating a landscape, that begins with inviting residents in to inform and participate in its design.

3.2 The Community Engagement Process

The information collected here is based on four linked data-gathering exercises conducted by WU faculty and students:

1. A neighborhood-wide public health survey
2. interviews
3. workshops
4. on-going engagement with community partners (ROBA, RWFDC/BESC, Community Garden)

While it is recognized that the information gathered is more qualitative than quantitative (and limited in scale), the views expressed by neighborhood leaders and other actively engaged residents have been critically important in developing a comprehensive understanding of the neighborhood.

Throughout all of the engagement activities described here, WU has consistently shared the limitations of the landscape master plan with residents and stakeholders. At this point, the landscape master plan is a proposal whose primary purpose is to generate ideas, and does not represent a commitment from MSD or the UVEI to implement any of the proposed features.

3.2.1 Ongoing presence

The formal engagement process outlined above has been strengthened by ongoing involvement with local organizations and community members since mid-2015. This informal engagement has included participation in community meetings, garden work days, social gatherings such as picnics, and leading youth activities through the Baden Enrichment STEM Center (BESC). Most of the participating residents are actively involved in the neighborhood through the community garden, the Revitalization of Baden Association (ROBA), and the local development corporation (RWFDC). Although there have been several improvements made in the last two years, perhaps the most important environmental initiative has been the development of the community garden by RWFDC and the Missouri Botanical Garden. Through this garden, a team of Baden youth have learned horticultural and basic professional skills, and local gardeners can harvest fresh herbs and vegetables for their tables. One resident said that he appreciates the space it brings to grow food and flowers for the neighborhood, as well as the commitment from residents and [the Missouri Botanical Garden] to keeping the garden a place of energy in the neighborhood (Hurley 1997).

3.2.2 Neighborhood Survey

In the spring of 2016 WU Professor Amy Eyler (Public Health, Brown School of Social Work) and her graduate student Nishita D'Souza (MPH candidate, 2017) conducted a neighborhood wide Public Health survey to collect information on resident perceptions of neighborhood walkability and public greenspace. Riverview West Florissant Development Corporation advised the team on the creation of the survey, and community members were involved in its dissemination as much as possible. Partners at the Baden Public Library and Our Lady of the Holy Cross distributed the survey to residents, and four local youths were employed to help distribute the survey door-to-door. Entitled *Baden Physical Activity and Greenspace Survey*, the 10-item questionnaire asked community members questions about the relationship between their physical health and their environment - walking, using recreation space, traveling for groceries. It also asked them to describe their environment in terms of sidewalks, lighting, natural sites, traffic, and to indicate how safe they felt walking in their neighborhood. Data was collected in the summer of 2016.

Three hundred and twenty-two residents of the neighborhood population (11%) completed the survey. Their average age was 47 years. Females numbered 201, males 121.

Results

- 39% of respondents reported meeting levels of physical activity recommended by the Centers for Disease Control (CDC). Nationally, about half of US adults (48.9%) meet minimum CDC guidelines for aerobic activity[21].
- Respondents perceived physical safety and infrastructure as barriers to physical activity. For example 83% thought cars exceeded posted speed limits, and 71% felt unsafe to walk at night. 48% thought the sidewalks are not well maintained sidewalks and 37% added that sidewalks are not well lit at night .
- Respondents perceive local greenspace to be very important for the health of the community (e.g. 84% think it is important for physical and mental health), but 40% of respondents report dissatisfaction with existing greenspace.

On the basis of these results, the Brown School public health researchers suggest that the next steps for designers and planners should be to ensure that Baden residents have adequate walking infrastructure and safe places, as these public space elements are instrumental in changing the public health behavior of communities (D'Souza 2016).

The results of the neighborhood survey have informed the Open Space Plan for Baden, using spatial, planting and contouring strategies to improve walkability in the neighborhood.

21 https://www.cdc.gov/physicalactivity/downloads/trends-in-the-prevalence-of-physical-activity.pdf

3.2.3 Community Development

WU Environmental Studies lecturer Scott Krummenacher and his Environmental Studies students undertook a community assets mapping exercise in Fall 2016, followed by precedent studies across the country. They developed some very useful Policy and Program Recommendations specifically for Baden community (Krummenacher, 2017). Their overall counsel is for a combination of community benefits and environmental sustainability, for which they have four main recommendations:

- **Create a Community Benefits Agreement**

A community benefits agreement is a contract between a community group and a developer guaranteeing that the developer provides certain amenities or achieves agreed-upon social outcomes within the local community. The recommendation is for an agreement to ensure that a percentage of workers (on for instance MSD projects) are hired locally, and that they receive training and the support needed to ensure long-term employment.

- **Implement small-scale urban greening projects around the future basin sites**

Fostering green stewardship in pilot project sites has emerged as a priority of the UVEI and its partners. This work has already begun through the efforts of the UVEI and its network of local change makers, with the development of a community garden and the planting of trees in Dickman Park. Further projects include a garden plan for the Holy Cross Church, and a Milkweed for Monarchs garden. Krummenacher recommends focusing on providing residents support to implement home greening projects, as well as continuing to use a youth conservation corps model to implement projects and develop public green space. UVEI should continue to work closely with residents and community stakeholders to develop and implement culturally relevant and appropriate programing.

- **Consider adapting elements from a hybrid Community and Conservation Land Trust Model**

In a community land trust, land is owned by a private, non-profit trust, but private properties are owned by homeowners. In theory, this makes housing more affordable by removing the cost of land. These restrictions are designed to ensure long-term affordable housing, even as an area develops and improves. In a conservation land trust, land is owned by a private, non-profit trust whose mission is to protect and steward the land and natural resources long-term social and environmental benefit. Decision-makers should consider carefully whether and how to incorporate elements of a hybrid community and conservation land trust model into open space development in Baden and other UVEI sites.

- **Consider developing a Friends of the Park organization in Baden**

This model is standard for a reason – it works. Friends groups are run by dedicated residents who take on responsibility for grassroots efforts to raise funds and engage residents in social activities in a park, as well as working to keep them clean and beautiful. In the short term, ROBA would be well-positioned to take on this project as a committee. If an urban land trust is developed and takes ownership of greenspace in Baden, a partnership between the Friends group and the urban land trust should be explored(Krummenacher 2017).

3.2.4 Collecting Place Stories: Oral Histories of the Baden Neighborhood

In December, 2016, Professor Andrew Hurley of the University of Missouri St. Louis History Department and his graduate student, Mark Loehrer, collected stories from residents, of places in the neighborhood that they consider important to the culture, history, and environment of their neighborhood. They include a range of voices supporting the development of the local environment. For instance, Father Vincent Nyman of the Church of the Holy Cross and the Revitalization of Baden Association, stresses that "the ecological needs of the planet demand a closer attention paid to how individuals can be shepherds of their surrounding environment" while longtime resident Starr Butler discusses the community garden "as a place that provides both educational and social benefits to the community." She feels this is an asset the Baden community can build on as they work to revitalize their neighborhood. Their stories - and many others - can be found online at http://placestories.missouriepscor.org/map.

3.2.5 Community Landscape Planning Workshop

On June 18, 2016, at the beginning of the landscape masterplanning process (but after the completion of the Design Studio described in *Section 5.0*) the design team led a 5-hour workshop to gather resident input on desired uses of future greenspace in the neighborhood. The Core Planning Team included Toni Cousins from the Riverview West Florissant Development Corporation, Alderwoman Dionne Flowers, Laura Schatzman from the UVEI, and Rod Barnett, Liz Kramer, and Rachel Folkerts from WU. The actual forum was led by a Facilitation Team consisting of Liz Kramer and the UVEI Baden Pilot Project Design Team. Rachel Folkerts created a Facilitation Manual for the workshop, which set out the agenda and described the activities for the round table discussions. This manual has been shared with UVEI partners and is available to others upon request.

Eighteen residents and community partners participated in the workshop, which was held at the Church of Our Lady of the Holy Cross in Baden. Small groups were led by team members in a process that used visual aids to explore residents' desires and concerns, and their visions for their community greenspace.

Results

The broad range of outcomes from the workshop can be summarized as follows:

Residents were concerned that the MSD buy-out was disturbing the community beyond its ability to recover. However, they were enthusiastic about the opportunity to make the best of a difficult situation and generally supportive of creating a public greenspace. In terms of a future public greenspace, key issues raised during the workshop included:

a. A particular concern for the decline of Broadway, the lack of businesses on that street, and the rise of prostitution and loitering there
b. Safety and privacy and the current perceived indifference of MSD to the maintenance of lots made vacant by demolition
c. Maintenance of any future open space that might be developed.

With respect to plants, residents were interested in and accepting of:

a. A general theme of prairies and woodlands, as long as site lines are preserved (some think trees invite danger, and make the area unsafe)
b. The possibility of expanding the Calvary Cemetery across the railroad into their open space
c. Involving youth in propagation
d. Attracting wildlife
e. Signage that would identify plants and habitat.

The outcomes from discussions about developing the basins into a public greenspace were:

a. An overall discomfit with the possibility of creating a permanent pond or water features, largely due to safety concerns. Some said a fishing pond would be a useful addition (and due consideration was given to the possibility of fish production), though it could end up dirty and trashy if not well-maintained
b. General concerns about safety and maintenance
c. The introduction of safe, visible pathways was important, because currently there is not a walking culture in the community, and a bridge over a basin was a popular idea
d. Many expressed the desire to drive to the site since people feel vulnerable on foot if others are in cars
e. A picnic area was especially favored, and places for children to play where they can be supervised. This would include separate areas for older children to play organized sport.

The community workshop yielded the following suggestions for physical components:

pedestrian walkway / cycleway	children's play areas
rain gardens	wildlife gardens
prairie	dog park
woodland	some water and bridge
parking close to site	social opportunities for families eg picnic areas
seating	viewing areas and open area
flowers	community center
boardwalks and leaning rails	simplicity, calm, quietness

All of these components have been included in the open space proposal recommended in this Report. In

terms of implementation, there was general agreement that the design and construction of open space should be staged so that clear, obvious progress is visible.

Residents in the workshop also expressed positive feelings towards their neighbors. Independent of the greenspace creation efforts, residents were working towards achieving the following goals:

a. Developing a neighborhood organization (which was already in progress at the time of the workshop and crystalized as ROBA later in 2016); and
b. Developing a community center (the Church of Our Lady of the Holy Cross was seen as a hub of activity and the current center of the community, there was interest in creating another community center near the current MSD project area); and
c. Encouraging more communication within the neighborhood. Residents talked about the development of an email, newsletter or social media program to assist with this. This project is currently being advanced by ROBA.

3.2.6 Sharing the Draft Plan and Gathering Detailed Feedback

On November 2nd 2016 Prof. Rod Barnett presented the draft landscape plan to community members at the monthly Revitalization of Baden Association meeting. Over the following weeks, detailed feedback on the draft open space plan was gathered by Rachel Folkerts through interviews with residents.

Community Response

- Residents support the overall vision of the draft landscape plan.
- Residents would like to be able to use the future greenspace in their neighborhood and prefer the draft landscape master plan – with its public gardens, connecting walking and cycle pathways, and community gathering spaces – to fenced detention basins.
- Residents would like to be near to a beautiful, peaceful natural area that provides space for family gatherings and for children to play.
- Residents want greenspace development to act as a catalyst for other neighborhood improvements and for greater empowerment of its residents. This was explicitly stated by each resident and community partner interviewed.
- Many residents are interested in participating in greenspace development projects, particularly through job creation.
- Residents would like local workers to participate in creating and maintaining greenspace. ROBA is interested in setting up local hiring agreements with any new business or development project in the neighborhood.
- Youth and adult volunteer participation in green stewardship activities is generally supported.
- Overall, most residents do not believe improvements will be made; they believe Baden and the north side have been neglected by design. Many are hopeful but wary of any proposed development project.
- Residents voiced concerns about the proposal with respect to long-term site maintenance, safety, and the long timeline to completion and maturation of the proposed design. There is a strong desire to see near-term improvements.

3.2.7 Key Insights

Much of the value of the on-going community engagement in the design process has been the development of relationships and trust between Washington University and the UVEI team, and Baden's residents. The team also gathered many insights into the people, strengths, and opportunities in Baden. Key insights from the workshop, the draft plan presentation and the interviews may be summarized as:

1. Residents see the open space plan as a critical opportunity to convert the MSD basin proposals into walkable public space
2. They endorse the environmental strategies built into the draft plan
3. They see the open space plan as a major step towards revitalizing their neighborhood
4. But they are wary of making physical, emotional and social investment in the landscape plan, since they do not believe it will come about.

Baden residents value the ties they have to their neighbors and community. Many who were interviewed had particularly strong ties to Our Lady of the Holy Cross Church. They would like to strengthen community ties, and are excited about the prospect of more community gathering spaces.

In interviews, several residents spoke about a shift in the last several decades from widespread homeownership to more renters. Many homeowners think that renters tend not to know how to take care of their property or how to be good neighbors. ROBA is interested in addressing this by helping newcomers learn how to be better neighbors through projects like creating a neighborhood welcome packet. Another way to address this is by encouraging them to become involved, initially in the community garden, and then in the development of the open space plan.

4.0 THE DESIGN STUDIO

4.1 Studio Objectives

In spring 2016, Prof. Rod Barnett taught a graduate studio for second year MLA students. During the studio, students developed design concepts for future greenspace in Baden, in partnership with the UVEI and MSD. These design concepts formed the basis for the subsequent masterplan developed by Prof. Rod Barnett. The objectives and outcomes of the studio are described below.

The goal of the studio was to develop a landscape plan for the whole basin network within the MSD buy-out area in Baden, incorporating the three proposed MSD stormwater detention basins into a wetland system that deals efficiently with the MSD system overflow that occurs in severe storm events. The studio aimed to develop an integrated urban watershed design and management proposal that is novel, practical, imaginative, feasible, and visionary.

Essential for the learning outcomes of the studio was an application of the principles of urban ecology to the UVEI Baden Pilot Project site. The Baltimore Ecosystem Study, which has been under way since the late 1990s and has become a leader in the field, defines the goal of urban ecology as follows:

To understand the structure and function of integrated socio-ecological systems in all their spatial, temporal and organizational complexity (Grove et al 2016).

The urban ecology goals of the studio were to discover what spatial, temporal and organizational systems (human and nonhuman) are at work in the study area, and to harness these systems in the design of a new kind of performative urban terrain. There was an express objective of designing a community space that breaks down the barriers between science and society. (Barnett 2016b).

Fundamentally, the student design was required on the one hand to eliminate fencing, provide habitat, introduce standing water and on the other to catalyze employment, attract investment, up-skill school children, reveal the water cycle and bring the people of Baden into closer contact with natural processes. In doing this it should meet all the functional requirements of standard MSD basins. The objective of the studio was not to *create* the open space plan, but to *contribute* to the development of the plan by researching, analyzing and developing maps, plans, sections, renderings, programs, scenarios, phasing diagrams and so on, and subjecting ideas to feasibility reviews through the normal studio review process.

The student design drew on the baseline data collected in Baden by the WU research team, including place-specific data on mosquitos, vegetation and soil chemistry, as well as other neighborhood-specific information provided by Washinbgton University, the Metropolitan St. Louis Sewer District, the UVEI, RWFDC, and other sources.

4.2 Studio Program

There were six students in the studio: Linda Zambito, Bin Yang, Shelbey Sill, Margot Shafran, Shu Guo, and Alisa Blatter. First they conducted contextual mapping, site analysis, and relevant social and environmental research, and undertook case studies of similar projects. They then visited the Baltimore Ecosystem Study and discussed that projects' successes and challenges with researchers and graduate students involved in it. Next they developed grading and hydrology diagrams in teams, and for the mid-term reviews each student designed their own general proposal for the Baden neighborhood.

After mid-terms the students worked as a single team to develop an overall networked basin system that would meet the requirements of MSD's water management strategy for the Baden district, and provide additional water for a range of value-added amenities. Their hydrology research had suggested the development of a networked system of detention and retention ponds. These ponds would be located in the lowest points on the valley floor, where MSD's basins are to be constructed. The retention ponds would be permanently filled, taking water both from the city system (clean and dependable) and from the impermeable surfaces (requiring cleansing and polishing). Mostly dry, or nearly dry, the detention ponds, designed to MSD standards, could absorb the back-up from large storm events. The retention ponds would absorb diverted stormwater and offer human and wildlife amenities, from millet production to homespun aquaculture.

Once the hydrology plan had been developed, five of the students selected a basin site to create what the studio called "sites of exchange," or areas of intense interaction between humans and nonhuman species where water and land meet. After developing their proposals the students aggregated them into the large-scale system design (Fig.4.1). A sixth student developed an overall plan for the whole site with the intention of providing a consistent thematic that would pull everything together.

The designs for the sites of exchange were to act as "devices" (topological, hydrological, ecological, structural) that offer varying degrees of performativity and interaction. The designers used regional biodiversity research to initiate plant and animal communities that would grow and develop over time. In each case the device had to offer opportunities for community members and their families to interact with the natural and constructed elements being established.

While the proposed water management armature is envisaged as a constructed permanent condition, the sites of exchange were developed to demonstrate opportunities rather than propose solutions. The students asked, "What if there were a millet farm? What if there were a fishing pond? What if we developed an area for people of no They researched the requirements for the development of these propositions, and probed the questions with design investigations that took them seriously.

4.3 Student Designs

The next several pages show the designs for five "sites of exchange", each of which is concerned with the daily encounter of local people with the natural systems that have been set in motion. Working from west to east the students explored the possibilities of a millet farm as a low-key economic contributor, an aquaculture proposition providing opportunities for fishing and for fish research, an anchor institution in the form of a community hub (refurbished from existing privately-owned light industrial buildings) with a new street-based public space attached, an urban campsite for diverse groups of users, and a wet and dry mini-network of ponds and walkways that acts as a gateway to the whole development, modeling at a smaller scale the operation of the entire terrain. The final plan is a proposal for the seeding of the whole domain with tulip trees as a self-organizing woodland. Tulip trees (*Liriodendron tulipfera*) are a species that can absorb toxins from the soil and transfer them to the atmosphere.

The students who worked on the UVEI Baden Pilot Project design framed the initiative as co-evolutionary. It would develop organically through the efforts of the people who live there, their organizations and community groups, through their partnership with the UVEI, through new partnerships that the UVEI would build amongst investors, sponsors, and not-for-profit organizations, and finally, through the support of the MSD Green Infrastructure Initiative.

Fig 4.1 A large-scale system design

4.4 Outcomes from the Studio

The goal of the Baden Studio was to explore the opportunity for rehabilitation as opposed to redevelopment. The strategy was to elaborate, from MSD's proposal for several new basins and basin extensions, an armature in the form of a networked system of wet and dry ponds. This would achieve - amongst many other things - the following ten objectives:

1. Link one end of the site to the other, providing pedestrian and bicycle access from North Broadway to Riverview Boulevard
2. Develop a continuous soft, porous boundary between the northern edge of the pond system and the residential neighbors adjacent to it
3. Situate the existing commercial buildings in the center of the system, where they could act as a hub for the whole system
4. Enable the sub-watersheds to discharge surface run-off at strategic points along the northern boundary
5. Enable connection to the City water supply
6. Function as a flood mitigation device and achieve MSD objectives
7. Act as a catchment for seed-dispersal from the Calvary Cemetery and the railroad
8. Provide opportunities for partnerships with nonprofit and other organizations to develop the green infrastructure component of the project
9. Allow for continuity in terms of water management and habitat creation at the same time as enabling each pond to have its own character and make its own contribution to the whole
10. Over time attract into the community both newcomers and emigrant relatives, to make their homes and raise their families alongside an attractive ecological park.

Fig 4.2 An Overall Networked Basin System

Site of Exchange

Each basin is considered a unique switching center that plugs different systems into each other in different ways. Sites of exchange exploit the concept of exchange - value, expressing the value of the elements (things, states, flows, information, etc.) that they transact in terms of reciprocity, co-operation and even co-evolution. The wet/dry water management system establishes a cluster of meridians, through which the site's life force courses, gathering and harvesting its energy in the basins. For this reason sites of exchange are located on or near the basins, a strategy that maximized their ability to attract, collate and direct transactional flows. These sites take advantage of water's capacity to act as a medium for exchange, passing matter-energy across the moving edge condition of each pond.

In some cases it is not the water itself that empowers the exchange, but the proximate conditions it sets up. The Transient Ambience terrain, for instance, promotes affiliations between diverse social forces, connecting nomads and travelers and people of no fixed abode, both with each other and with other species whose life worlds are in many ways similar, in a landscape that nurtures rather than resists their choices, their outsiderness, and their independence. Meanwhile, the Farm for Food and Forage, as its name suggests, instrumentalizes the production and habitat potential of grain + water into a single landscape that spans scales of economy and ecology, intersecting laber, capital, genetics, community and the evolutionary trajectories of aquatic urban wildlife.

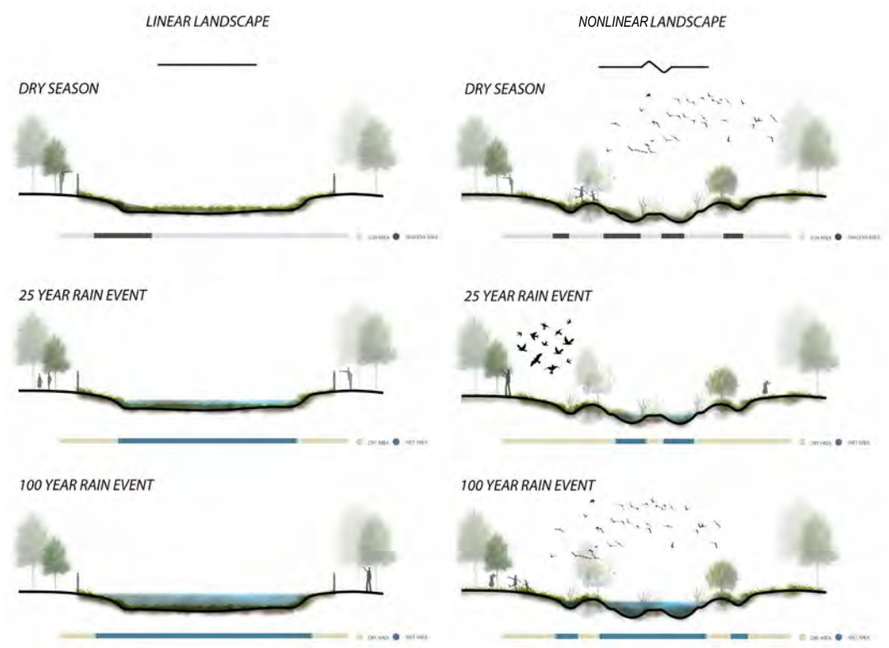
MARGOT SHAFRAN

As urbanization decreases in post-industrial cities such as St. Louis, their peripheries become economically blighted. They lack simple public amenities - street lined streets and recreation parklands. Let us imagine a future where the neighborhood of Baden is integrated within its natural setting and fosters a sense of community, identity and pride. This simple strategy begins with an effort by every 5th grade student to germinate a seedling, which is then be planted by each community member to create a participatory self-organizing woodland.

Synchronized Relationship between Daily Life and Natural Cycles

High Density Groves

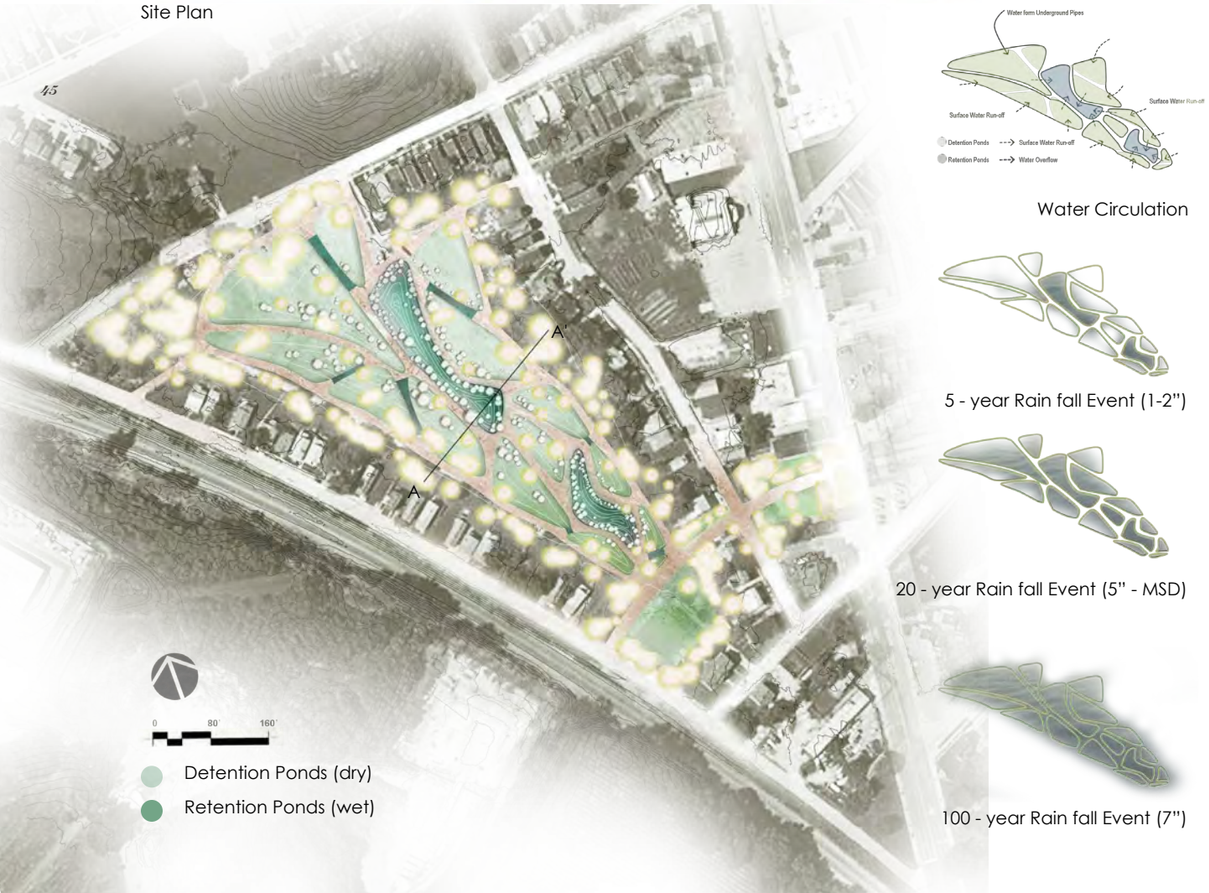
BIN YAN



We make basins to collect rain water, but what kind of basins can we make? How can we integrate more ecological functions to make them as performative as possible?

My previous research led to the conclusion that the diversity of site conditions contributes to the biodiversity of the ecosystem. Therefore, instead of making one big basin, I organized a series of dry and wet basins to mitigate floods event on the one hand, and provide diverse habitats on the other. The resulting system catalyzes spontaneous ecological processes and interactions within the overall water network.

Site Plan



Water Circulation

5 - year Rain fall Event (1-2")

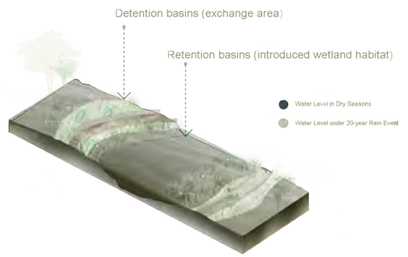
20 - year Rain fall Event (5" - MSD)

100 - year Rain fall Event (7")

View from the Entrance

Process I

Wetland habitat is introduced into the retention ponds expanding and contracting with the fluctuation of the water level. The detention ponds provide new habitat for wetland species in flood seasons which undergo a continuous interaction with the woodland species expanding to this area as well.

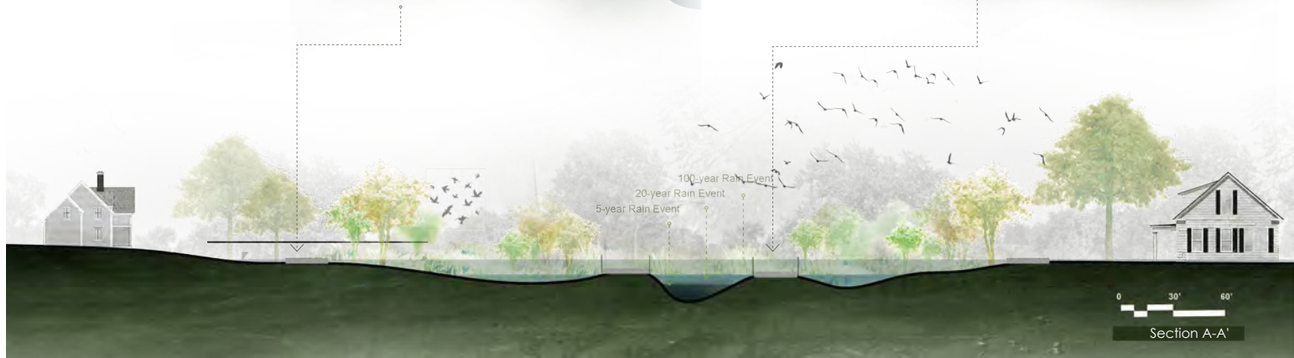


Sidewalk Details

Process II

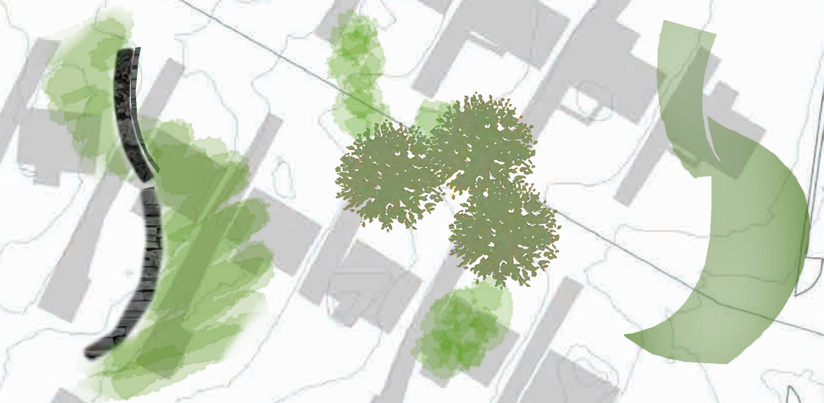
The existing woodland habitat remains and expands to the lower detention areas through the spread of seeds. Again, the growth and condition of the woodland plants is influenced by the fluctuation of the water level and the interaction with the wetland species which eventually expand to the detention ponds as well.

Boardwalk Details



Transient Ambience

LINDA ZAMBITO



Modularized mounds

The nomadic human body is the subject of this investigation. Pliant, mobile, sensitive, fragile, dependent on nutrition and rest, the transient body receives a field of contoured embankments that call it to repose. Gently geometrized, and uplifted amongst carefully-selected fruit trees and prairie wildflowers, this site of exchange recalls the transit camps of migrants. It has organization, and yet its informality enables visitors to adapt it to their individual needs. It fits the human body like a glove; two "soft machines", two contoured fields in intimate negotiation, moving together, the one sustaining and caring for the other.

Standing water

10-year rainstorm

20-year rainstorm

Long section

Short section

SHU GUO

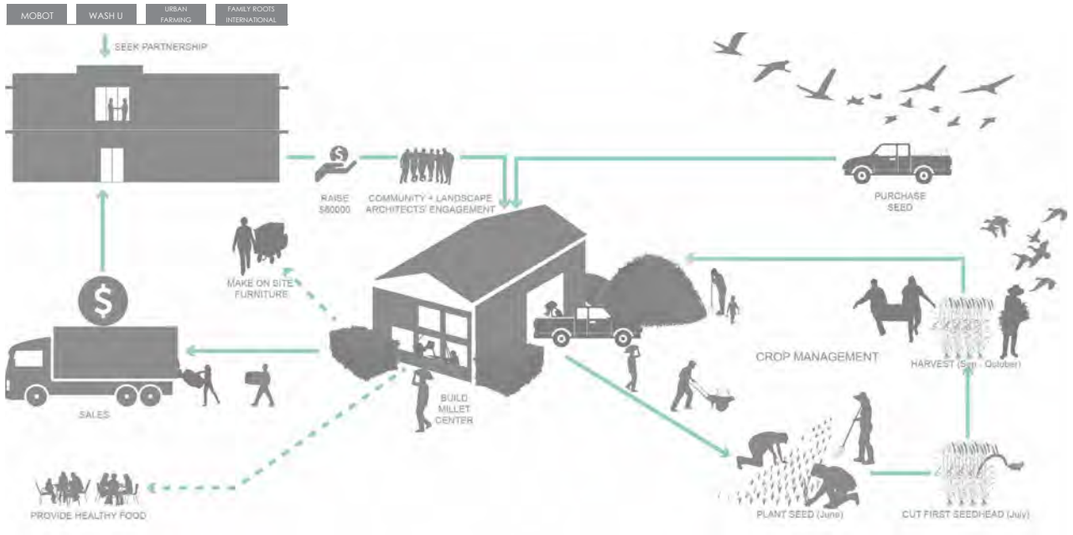
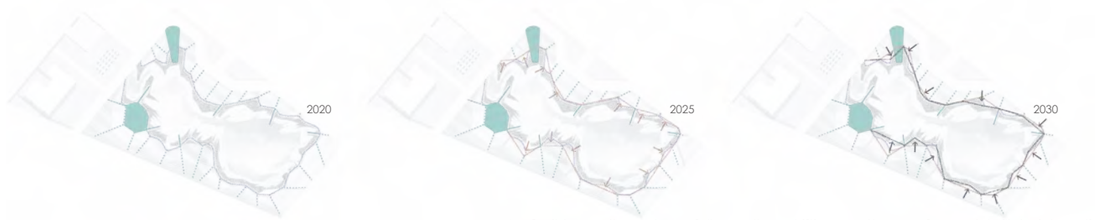


Diagram of Millet Production

Millet is a food resource for human food provision as well as small animal forage. This project demonstrates how urban agriculture can promote biodiversity and public health as well as provide job opportunities, community engagement, and economic benefits. Marsh plants are introduced alongside the millet plantation to filter water and provide habitats.

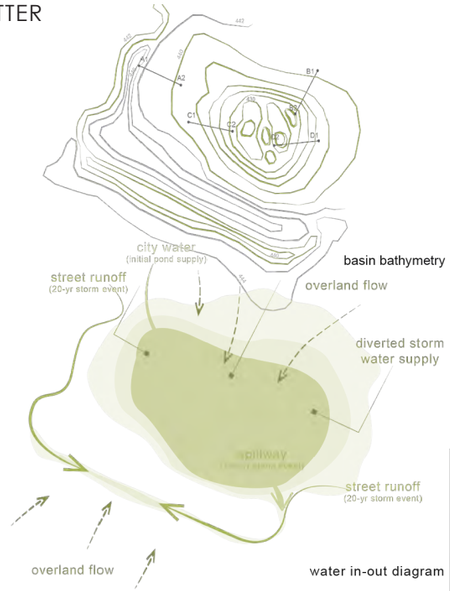
Field Study

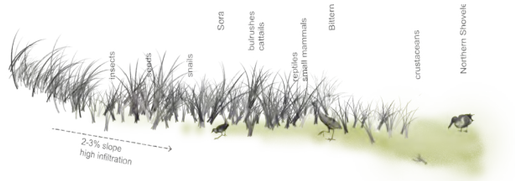


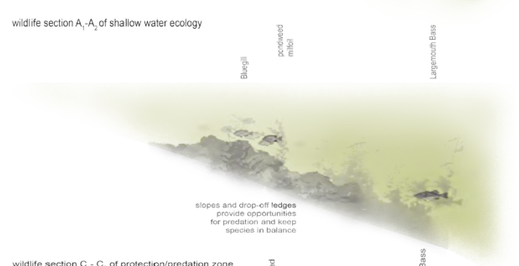
A flexible path system follows the shifting patterns of marsh/millet interaction.

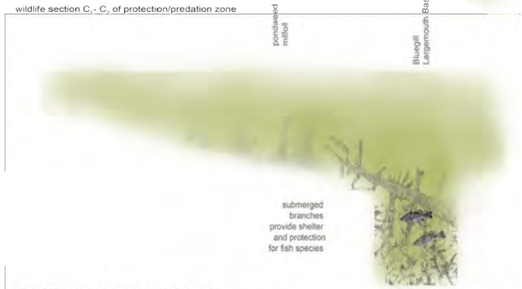
Site Plan

ALISA BLATTER





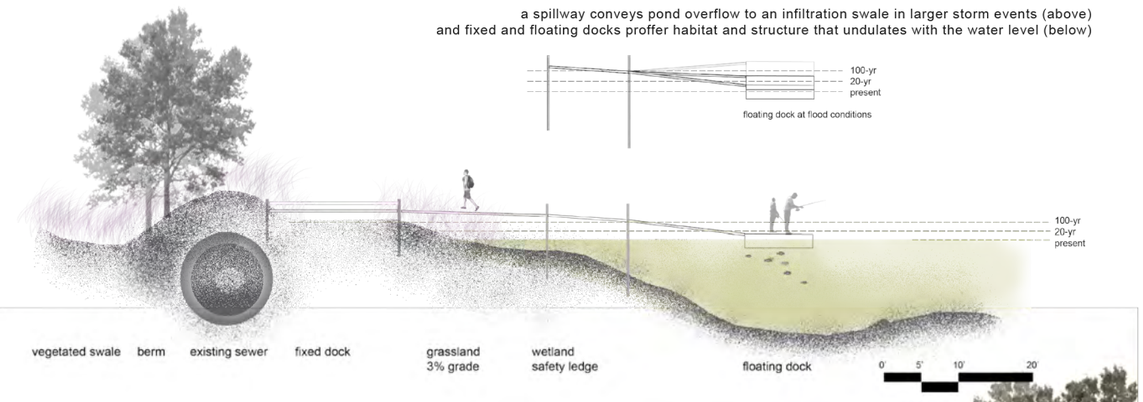




A constructed pond with a wet prairie surround absorbs diverted stormwater, alleviates 20-year to 100-year storm events, and supports an active community of fish species.

plan of neighborhood fishing basin with fixed and floating dock network

a spillway conveys pond overflow to an infiltration swale in larger storm events (above) and fixed and floating docks proffer habitat and structure that undulates with the water level (below)

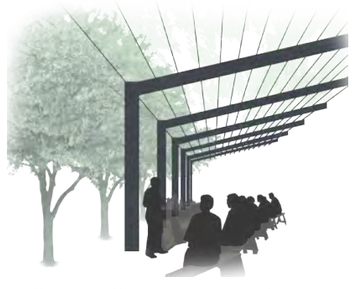


The fishing pond provides an ecologically interactive amenity in a new kind of social setting. Designed to promote species richness, it becomes habitat for introduced populations of minnows, blue gills, and largemouth bass. The unique fishing community that develops could play a direct role in managing these populations.

pond assemblage, dock system, and fishing community

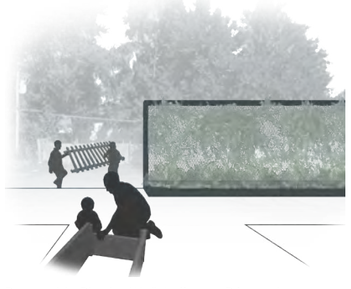
SHELBEY SILL

Designed to take advantage of a collection of existing buildings, the proposed community hub is at the center of the Baden Project site. Each building houses community programs such as youth and family resources, a gathering space, training facilities, a hub store and donation area, as well as a green house and seed propagation nursery. Additionally two components of the surrounding site include a permeable wall and rain garden display that takes advantage of existing infrastructure to create a new type of street with its primary focus on pedestrians rather than cars.



Community Outreach and Training Programs

Bridge Systems over Rain Garden Showcase



Permeable Planter Wall Acting as Privacy to Residents

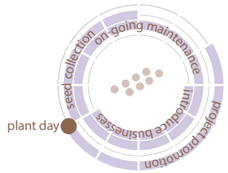
Evolution

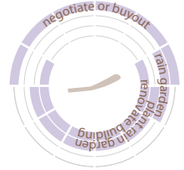
designing with time

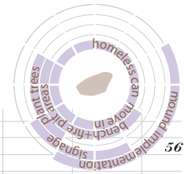
Recognizing the realities of the project's implementation, the Baden Project is not defined by a single master plan or the "moneyshot", but realizes the evolution of natural and social processes as the project continues to grow.

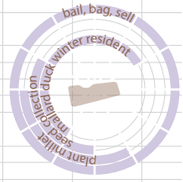
Self-Organizing Woodland | Homespun Aquaculture | Anchoring the Collective | Transient Ambience | Wet and Dry Networks | Farming for Food and Forage

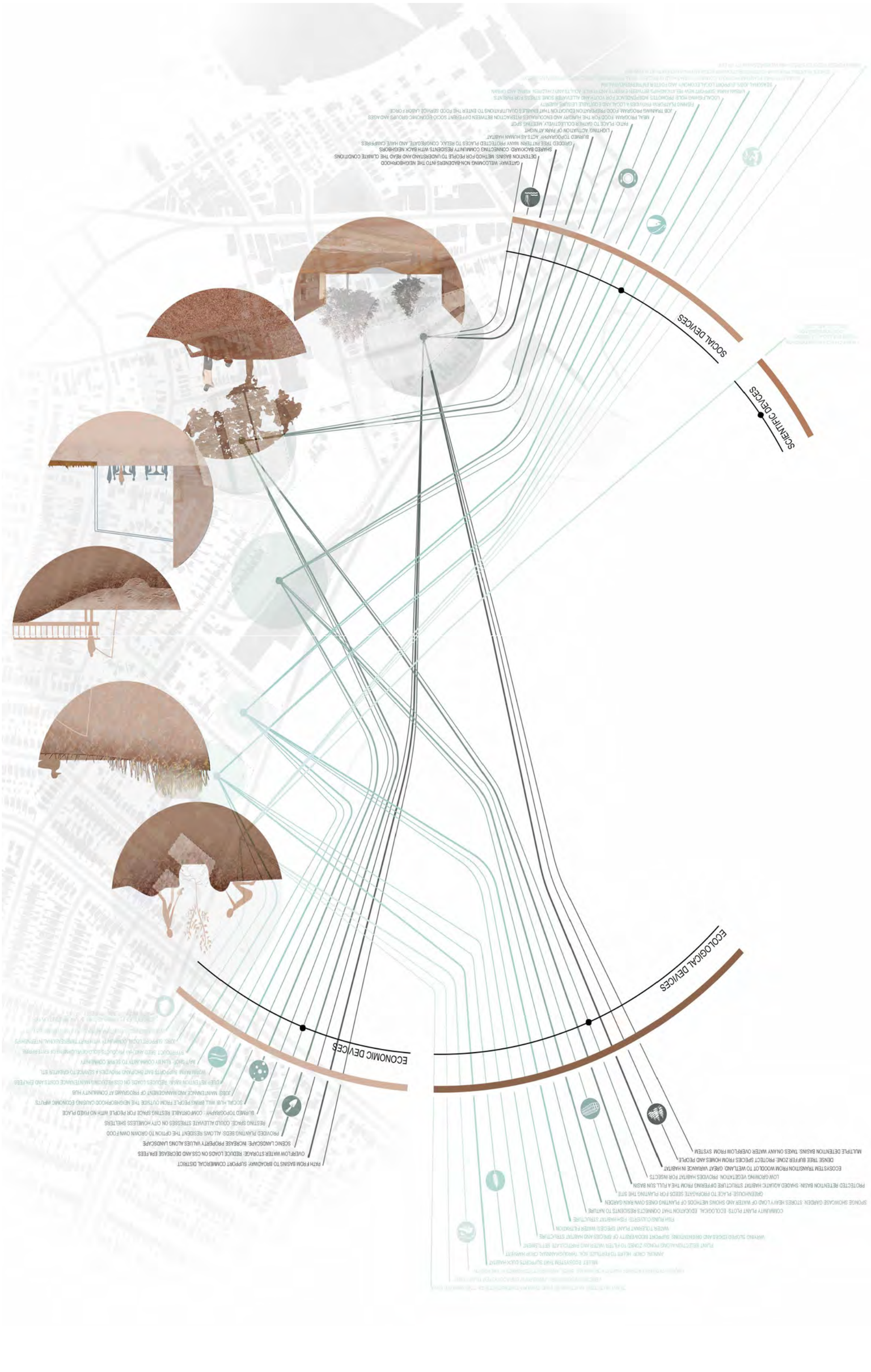
6 projects, 1 year





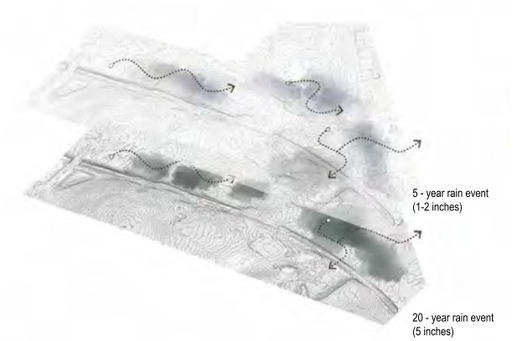





SOCIAL DEVICES
SCIENTIFIC DEVICES
ECOLOGICAL DEVICES
ECONOMIC DEVICES

CONSEQUENCES

= SITE CONDITION + WATER MANAGEMENT + COMMUNITY INVOLVEMENT + BIODIVERSITY FORMATION + DESIGN

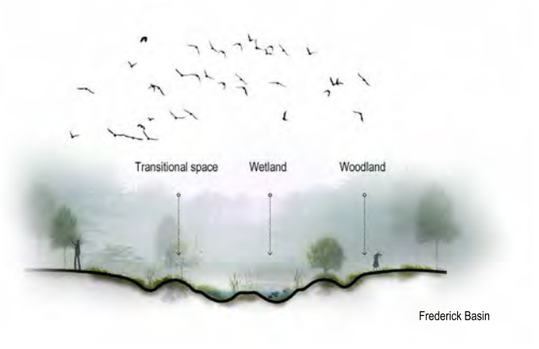


MSD'S OBJECTIVE IS ACHIEVED

Well, it does not flood anymore. Pity all those good houses had to go. But now we got a park, we got habitat, we are safe from the water, and—folks are coming back.

WETLAND HABITATIS CREATED

OK so it is a swamp, but I like it. Every morning the sun comes up and the weeds turn red.I love my morning walks even got Casey coming with me. Fish, duck, birds—he catches fish here, you know—blue gills, and those other things.

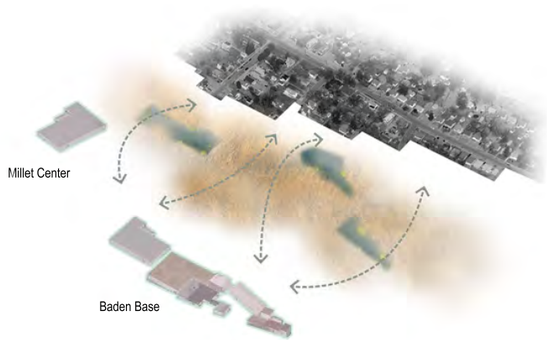


BIODIVERSITY IS ENHANCED

Used to be very dangerous. Now we got nuts'n berries and really tall grasses with fall seeds that bring the birds. Doesn't smell—I thought it would, but it doesn't.

IMPACTIS REGIONAL

I saw a coyote the other day. Last week Muriel swore she saw a deer. Course the cats are loving it. So many more birds and lizards. Now we got ducks and herons. God knows where they came from...



ANCHOR INSTITUTION IS ESTABLISHED

Sometimes there is nobody here, other times it is crowded. I can always get something to eat—chew the wind. My kids get their bikes fixed. One day I saw the ghost of Miles.

SLEEPING HABITATIS PREPARED

Who are you? Why are you here? Will you stay long? Let's sit together and talk. Sit down, have a coffee, lookat the moon—it's nearly full. We can watch the train from here. It'll be by soon—one hundred trucks, going west.

FOOD IS PRODUCED

We thought she was a mad woman, but now even my teenagers work there. Folks come from Clayton to buy our shit—I mean manure. In three years, we'll have paid the bank and I'll be driving a BMW.

SLEEPING HABITATIS PREPARED

They moved out ten years ago, went to St. Charles. Now they are thinking of coming back. Auntie's house is still over there on Tillie. She passed, it's up for sale. They wanna come back. Life is too short.

5.0 THE CENTER FOR EXPERIENTIAL LEARNING

Situated in Washington University's Olin Business School, the Center for Experiential Learning (CEL) runs a practicum course – an educational program in which student teams work with a sponsoring organization on business and management problems. During the fall of 2016, an interdisciplinary team of six graduate and undergraduate students participated in a CEL practicum project as part of the UVEI Baden Pilot Project. The course was supervised by Daniel Bentle (CEL Director) and the team by Prof. Glenn MacDonald (Olin Business School). The student team was managed by 2017 MBA candidate, MaryKate Mahoney. Members of the WU research team, including Prof. Rod Barnett, Beth Martin, and Rachel Folkerts also advised CEL students.

The purpose of the CEL practicum was to research best-practices for the maintenance of similar green initiatives and to develop a cost-reference tool to enable the UVEI to estimate the economic costs of the proposed open space plan. This was accomplished through a two-phase research process.

5.1 Situational Mapping

During the first phase, the CEL team undertook a situational mapping process in order to understand the current systems in place and the key players for the management of open spaces in St. Louis. This included an investigation of best practices in open space management globally, and especially in cities with similar economic, demographic and social factors to St. Louis. Cities researched included St. Louis, Detroit, Chesterfield, Cincinnati, Cleveland, Baltimore and Los Angeles. The relative costs of typical components such as cycleways, street furniture, planting, lighting, and fencing were determined, and the construction and maintenance costs of relevant landscape types such as wetlands and prairies were investigated. In St. Louis, cost referencing was undertaken with a range of butterfly gardens, rain gardens prairie restorations and detention basins. Financial information was shared by individual officials and decision-makers involved in projects in their respective cities.

5.2 The Calculator

A tool to estimate the implementation and operating budget of the proposed open space plan was created by the CEL team during the second phase of their research. The stated purpose of this cost reference tool is to:

a. guide the design process for the landscape architect by helping understand the budgetary constraints for each component
b. help the UVEI and its partners to visualize the complex nature of design and implementation

This tool demonstrates the complexity of the relationship between design and long-term maintenance. Specifically, the tool makes it easy to see that design decisions have budget implications for decades. The cost reference tool is a "good place to see a condensed representation of the many components that go into developing a dual purposed water retention basin and detention basin into an interactive park area" (CEL 2016). The calculator can be found at https://drive.google.com/drive/folders/0B83i6YIk9VTvV1BRa2E3d2dxenc.

The team found wide variations in pricing of projects across time and location that make it difficult to estimate the budget precisely. It therefore has significant limitations that make it inappropriate as a tool to provide precise budget estimates. Key limitations include a small amount of available data that varies significantly depending on place and the specific conditions of each project. Many components were estimated based on best-available data and simplifying assumptions (e.g. unit prices were calculated without considering wholesale pricing). In addition, the cost reference tool assumes a uniform lifespan across components and do not consider the effects of delays to the project timeline. Another key limitation of the project is that it only evaluated the economic costs. While case studies examined by the CEL research team indicated that the economic, environmental, and health benefits of parks outweigh costs, no tool was developed to quantify those benefits. Ultimately, the cost-reference tool is intended as a conversation piece, and a framework for decision-making.

The aim of the Baden Pilot Project was to develop plans for an ecological community park - to ask, even, what such an entity might look like, how it might perform, and how it could be designed and implemented. While the plan described in the rest of this book was based on analyses conducted by the various project parners, and the investigative designs of the students in the landscape studio, it was primarily designed by Rod Barnett, the PI for the Baden project.

6.0 THE RESEARCH PROPOSAL

6.1 Design Research

The UVEI Baden Pilot Project combines research approaches from the scientific and the design disciplines. Knowledge in these disciplines is constructed differently. However, all the disciplines involve creative work and empirical work. While the skill sets are different, each discipline produces outcomes that are novel and useful. Research by means of design in landscape architecture involves an iterative process of drawing and reflection. It involves practice, reflection on the processes and outcomes of that practice using emergent theoretical frameworks, and then further practice that is informed by the reflection.

Research by design usually begins with a research proposal that sets out a research question, a rationale for the work, and an initial approach to methodology (although specific methods and techniques evolve and emerge with the project (see Downton 2002; Austin 2004)

6.2 Research Question

In addition to the objectives and purposes laid out in the introduction to this Report, the Baden Design Team developed some more specific aims to guide their research.

Aims

The UVEI Baden Pilot Project aims to:

- Address the key findings of the project's community engagement process
- Achieve the drainage standards set by MSD
- Make the water cycle more visible
- Visually integrate drainage structures into the built environment
- Preserve and enhance landscape and heritage values
- Provide a liveable environment for all
- Develop an ecological park that acts as a benchmark and model for further projects
- Show how linking ecological urbanism and environmental justice provides a powerful approach to sustainable urban design

The aims and objectives were developed in accordance with a working research question. This eventually transitioned into the following:

Can a feasible, adaptive open space plan be developed for the Baden neighborhood that meets the objectives of MSD, UVEI and the community?

7.0 DESIGNING THE WATER

7.1 Overview of MSD's Approach

A drainage system in St. Louis has two primary components. These are what MSD calls the *design* component and the *overflow* system. The design component consists of the engineered inlets, pipes, storm sewers, and improved and unimproved channels that function during typical rainfall events. The overflow system, which operates when the design system reaches capacity, includes major overflow routes such as swales, floodplains, detention basins and natural overflow and ponding areas (MSD 2006). Overflow systems are developed in order to avoid the flooding of adjacent structures, such as basements.

Stormwater best management practices (BMPs) are design practices that have been developed to deploy natural processes to attain drainage goals and in the process, provide outcomes such as the improvement of water quality, creation of habitat and public amenity (MSD 2012).

The natural processes that these BMPs rely on to improve water quality (and thus strengthen habitat health) include microbial activity, filtration, infiltration, denitrification, nutrient reduction and evapotranspiration. The designed structures that encourage these processes are retention basins (or wet ponds), constructed wetlands, infiltration basins, dry swales, surface sand filters and bioretention filters (ibid.) The standard detention basins that MSD uses to control flooding do not typically involve the use of natural processes to clean water or provide habitat (though they may). Detention basins are dry depressions that temporarily fill with stormwater after a major rain storm, and then release that water into the design system over a period of time, to enable the system to cope with the flow (MSD 2017a). Stormwater BMPs have been developed both to control flooding and to achieve the further goals of water quality, habitat enhancement and public amenity, though their flood control efficiencies are reduced, owing mainly to the contouring and planting that are incorporated into the structure.

MSD's Baden strategy involves the development of three detention basins in the buy-out area. This research asks whether these detention basins can

a. include retention zones within them, or
b. be extended to include retention ponds at their edges, or
c. actually be retention ponds instead of detention ponds and still achieve MSD's efficiency objectives with respect to flood control.

7.1.1 Detention Basin Design

MSD's Post Construction Stormwater Management focus is on "capture"- the mitigation of flooding during 1-2 inch rain events (of which there are about fifty per year).[22] The current standard MSD detention basin design can therefore take 1-2" of rain into the sewer system before it starts to run overland to the lowest point. MSD's plan to construct three basins in the Baden neighborhood requires the basins to have sufficient capacity to take 5" of rain - the entire volume of a 20 year 3 hour (20/3) cloudburst storm - before major flooding occurs. Each basin will incorporate an outlet structure through which all the water in a 20/3 event passes, as well as an overflow weir set one foot below the berm, at the 20/3 ponding depth. This emergency spillway exists to remove excess water in giant storms. Water rising beyond basin capacity will flow over the weir. It is a cut-out at the top of the berm that releases the excess water on to the street. A 100-year storm event (7" of rain), then, will cause street flooding. This is why MSD often construct deep basins, sometimes maximizing the angle of repose, and then surround the basin with safety fencing.

There is currently no MSD requirement for minimum water quality in standard stormwater detention basins. This means that the water captured and released by basins carries whatever impurities it has picked up in its travel overland (along roads and across parking lots in severe storms) and through subsurface conditions. However, standard basins have a rip-rap or concrete forebay that filters out some sediment and trash running with stormwater. Most pollutants are not removed by the rip-rap. Nevertheless, detention ponds - as MSD states - are less effective at removing pollutants, because the water passes through them quickly.

7.1.2 Green Infrastructure

MSD has initiated a Green Infrastructure Pilot Program. For MSD, Green Infrastructure (GI) refers to practices that redirect stormwater by diverting it to locations where it is detained, infiltrated into the ground, evaporated, taken up by plants or re-used by the types of structures mentioned in Section 7.1 above (MSD 2016 section 1.1). MSD is committed to the introduction of GI practices: its report states that GI "can supplement redevelopment efforts, add greenspace to cities, increase recreational opportunities, increase groundwater recharge, improve air quality, increase property values, enhance urban quality of life, and improve human health." (MSD 2016 section 1.4). Currently, MSD plans for the buyout zone in Baden do not include GI.

7.2 The Larger Opportunity for Green Infrastructure

Stormwater and sewage flow are issues of environmental justice in Baden, since there has been sewage back-up in residents' homes. For MSD the problem is also one of ineffective customer service. They realize that displacement of householders and residents through the buy-out system is a challenge for the community. MSD Director of Environmental Compliance, Bruce Litzsinger, has noted that MSD "tries to be sensible and efficient in the redesign that aims to solve all of the sewage problems."[23] The amount of land taken for basins is calculated to be sufficient to capture maximum volume, and provide the most service for the minimal cost. "MSD is not able to investigate and pay for a lot of experimentation with what they do in projects like this," Litzinger explained.

One of the goals of the research presented in this report is to conduct the experimentation that MSD cannot do, and evaluate it against triple bottom line criteria. Triple bottom line evaluation criteria are used (loosely) to justify funding GI in the 2016 MSD GI Report. A quantitative approach to CSO/GI is presented in a report prepared by Stratus Consulting Inc. (2009) for the City of Philadelphia Water Department called *A Triple Bottom Line Assessment of Traditional and Green Infrastructure Options for Controlling CSO Events in Philadelphia's Watersheds*. This report concludes that Low Impact Development (LID)-based green infrastructure provides a wide array of environmental, social and public health benefits to the community and, importantly, that the more investment in GI, the greater the financial benefits to the city. The financial benefits accrue primarily through the reduction in plant mortality by heat stress, improved property value, increased recreational opportunities and water/habitat quality enhancement.

The MSD GI Pilot Program was enabled through the GI Plan that the EPA recently introduced, mandating MSD to spend $100 million on green infrastructure over 23 years. This is an experimental program. While, to date, MSD has used the money mainly to change impermeable surface to permeable surface, making green roofs and rain gardens for instance, they are interested in extending their efforts. So far they have not been able to integrate GI and stormwater detention basins (what MSD calls an "overlay") - they do one or the other in different locations. For example, a green basin might overflow into a regular basin.

One departure from MSD's normal approach is the Cortex Innovation Community, which was a partnership between Cortex and MSD. The project involves an extensive GI field, with different GI elements within it, including pervious paving, rain gardens, swales and infiltration ponds. MSD said that they paid for the stormwater infrastructure and Cortex paid for the GI.[24] MSD's financial target for the implementation of projects like the Cortex development (and the UVEI Baden Pilot Project) is $180,000 per acre. In the case of Cortex, the cost was approximately 150% higher than that. The target translates to $4.13 per square foot which, according to the CEL calculator, is very inexpensive for a landscape project. The Baden neighborhood open space plan involves approximately 20 acres of buy-out properties. The supplementary terrain (that when developed would "glue" the basins into one connected landscape) comprises a further 40 acres, not counting Dickman Park. Using the target formula, it would cost MSD $5.4 million of the $100 million GI funds if they completed their portion of the project as a GI development. The GI development of the supplementary terrain would cost $10.8 million more than that.[25]

The kind of green infrastructure investigated by the Washington University team incorporates detention basins and retention ponds, similar to those used extensively in the MLA student design for a multiple pond system, but without the surface GI connections between ponds. Retention ponds hold standing water:

22 http://www.stlmsd.com/what-we-do/stormwater-management/detention-basin-and-water-quality

23 UVEI meeting 5/16/16
24 (UVEI meeting 5/16/16)
25 The calculator devised by the CEL shows that the cost of development of a "high" value "wetland system" is $142.5,000 per acre. By the calculator, then, the 60 acres at Baden, developed as a wetland, would cost $8,550,000

they are permanently or semi-permanently wet. The WU open space plan does not propose extensive use of retention ponds, but they are incorporated precisely because of their ability to deliver the benefits identified in the Philadelphia report. On the one hand the plan particularly includes ecological services such as filtration for water quality, aquatic habitat for biodiversity enhancement, and mixed dry/wet species assemblages (fish, plants, insects, birds, animals) to assist with urban wildlife recovery. On the other the plan aims for social benefits: pedestrian walkways, children's play areas, active recreation zones, viewshafts, and allied social programs.

MSD has said that they are prepared to investigate incorporating the non-standard grading and contouring that wet ponds require into the shaping of their detention basins as long as they can be constructed to meet their slope and berm requirements. "Bioretention BMPs on the fringes of the detention basins, or a bioretention/detention hybrid is definitely something we are open to and interested in," Litzinger stated (UVEI meeting 5/16/16). However, retention basins are not viewed by MSD as a volume reduction method, so cannot be included in calculations of basin capacity.

7.3 Design Parameters

Integrating retention basins into MSD's standard basin design process requires understanding that process. Christine Palmer, the MSD civil engineer entrusted with the Baden basin designs explained the general detention basin design process, summarized below.

7.3.1 General Project Parameters

1. Check building foundations have been removed from basin zones
2. Check street removals have been approved
3. Check proximity of existing sewer lines and outlets
4. Identify existing trees to be retained
5. Set basin extent
6. Set basin depth
7. Calculate berm profile: 2-3' wide; min. 2%, max. 3:1 slope
8. Incorporate concrete spillway to road
9. Incorporate inlet structure: forebay @ 2% slope
10. Incorporate vegetation (tall grass).

7.3.2 Water Supply Parameters

Lecturer Gary Moore of Washington University and MSD explained the relationship between standing water and water supply. Incorporating green infrastructure means considering where the standing water in retention areas will come from to replace loss by evaporation, evapotranspiration and infiltration.[26] Approximately 45% of the precipitation on the catchment areas that will feed the basins (Fig 7.1) falls on impervious areas. Depending on a range of subsurface impediments, soil conditions, and evapotranspiration, less than that amount will be available to keep the ponds wet. Not all the water from a substantial event becomes run-off.[27]

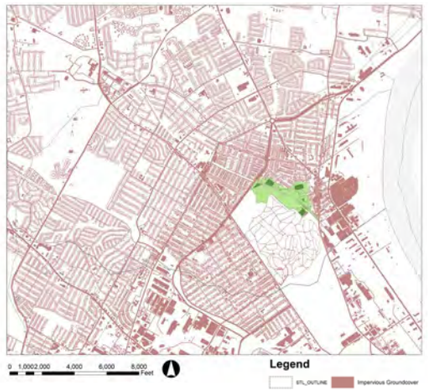


Fig 7.1. Impervious groundcover

To ascertain supply, the relation between pond and catchment is calculated in terms of acre feet. An acre foot is equivalent to one foot in depth over one acre of water. Five acres of catchment are required for 1 acre foot of surface area. The design team calculated the acreage of the Baden catchment field (the total water supply area) and the proposed acreage of water. The field has 107 acres of impervious catchment, which will yield 21.4 foot acres of water. The calculations for each basin yield the depth of the basin. This information is given in Section 9 of this report, The Open Space Plan, where the individual basin designs are explained.

If there were no collection systems in place, there would be sufficient run-off to fill the basins (Fig 7.2). This run-off could be augmented by water drawn from the existing CSS, but this is an expensive operation. It would mean adding new storm sewers through the drainage area to divert water from some

26 In the St. Louis region evapotranspiration and precipitation are about equal. Approximately 38" of rain falls in the region per year, and approximately 38" is lost through evapotranspiration.
27 It is possible to minimize loss by infiltration through the installation of liners for the ponds, but this is expensive, and there will still be continual water loss from the basin wet zones

of the existing sewer pipes and streets. The water from the CSS would enter the retention ponds with a high degree of impurities in it. Although the ponds are designed to remove potential contaminants, a less expensive option would be to divert water from the City supply. This water would contain chlorine and fluoride. Fluoride does not seem to affect plant health, though there is some evidence to show that chlorine does. A recent study on the role of nutrients and chemicals in GI showed minimal accumulation of chlorine in plants, but stated that the removal of these kinds of chemicals varies widely across the different types of green infrastructure. Exactly what the effect of high levels of chlorine and fluoride on soil microbes and other animals is difficult to assess. The study indicates that the removal of these chemicals is more effective in retention and detention ponds than swales and constructed wetlands (Driscoll et al. 2015).

MSD is relying on a 10:1 capture to basin ratio for a 100-year (7") storm event. However, smaller areas outside the main basin could rely solely on GI for a 4:1 ratio storm event (these occur approximately every 3-4 months and yield 1" of rain water).

7.3.3 Mosquitos

Research conducted in Baden by Washington University's Tyson Research Center indicated a dominance of the invasive *Aedes albopictus* (Asian tiger mosquito), which lays its eggs in standing water. The depth of the retention ponds in the proposed open space design varies between 1' and 5' depending on the ecological resource it is intended to generate. Therefore it is necessary to consider the control of mosquitos. Most studies, and certainly most informal advice, regard the removal of mosquito larvae as more effective than attempts to control adults (Centers for Disease Control; EPA).

In keeping with the use of natural processes to provide water quality and wildlife habitat, the use of pond design techniques and natural predators for larvae control presents as a more suitable alternative to the application of larvicides and other water-based treatment programs (Arn and Unmack 2010). The fish species *Gambusia affinas* is often cited as an effective predator of mosquitos in retention ponds and this species has been successfully introduced in many aquatic systems around the world (Aarn and Unmack 2010).

One female can consume hundreds of mosquitos in a day (up to 300 per hour). Recent studies, however, show that there are problems with the use of *Gambusia*, especially when introduced outside their

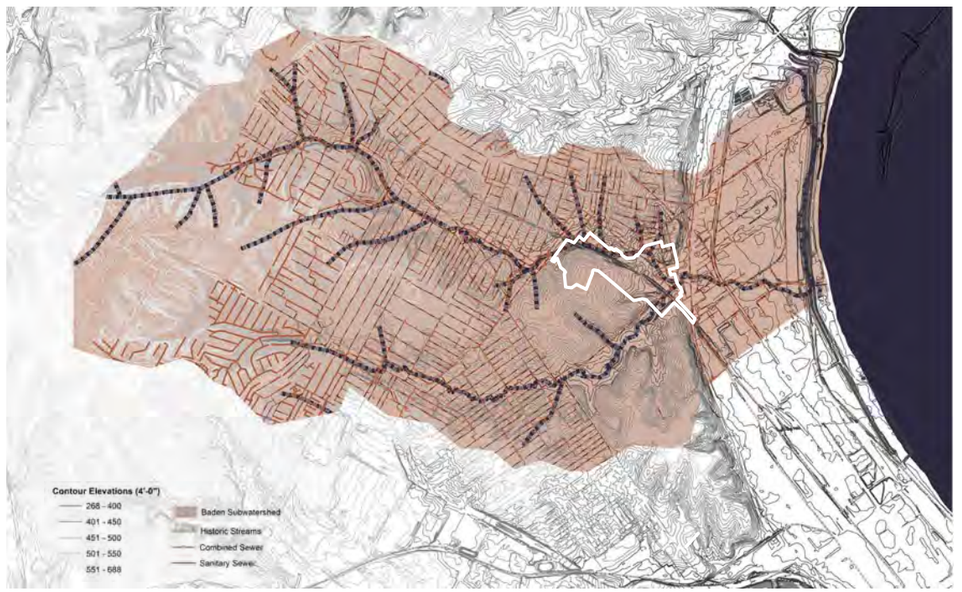


Fig 7.2. Combined stormwater and sanitary system

natural range. They have been known to predate other insect larvae, for instance, including native predators of mosquito such as dragonflies, as well as the eggs of various native fishes and amphibians (WDFW 2017). *Gambusia* do occur in Missouri and the Missouri Fish and Wildlife Information System lists them as present in the wetlands and lakes of St. Louis County, but it may be prudent to consider alternatives. Other small native fish species are known to eat mosquito larvae, including those in the killfish family. Killfish occur in all types of stream habitat, including shallow areas with swift currents, pools and backwaters (Minckley 1969; Pfleiger 1997, 327; MFWIS 2017). Larger fish such as bass, bluegill and catfish are natural predators of mosquitos. Whether these species can or should be introduced into urban ponds is a matter of further investigation, and a natural systems approach to the mosquito issue would seem to make this research worthwhile: "Try finding a mosquito in any body of water inhabited by fish" (Aarn and Unmack, P. 2010).

7.3.4 Fencing

MSD is required by Missouri code to secure basins with side slopes of less than 3:1 with 6 ft fences and to fence basins that can fill 4' or more in a 100-year storm event, just in case a person is in the basin when it begins to fill. The proposed Frederick basin is 3' deep and will not need to be fenced (it is wide and broad enough not to require greater depth for flood mitigation). The two other proposed basins, Partridge-Oriole and Tillie, must address the issue of fencing from the perspective of safety. Taking the fence away is new for MSD, Litzsinger said, but it could be classified as "greening" in the same sense that removing buildings and impervious areas are so classified. The eventual design for the Tillie and Partridge basins would evolve through a negotiation of the safety requirements, and how these might be met.

7.4 Designing the Water

While the engineering design of the green infrastructure at Baden is not an objective of this investigation, finding out how plastic the current parameters are for basin design is an important step. MSD has demonstrated a willingness to discuss and evolve their approach to urban stormwater basins, both through their GI Plan and their enthusiasm for Washington University's involvement in the development of a water-led park design for the Baden community. An integrated approach to stormwater management is good for the watershed, the community and the urban water system, where stakeholders form a partnership and share ideas toward a common vision. Detention and retention ponds could, in many parts of St. Louis, be the catalyst for new public space. It is important how these waterways are incorporated into a strategy for sustainable urbanism - if the water systems are not operating at all levels, the city cannot fulfill its responsibilities environmentally or socially.

BASIN WATER SUPPLY

Fig 8.1. Baden open space masterplan

8.0 THE BADEN COMMUNITY OPEN SPACE PLAN

Research conducted by the students in the Master of Landscape Architecture studio, discussions and workshops with the community of Baden, and interactions with UVEI and MSD led to a very specific approach to the final design of the open space plan, which was undertaken in the summer and fall of 2016 by a team led by Rod Barnett. This new design supersedes the work done in the Master of Landscape Architecture Design Studio, building on the outcomes and proposals from that work and responding to the critique of the student work elicited in the Final Reviews with which it terminated. (The student designs are explained in a publication called *Soaking the Ground* (Barnett 2016a).

There are five components to the proposed design strategy:

1. Theoretical Framework

The plan had to be based on solid, current principles and methodologies of urban ecology. The student team had visited Baltimore, observed the 20 year Baltimore Ecosystem Study (BES), and interviewed its directors, doctoral students involved in the study, and scientists conducting ongoing research. The BES published a book called *The Baltimore School of Urban Ecology* (Grove et al. 2016) which was reviewed and discussed in the studio. Students agreed that the tenets and principles it laid out are consistent with the Sam Fox Master of Landscape Architecture's commitment to bring together ecological urbanism and social justice in the development of landscape solutions within the urban environs of St. Louis, MO.[28] This generated the basic theory.

2. Community Participation

Meetings, workshops and surveys conducted with members of the Baden neighborhood provided the students with information direct from the community. The results of these community engagement initiatives are summarized in Ch. 5, Community Engagement. In community meetings our team found a group of people who were unhappy with the prolonged demolition process and upset about the MSD buyout program. However, residents were also optimistic about moving forward and developing a long-term community asset from the opportunity. While there is currently relatively high dissatisfaction with neighborhood greenspaces (40% of respondents to the public health survey reported dissatisfaction), information gathered through our community engagement process showed positive reactions to the proposal for an open space system that delivered ecosystem services, infrastructure to provide opportunity for physical activity and family gatherings, and immersive plant and water-based scenery.

3. MSD

The MSD's plan for the development of three basins in the Baden neighborhood is the impetus for this open space project. Integration with their water management guidelines, their basin design parameters, and their vision for the incorporation of green infrastructure BMPs into their design strategies, is critical to the success of the open space proposal. While the partnership with MSD depends on the ability of the proposal to meet their flood mitigation objectives, their budgetary structures, their timeframes and their implementation procedures, it also requires some flexibility on the part of MSD to incorporate integrated GI practices into the design and implementation of standard basins.

4. UVEI

The proposal was only possible as a result of the City's Urban Vitality and Ecology Initiative. It was therefore important to understand UVEI's goals and objectives, both at the level of individual Pilot Projects and at the scale of the city. While the design for Baden had to be based on the neighborhood's particular geography, hydrology, community and context, it was desirable nevertheless that aspects of method, process and outcome would be transferable to other Pilot Project sites, and indeed could be useful in the ongoing selection of Pilot Project sites. UVEI's roles include ensuring feasibility and viability, advocacy, the development of standard process for Pilot Projects, engaging St. Louis's professional and philanthropic community, and the development of a strategic implementation network that could fund successive phases of the construction not funded or built under the auspices of MSD.

5. Washington University in St. Louis

The fifth component of the open space planning process is provided by Washington University in St. Louis. The mobilization of the interdisciplinary research, planning and design team enabled the UVEI Baden Pilot Project to be based on current, relevant empirical research in Baden. The Washington University team of environmental scientists, ecologists, political scientists and landscape architecture faculty and students was responsible for the initial idea for an interactive system of outdoor laboratories, community gardens, urban agriculture, ecologically diverse biotic communities and other related elements. From this foundational set of objectives came the development of a unique spatial and social vision for the Baden community.

28 http://www.samfox.wustl.edu/programs/mla

8.1.2 The Formula

Aggregating the five components above yields the following open space design formula for Baden:

	urban ecology principles	+	Baden community aspirations
+	MSD guidelines	+	UVEI initiative
+	WU research and design	=	the Baden Community Open Space Plan

8.2 Proposal

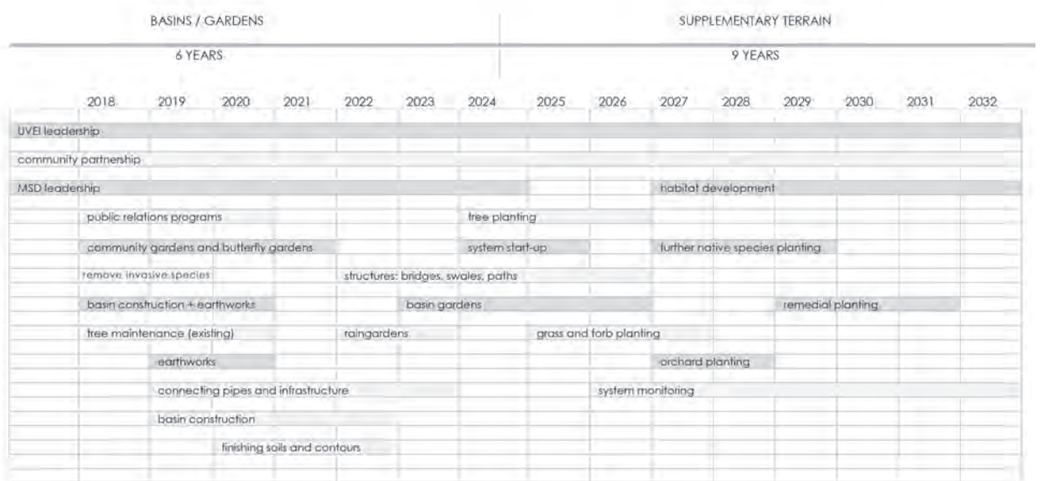
8.2.1 Initial Framework

A self-sustaining ecological landscape in urban terrain is best established over time, usually decades. The involvement of local community members in this process also takes time, as they too adapt and evolve to the changing circumstances that a shared, long-term project requires. Research in urban ecology, landscape architecture, community planning, and social justice, as well as long experience amongst communities and their advocates, shows that masterplans oftentimes, for a variety of reasons, do not get built as planned, if at all. It is better to develop a planning and design *strategy* for large-scale community projects, than a *design proposal* with precise instructions for construction as designed. The Baden Open Space Plan proposes an initial framework, involving ground-plane contouring, planting and some infrastructure integrated as much as possible with MSD's plans for managing the water in the district.

8.2.2 Scenario Planning

After the establishment of this basic condition, multiple alternative landscape scenarios may evolve, depending on a wide range of unpredictable contextual forces. The initial landscape condition should be an agreed platform with a set of broad, flexible rules, so that it is as open as possible to change, and can adapt to this change, becoming more robust in the process. While it is not possible to predict how external events may affect, say the boundary conditions of the park, or the funding of structures such as pavilions and bridges, it is possible to speculate advisedly on possibilities.

Table 8. The main components of the long-term strategy [fifteen years]



8.3 Key Elements

8.3.1 Ecological Democracy

The Baden Open Space Plan seeks to establish a socio-ecological system in which the social and the biological are given equal weight, and the ultimate goal is a healthy human habitat that operates as an integrated social-ecological assemblage. This requires a design approach that weaves the social into the design of the biophysical and vice versa, so that they are integrated as much as possible from the beginning of the project.

8.3.1.1 Three Gardens

Three gardens are proposed, one at each basin site:

Partridge + Oriole Aves	*prairie garden*
Tillie Ave + Newby St	*glade garden*
Frederick St	*woodland garden*

These landscapes reflect the regional ecologies of Missouri, using native plants to clean the water, create habitat, and provide a pleasant amenity for the people of Baden. To achieve this, the basin structures are designed to resonate with the community's values, aspirations and objectives, as identified in the surveys conducted by WU faculty and students. The basins are redefined as *gardens* to diminish the effect of the instrumentalisation of the neighborhood landscape that the word "basin" implies, to enhance legibility of the overall social-ecological thematic, to emphasize the constructed nature of the project, to domesticate the native plants that are used exclusively throughout the proposal, and to contribute to the revaluation of the neighborhood as a great place to live.

8.3.1.2 Interstitial Terrain

The three gardens merge as seamlessly as possible with the interstitial landscape that "glues" the whole assemblage together. This connective terrain comprises ecotonal plantings that characterize the overlapping of ecosystems, such as might be found between prairie and woodland. Developing the large, irregular Baden site into one interactive biophysical assemblage means utilizing some land not owned by MSD or LRA. Daley International, the cleaning product company, runs a storage and warehousing facility at 1240 Switzer, between the railroad and Dickman Park (see Fig 8.2. which shows parcels not owned by MSD and LRA). Linking the western and eastern halves of the terrain together requires the use of Daley International land. Within the overall framework a range of supplementary - important but nonessential - components are established. These are three independent (but linked) rain gardens, a butterfly

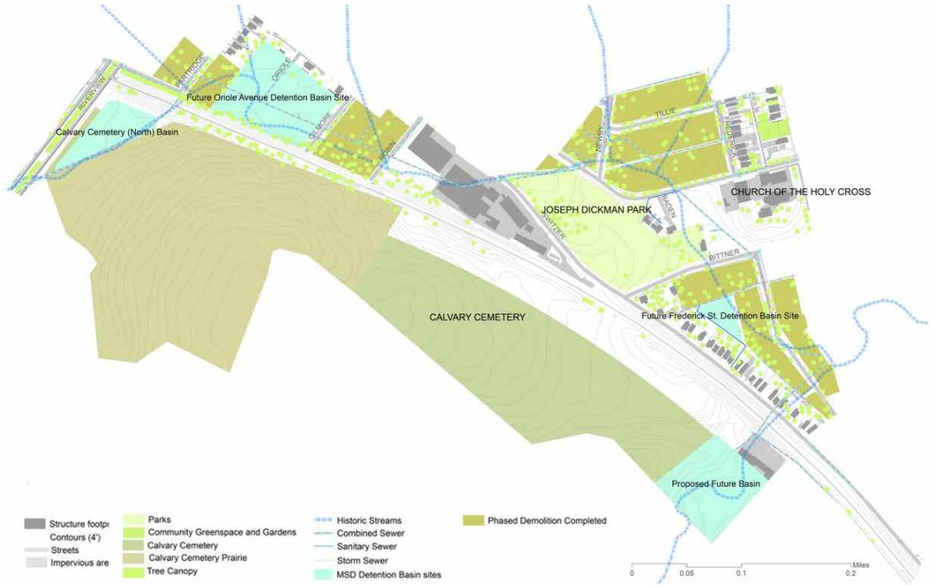


Fig 8.2. Parcels are not owned by MSD or LRA

garden, passive and active recreation areas (such as play and picnic areas), and a community orchard.

8.3.2 Water Management

The three basins are considered as temporary storage or holding ponds. Each basin contains filtration and discharge devices that function independently, at the same time as working with the other two to accept water from the overall catchment area. During heavy rain events, overflow will be temporarily stored in the basins to protect against flooding, until it finally discharges directly to the CSS. Generally, stored water will not move from basin to basin (as it does in the student design), but remain in the individual basin and discharge straight into the sewer system. This strategy, rather than the networked scenario explored in the studio, means that overland and subsurface inter-basin infrastructure is minimized, and costs reduced accordingly. As mentioned in the previous section there is potential for the Frederick basin to accept discharge from Tillie and Partridge during high storm events and, should this be considered desirable, the drainage infrastructure that enables it should be constructed at the same time as the basins and their drainage, overflow, and pipe systems.

The overall water management objectives of incorporating GI into the detention basin design are to:

- Reduce the occurrence of floods
- Moderate flood peaks
- Increase infiltration of rainwater
- Improve water quality
- Provide habitat
- Increase biodiversity
- Connect residents to urban nature by revealing the water cycle

Together, the basin gardens act as sponges to soak up extra water during times of heavy rain, and slowly release it at a rate with which the stormwater system can cope.

Prior to implementation of any of the above, the whole is graded to ensure the required capacity for flood mitigation. Structural elements (the walls and steps proposed for the Tillie and Frederick basins) are constructed at the same time as the grading is carried out.

8.3.3 Structures

The elements of the proposal that are not biophysical are important to its success as a social landscape that fully supports community life. On the one hand, they include such separate components as pedestrian and bicycle circulation, a physical fitness circuit, picnic areas, observation points, sports fields, a bridge, repurposed drainage pipes and a community pavilion. On the other, they involve the synthesis of biological and constructed elements within the structure of the basins themselves, where stepped terraces, wooden or concrete walls, and fencing become intrinsic parts of the basin structures. These elements perform socially and ecologically at the same time, bringing recognizably architectonic lineaments to ecosystem functionality.

8.3.5 Potential Community Anchor

The Church of Our Lady of The Holy Cross is the primary community hub in the Baden neighborhood. However, the Daley International buildings at 1240 Switzer are ideally located and scaled to become a related, but different, kind of community-based retail and service center. The development of a neighborhood resource on this site would require finding investors, repurposing the buildings, attracting/

Fig 8.3. Three Gardens

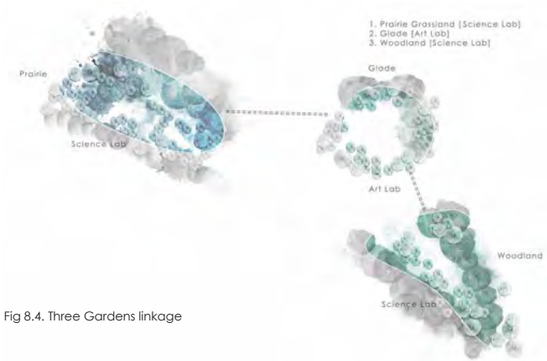


Fig 8.4. Three Gardens linkage

enabling appropriate users, and integrating the site into the overall open space plan. Some possible uses include:

- Urban Field Station for conservation organizations
- Urban Ecology Lab
- Youth Employment Center
- Not-for-profit bicycle sales and repair

Fig 8.5. Wet ponds embedded at the bottom of dry ponds

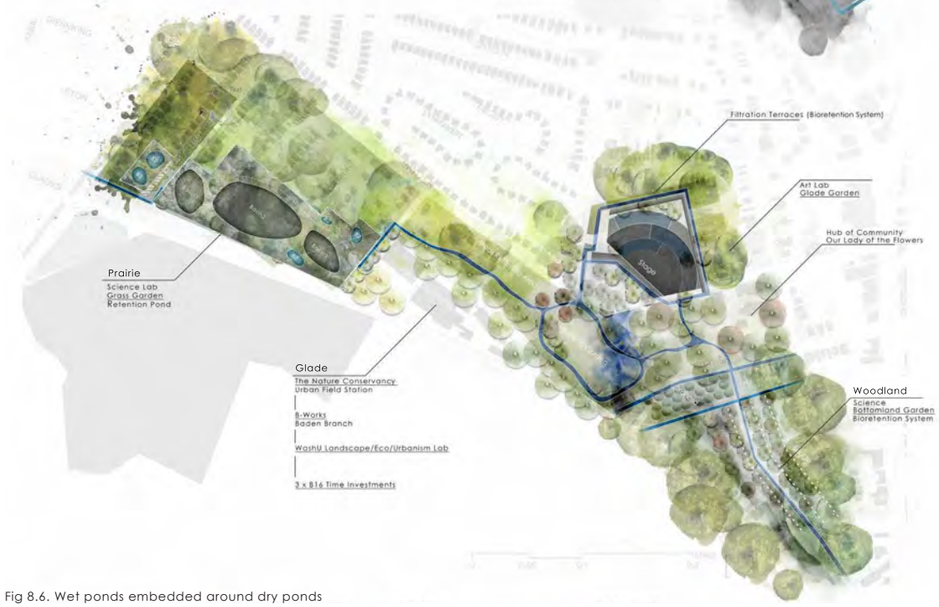


Fig 8.6. Wet ponds embedded around dry ponds

8.4 Garden Design Studies

The design studies that follow do not propose specific solutions. Rather they explore ideas. The Partridge-Oriole Prairie Garden incorporates three different approaches, which are shown in three different plans and accompanying drawings. Within the three designs there are further explorations. The Tillie-Newby Glade Garden also investigates three alternative treatments of a difficult but promising basin site. Finally, two separate studies are developed for the Frederick Woodland Garden, and a series of alternative treatments is shown for the basin edge.

8.4.1 Partridge-Oriole Prairie Garden

MSD's proposed Partridge - Oriole basin will extend the existing low-profile detention basin between Partridge Ave and Oriole Ave eastward to Gilmore Ave and westward to Partridge. Five parcels on the other side of Partridge will not be able to be incorporated into the Partridge-Oriole basin as (unlike Gilmore which will be truncated) the road cannot be removed to accommodate this. MSD has said this could become green infrastructure. There are possibilities for further supplementary rain gardens that could be linked to the larger detention basins, but not available for water storage in flood events. These possibilities are explored in the designs below.

The opportunity exists to create a dry pond (detention) system with wet (retention) ponds embedded in it. Combining both types improves water quality, enables a more complex plant community to evolve, increases habitat, offers a wider range of user experience, and permits the introduction of aquatic bird, insect and animal species. Two alternatives are proposed:

1. Wet ponds are embedded at the bottom of dry ponds (this is the condition illustrated in the overall open space plan (Fig 8.5) and the cross section on p.82)
2. Wet ponds are embedded around the dry ponds (illustrated in the cross-section on p.82).

The Partridge basin draws on a catchment of 38 acres. The current basin takes two days to drain after a big storm. There is no standing water. The new basin is designed (by MSD) to cover 7.14 acres.

Three different scenarios were investigated for the incorporation of green infrastructure into the MSD design for the Partridge Basin:

Study 1. Stepped Terraces of Wildflowers + Water
Study 2. Tallgrass Prairie Rows
Study 3. A Prairie Wetland

Each design study addresses MSD requirements for capacity, storage and release. MSD has set the minimum berm elevation at the 444' level (Fig 8.7). Allowing for one foot of freeboard that means the maximum water level in the basin will be at 443'. MSD has indicated that a spillway will be located on the south side, approximately 20' long and one parcel wide - this could double up as an access road. The cross-section in Fig 8.8 shows how this works.

Whatever the design, any basin proposed for the Baden area must have sufficient capacity to take 5" of rain (a 20/3 cloudburst) before major flooding occurs. The component parts of a standard basin must be incorporated into any alternative basin designs. These include a berm of recommended dimensions, an outlet structure, an overflow weir (emergency spillway) and an Inlet/collector that catches trash and particulates.

Fig 8.8. A spillway located on the south adding another access road

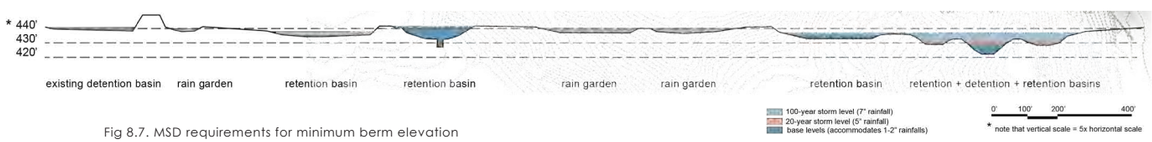


Fig 8.7. MSD requirements for minimum berm elevation

Two of the three design systems require the re-grading of the existing Partridge-Oriole basin, in order first to maximize the GI BMPs for this basin zone by enabling more macrophytic and prairie plant species, by providing more habitat structure, greater biodiversity, and more community access. Second, re-grading the existing pond enables the westward view from Gilmore and the vista eastward from Partridge to be more comprehensive - not only looking like the operational ecosystem it is evolving into, but through the combination of plant gradients and contouring, becoming more beautiful.

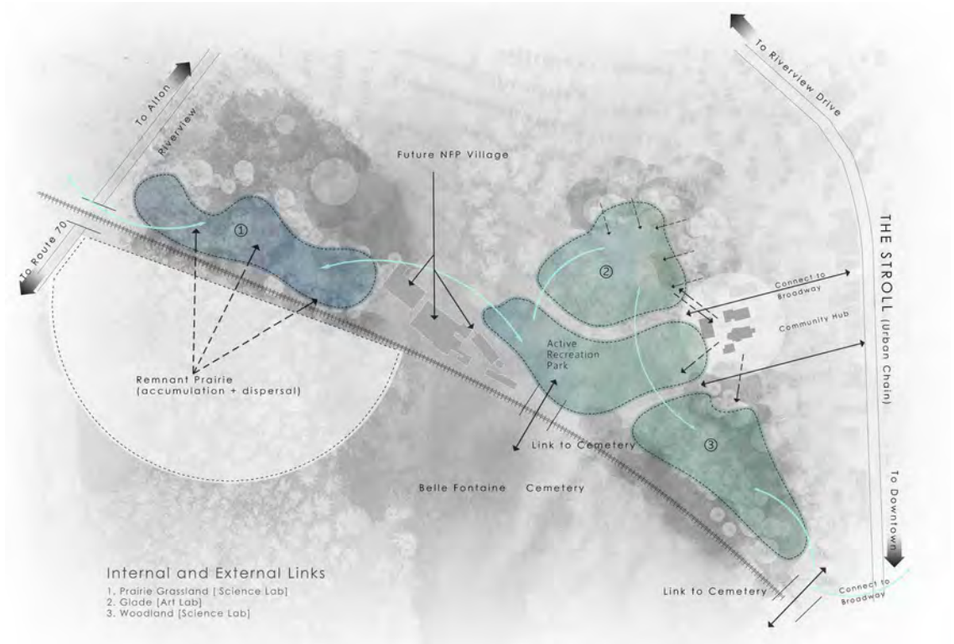


Fig 8.9. The Baden proposal connects neighborhood and welcomes participation

Fig 8.10. Partridge Study 1: Stepped terraces

Partridge Study One: Wildflower water terraces

This plan consists of stepped terraces of lawn and native grasses that capture and filter water. The usual order of filtration is reversed, as the water enters the basin through a collector/particulate filter, and then moves through an accessible lawned terrace to a lower area planted with grasses where it can either drain within a 72 hour period, or be developed as a retention pond. The north terrace, closest to the parking lot, is a bioretention zone. It receives water from the roads, filters it and discharges it into the CSS (or recycles it). The middle terrace (lawn) and south terrace (grasses) have sufficient capacity to capture the required amount of water (5") during heavy rain events and in 7" rainstorms can overflow into the upper water terrace. A spillway from the upper terrace discharges stormwater on to Gilmore Ave and Robin Ave. This design presents the Partridge basin as a constructed prairie garden using a very precise range and number of species for maximum flowering season impact.

Fig 8.11. Partridge Study 1 perspective

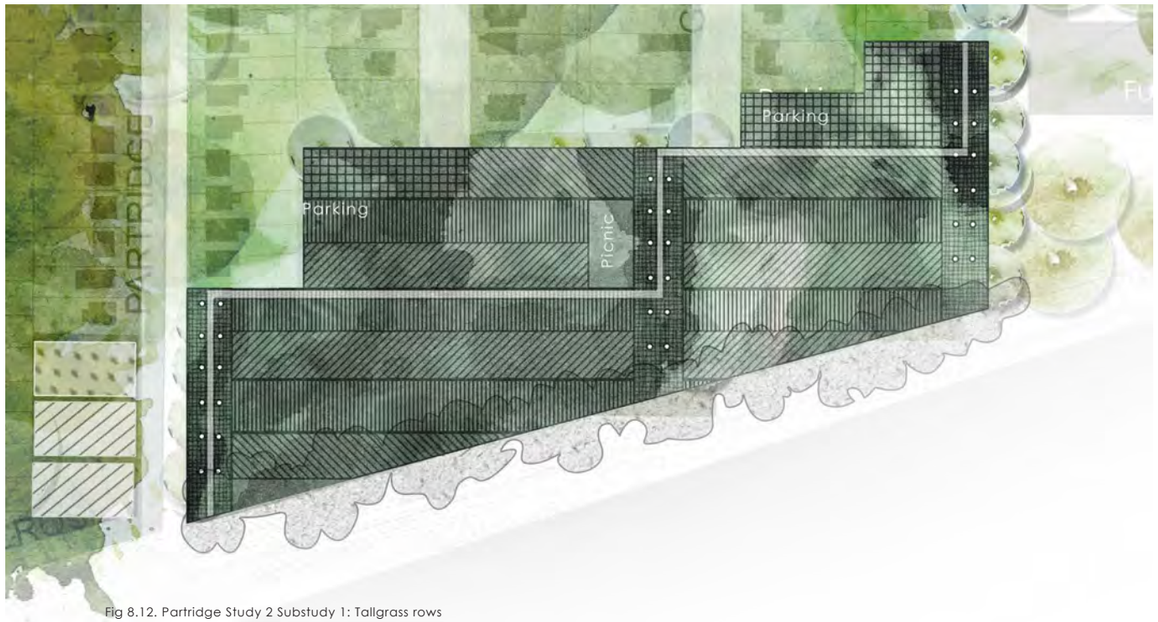


Fig 8.12. Partridge Study 2 Substudy 1: Tallgrass rows

Partridge Study Two: Prairie tallgrass rows

The second Partridge plan takes the idea of a prairie garden further by gathering selected wildflower species into rows that enable visitors to pass between the plants on narrow paths. The row species can be selected according to the maximum height of the plants, or flower color, or flowering season. The proposed linking path and cycleway brings visitors through the middle of the garden, and a picnic area is located where the east-west rows are divided by trees in double lines running north-south. In this design the basin need not be terraced or stepped, but the floor of the basin should be level to

Fig 8.13.Partridge Study 2 perspective

Fig 8.14. Partridge Study 2 Substudy 2: Tallgrass rows

accommodate the rows of grasses, enabling visitors to distinguish between plant species according to height, color, flowers, and seed heads. The basin can be constructed according to the requirements of a standard MSD basin. The plan shows parking lots, the cycle/pedestrian way, and access across the rows by way of berm or bridge (Fig 8.12).

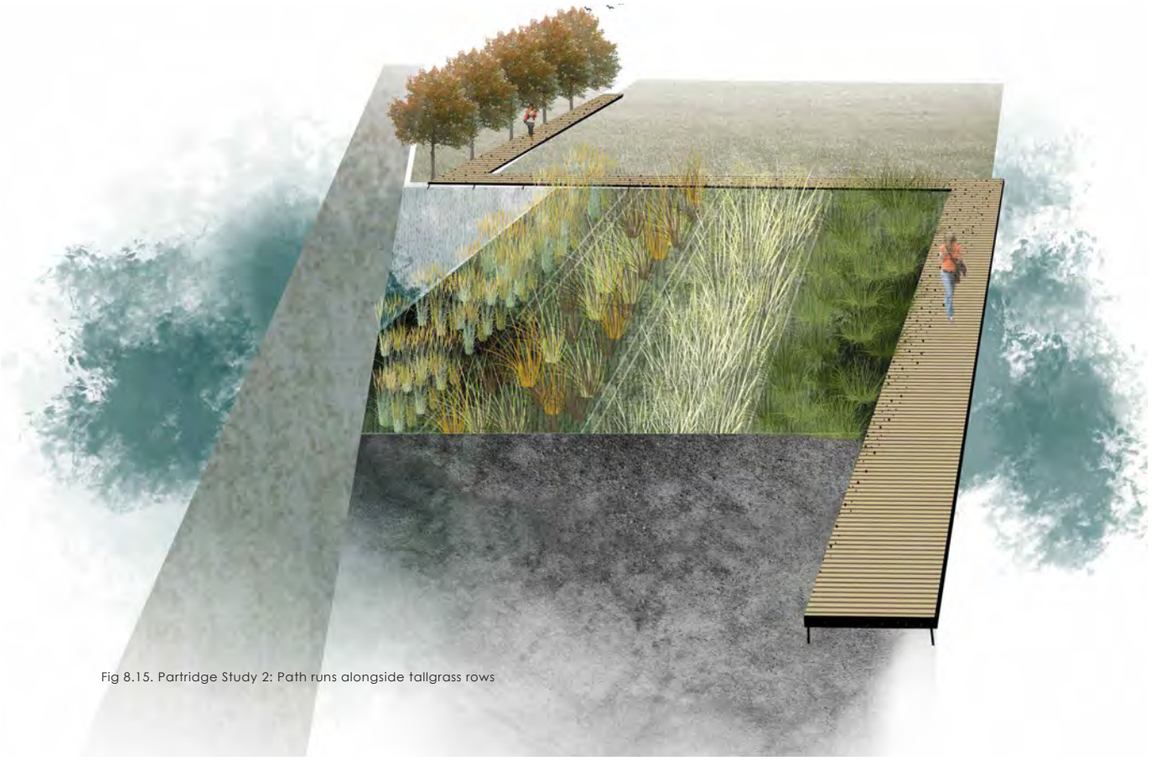


Fig 8.15. Partridge Study 2: Path runs alongside tallgrass rows

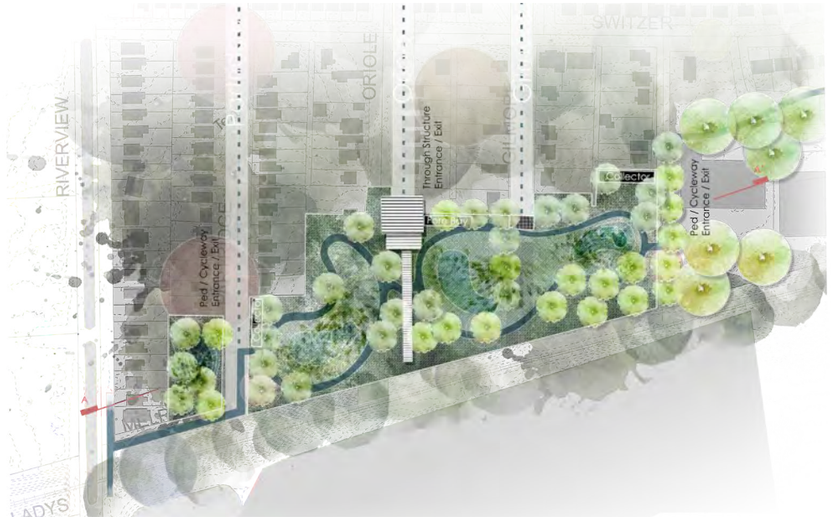


Fig 8.16. Partridge Study 3 Substudy A

Partridge Study Three: A prairie wetland

This is a naturalistic wet prairie setting. The basin zone is divided by a boardwalk entered from Oriole Ave by means of a wooden pavilion with a butterfly roof. The boardwalk leads to a deck below the railroad bed, from which the Partridge garden can be viewed. There are two sub-studies: in the first a pond is graded to permit water to stand in the lowest contour after a large-scale rain event (Fig 8.16). The exposed sides are planted with native species adapted to the variable conditions. Careful selection of forbs and grasses - for instance, bluestar, bergamot and coneflower - would enable the slopes to be covered permanently. While the ponds are intended to mostly be dry, they could be designed for water on the bottoms to drain more slowly, or to even be permanent. The depth of this water could be 3', to sustain some aquatic life: plants, insects, even fish and birds, though for successful fish habitat most recommendations are for 8' of water over 25% of the surface area.[29] The long-section shows how the contouring enables water to be caught in the low-lying areas (Fig 8.18, 8.19). In the second substudy the basins are designed as oval dry detention ponds surrounded by smaller wet bioretention zones (Fig 8.17). The basins fill to capacity and drain, while the bioretention zones (BZ's) remain filled with water.

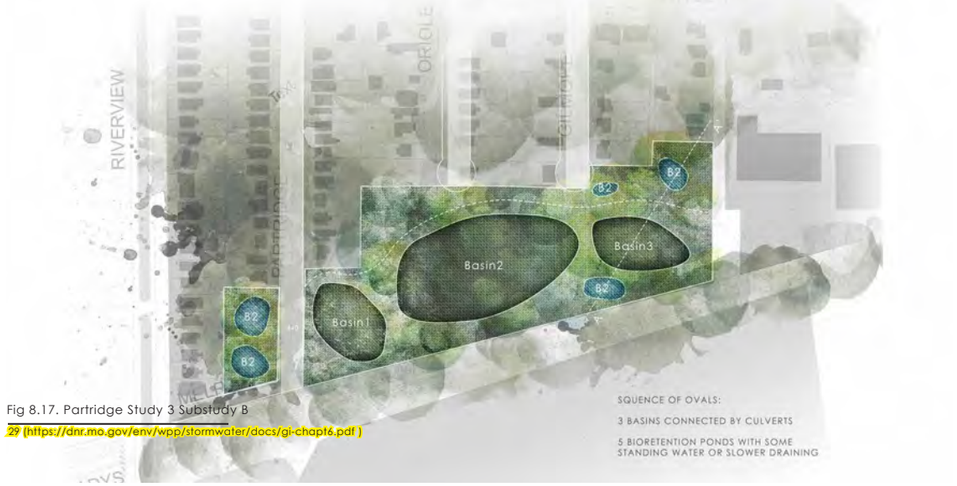


Fig 8.17. Partridge Study 3 Substudy B

29 (https://dnr.mo.gov/env/wpp/stormwater/docs/gi-chapt6.pdf)

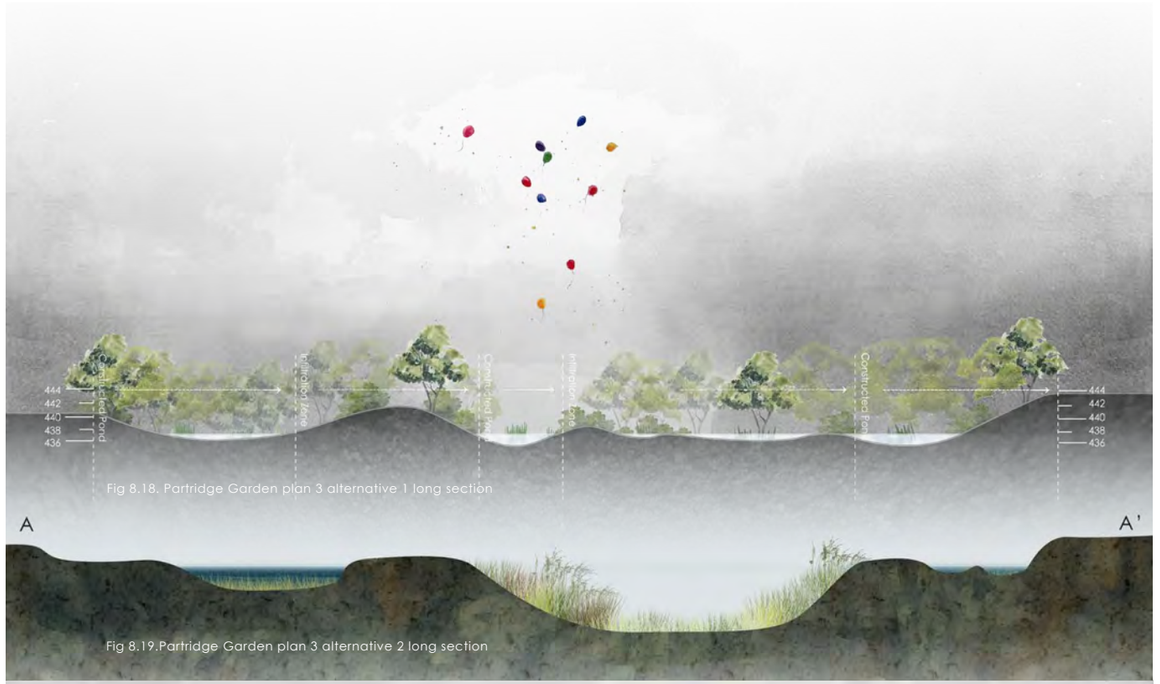


Fig 8.18. Partridge Garden plan 3 alternative 1 long section

Fig 8.19.Partridge Garden plan 3 alternative 2 long section

Fig 8.20. Partridge Study 3 perspective

8.4.2 Tillie-Newby Garden

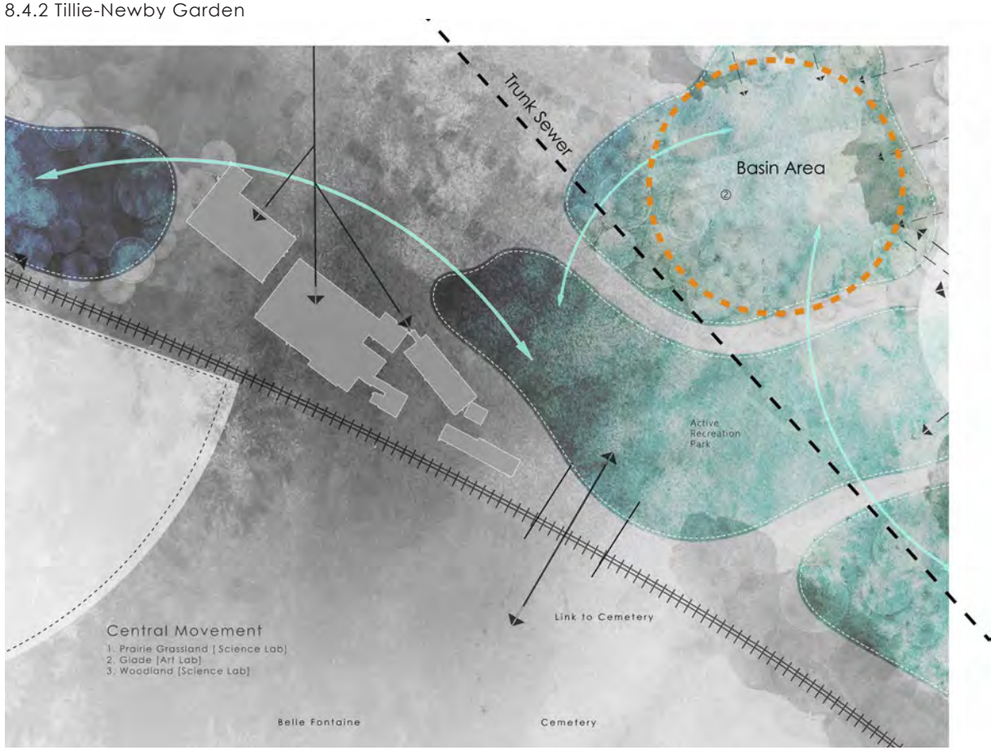


Fig 8.21. Tillie-Newby Garden showing location of sewer

The MSD plan for the basin in this area requires the removal of Tillie Ave. This plan is complicated by the fact that an underground trunk sewer goes through the south-west part of the basin site. Soil cannot be removed from around the sewer line, so the basin is constrained to the north two-thirds of the site (Fig 8.21). This constraint has meant that the site may be developed as an amphitheater with the stage to the south. The maximum water elevation in the basin will be set at level 439'. Stormwater would enter the basin from half way down Newby at approximately 430'. The depth needed for a 100-year storm is 428, and so MSD will set a small orifice pipe in the overflow structure at 427. The emergency overflow weir will be at 439, making the outflow structure 12' high. Any storm beyond the 100-year rating will exit the basin by means of the spillway. However, MSD states that the Tillie Basin could be connected by pipe to the proposed Frederick basin, since the latter has more than enough capacity for its catchment. In this case the Tillie basin would overflow into Frederick during periods of rain greater than 5".

The Tillie basin is divided into planting zones that exemplify the characteristics of a glade or savannah. Glades are small, thin-soiled, rocky clearings in timbered areas, typically found on south- and west-facing slopes (WU 2017). A mesic savannah is a seasonally saturated area dominated by widely spaced trees so that the canopy is open or not complete. Glades and savannahs are resistant to drought, and yet experience regular inundation (Nelson 2010). The savannahs at Shaw Nature Reserve have chinquapin oaks with an understory of violets, primroses and coneflowers. The three Tillie designs study the translation of these ecotypes into small, urban gardens that draw attention to their biological value and demonstrate their intrinsic beauty. The studies explore the dramatic potential of the slopes and levels required for basin capacity, and introduce rocks as a graphic and spatial feature that is also a place for children to play.

Tillie Study One: An inverted cone

The basin is a cone and plane system that offers a variety of programs, from events to botanical inquiry. The trees are planted in lines, with a north-south line of rocks doing double duty as a playground for children (Fig 8.24). A second version of Study One has the curved plane of the cone planted in short grasses with fastigiate trees creating a boundary, either following the streets, or following the curve of the bowl (Figs 8.25, 8.26). In medium to large rain events the bowl fills with water. The southwest wall is configured as an instrument for measuring water level. This simple gauge would indicate to visitors the various levels that water has reached at different times. These levels can be related to the plants growing on the opposite slope, so that species' hydric tolerances are connected to actual hydrological conditions. Plants could be distributed in layers to underscore these relationships.

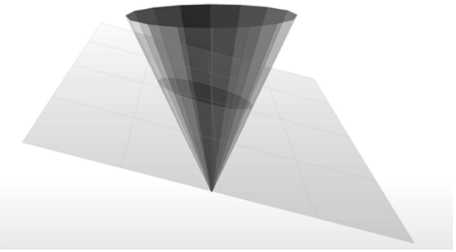


Fig 8.22. Inverted cone model

Fig 8.23. Inverted cone model section with slope

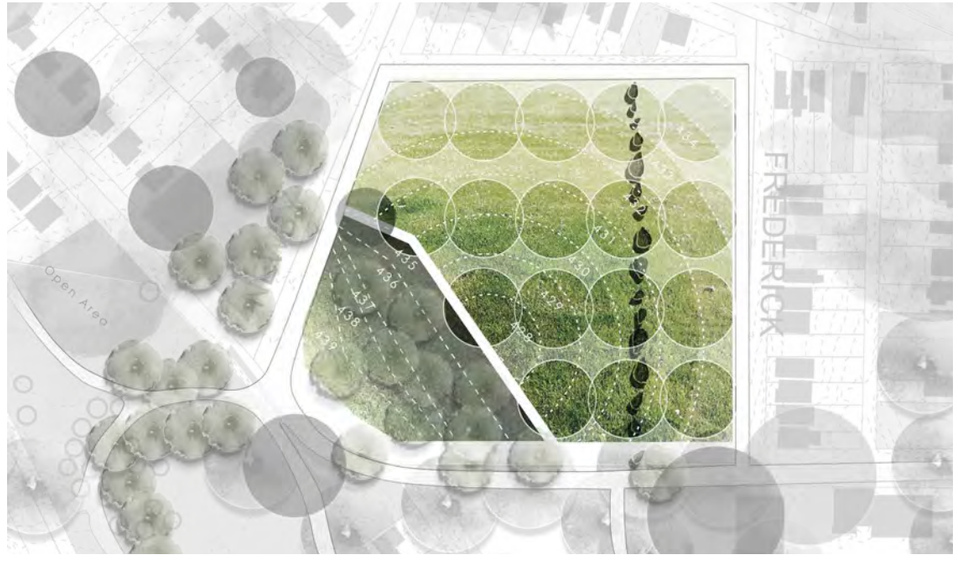


Fig 8.24. Tillie Study 1

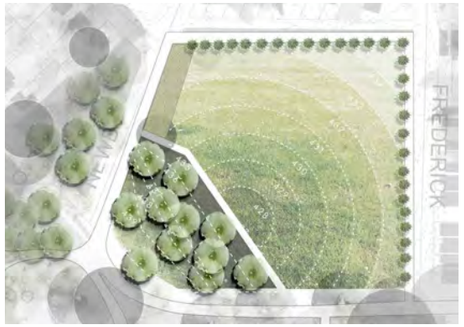


Fig 8.25. Boundary with fastigiate trees following the street

Fig 8.26. Boundary with fastigiate trees following the curve

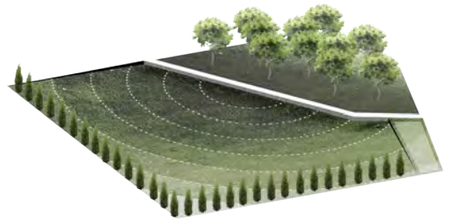


Fig 8.27. Perspective of south-west wall

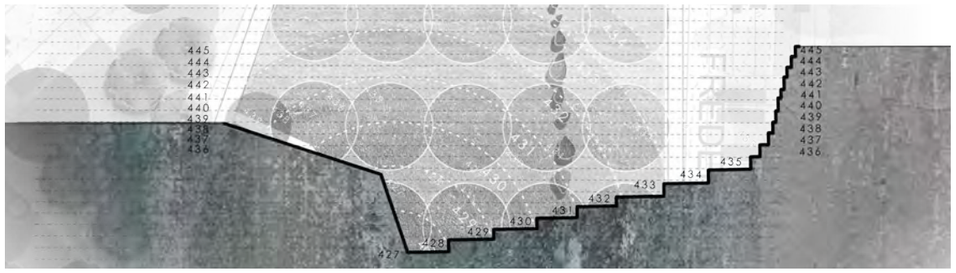


Fig 8.28 Inverted cone model section with broad steps

Fig 8.29. The line of rocks serves as a playground for children

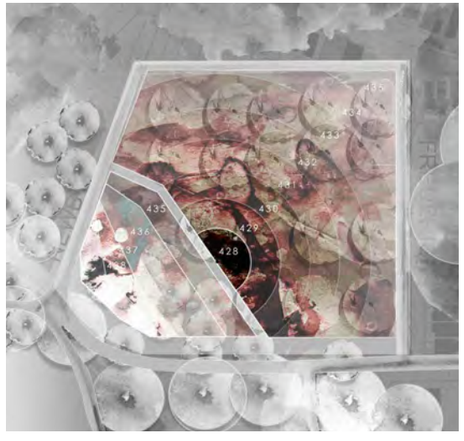


Fig 8.30.

Tillie Study Two: Water steps

Broad shallow steps of grass alternate with curved ponds that support aquatic plants. There is a performance stage at the bottom (Fig 8.31). Stormwater enters the basin through the collector, which conducts a first stage cleansing, and then passes from retention pond to retention pond on its way to the CSS, or to be recycled by pumping. This layout, the most programmable of the three presented here, exploits the potential of the site as an amphitheater for formal and informal local performance events. Lights enable the space to be used for events at night, and are also an opportunity for signaling the space as a community landscape that is cared for and played in (Fig). Construction would be simple and robust, and designed to make maintenance as easy as possible. The garden/basin could be fenced and gated, and opened only for events, or it could be developed to reduce or eliminate the need for fencing. Note that a staircase is placed to enable rapid entry and exit!

Fig 8.31. Tillie-Newby Study 2

Fig 8.32. Section through Tillie-Newby Study 2

Fig 8.33. Section through amphitheater

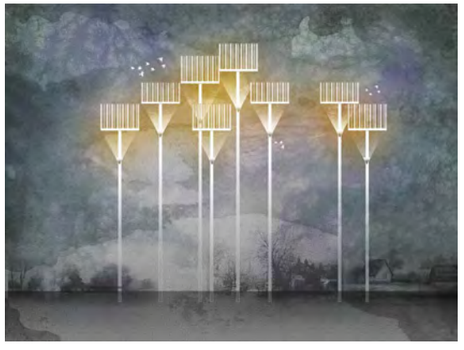


Fig 8.34. Lights form a prairie in the sky

Fig 8.35. Perspective of stage and amphitheater

Tillie Study Three: Rock and contour

Some additional grading would have to occur, but this scheme is mostly a planting strategy, with rocks to add scale and informal seating, and to testify to the garden's origin in the idea of a Missouri glade. The cross sections show that the grading can be combined with steps, particularly at the collector (Fig 8.37), and that there could be a retention function. If handled well the garden could be pedestrian accessible. Depending at what level the outlet is set, water could drain in 72 hours. In this case the upper slopes would be seldom or never inundated and the slopes could be covered with a naturalized community of appropriate plants. Figure 8.38 shows two different cross-sections to indicate that the overall concept of the basin is open to different treatments, depending on project requirements, and the perspective depicts a designed condition that is curiously close to the way dolomite sinkholes are incorporated into urban parks such as Carondelet Park where the underlying karst system is revealed as a dramatic landscape feature.

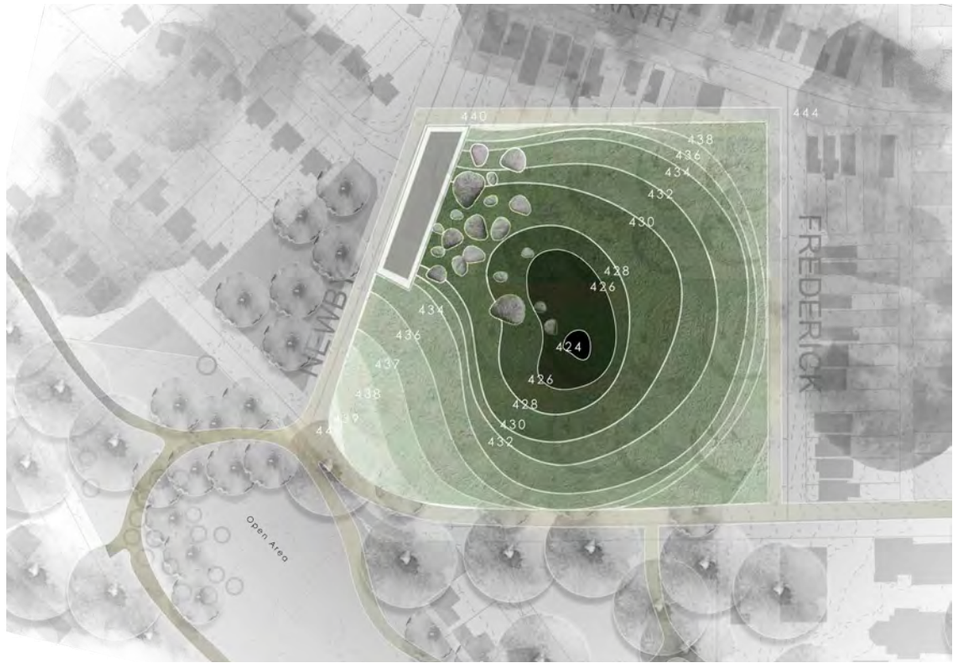


Fig 8.36. Tillie-Newby Study 3

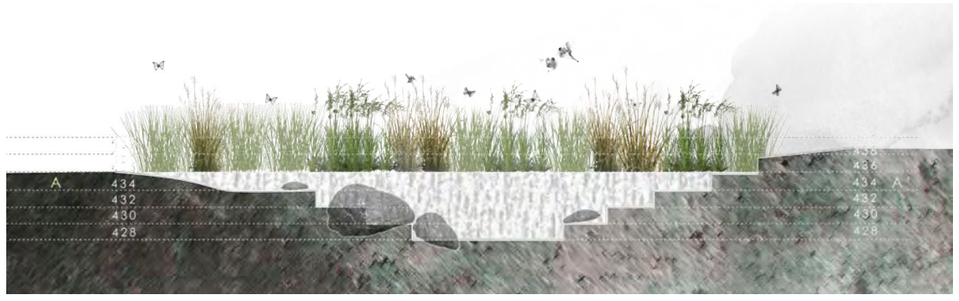


Fig 8.37. Collector section with steps

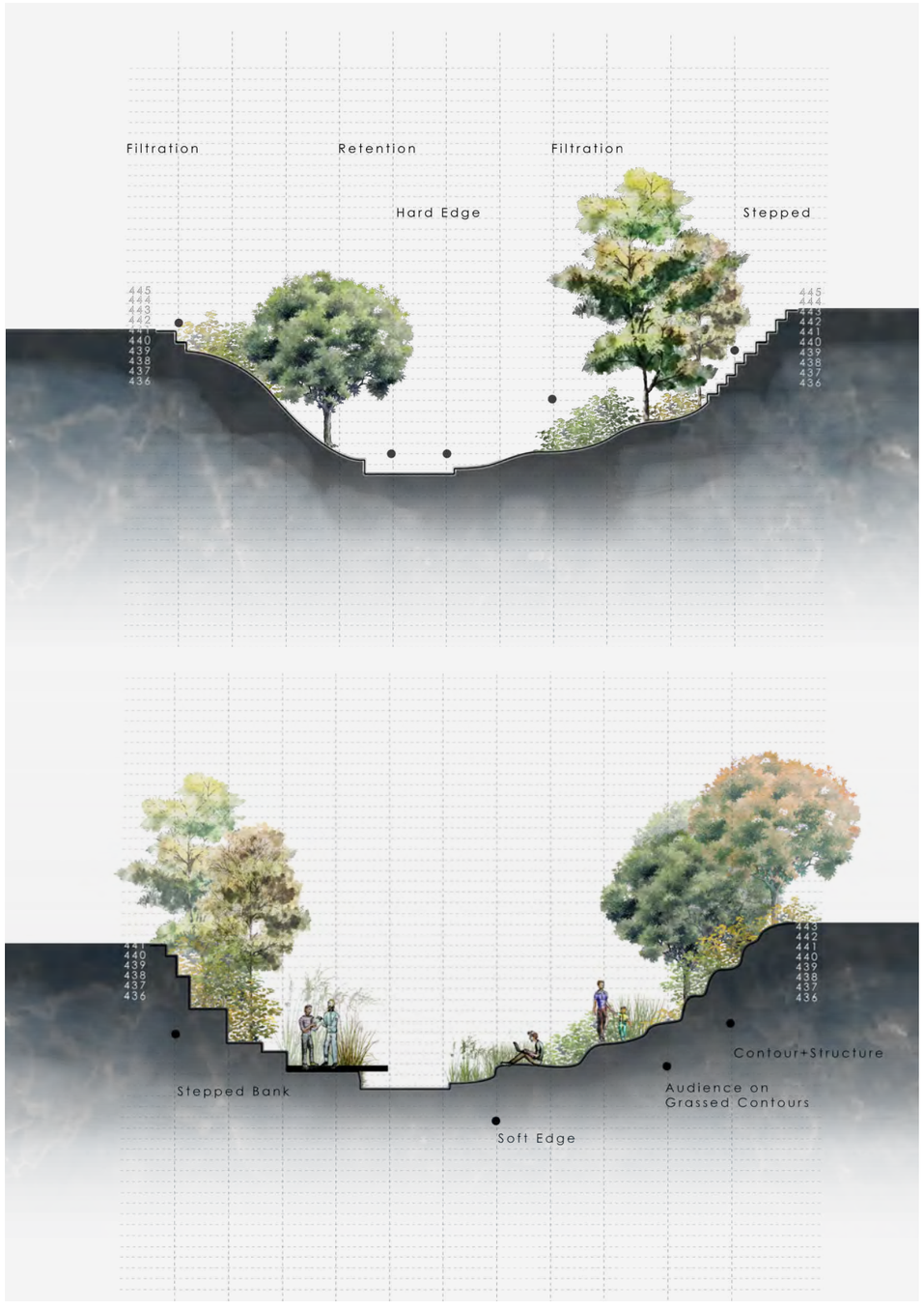


Fig 8.38. Tillie-Newby Study 3 cross-section alternatives

8.4.3 Frederick Woodland Garden

As noted, this basin potentially has more capacity than is required by MSD standards. Two scenarios explored the possibilities this opened up. The first study focused on a bridge that traverses the length of the basin, providing visual access to the plant communities taking hold in the woodland that will be established there. The second strategy repurposes drainage pipes to act as overflow structures, planter boxes and micro-ecologies. In both cases the basin is considered as a sunken garden *and* as a bottomland landscape consisting primarily of temperate arboreal species such as sweet gum, bald cypress and tupelos. It is in the bottomlands of Missouri that the sponge-like action of low-lying landforms is most visible, and most performative. The opportunity at the Frederick St basin is to reveal the hydrological processes that contribute to the formation of bottomland plant communities; the bridge serves as an ideal observation structure.

Fig 8.39. Frederick Study 1

Frederick Study One

Broad, shallow steps run the length of the garden, stepping down each side to a central swale. Different plant and animal communities occupy the various habitat opportunities the steps provide: submerged, emergent, mesic, dry (Fig 8.40). Over a very long period of time trees grow and the garden evolves. A bridge - for cyclists and walkers - connects Christian Ave in the east to Bittner St in the west. In effect, this garden and its bridge are the entrance to the whole eco-social community that is developing in the Baden neighborhood. The bridge, long but modest in construction and materials, links the bottomland garden to an orchard that could develop as a public-private initiative between Bittner and the lane that connects Switzer Ave to Church Rd. The short sides of the orchard abut private property, separated from the orchard by screen planting and fencing. This version of the Frederick Garden could deploy one of a variety of edge elements: berm, ramp, stepped, sloped. Whichever is chosen needs to be carefully designed for maintenance and plant diversity.

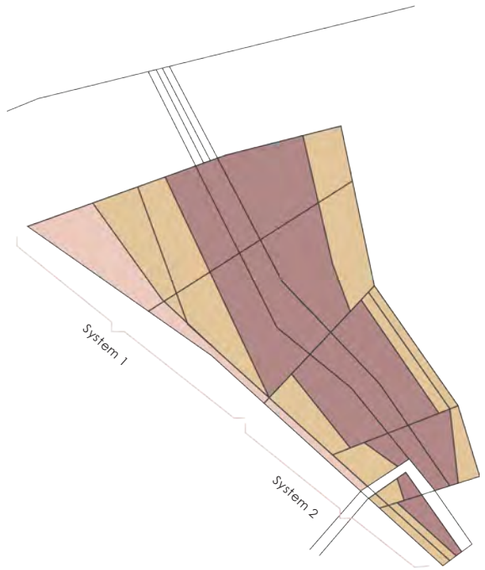


Fig 8.40. Frederick Study 1: Step diagram

Fig 8.41. Cross-section of Frederick garden bridge and steps

Fig 8.42. The bridge brings wakers and cyclists to the orchard

Fig 8.43. Bridge construction detail

Fig 8.44. The path through the orchard

Frederick Study Two

The floor of the garden is a single slightly sloping (2%) plane that acts as a detention pond when required but that spends most of its life as a play space (Fig 8.45). Drainage pipes recovered from light industry closures (Fig 8.46) are carefully incorporated into the biological field that is developing in the garden, providing vertical habitat, and perhaps - if connected to the CSS - operating as overflow pipes. The plans show the potential distribution of square, rectangular and cylindrical concrete and ceramic pipes, and the possibility of creating raised garden beds to complement them. These beds would be larger and therefore able to incorporate more complex communities. The pipes and the raised beds would also serve as insect and bird habitat, and the whole space could be accessible to visitors for exploration, play and study.

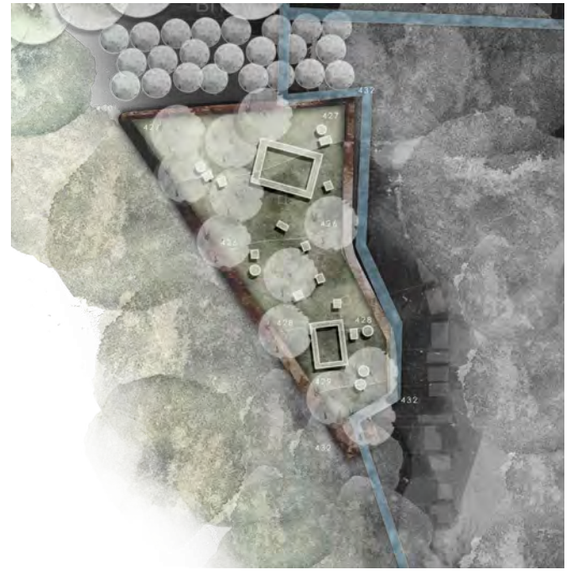


Fig 8.45. Frederick Study 2

Fig 8.46. Recovered drainage pipes

Fig 8.47. Pipes serve as insect and bird habitat

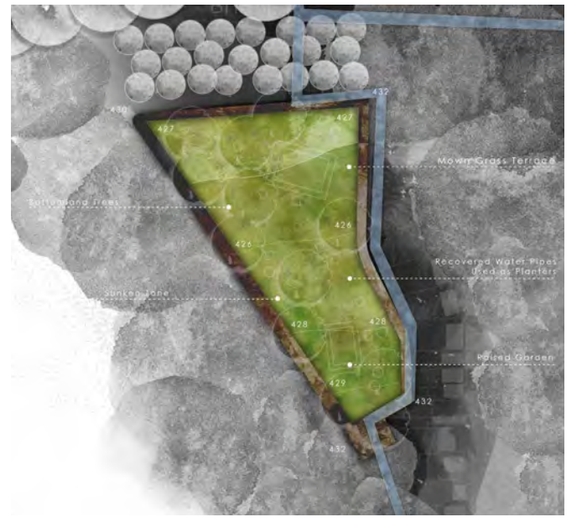


Fig 8.48. Site plan details

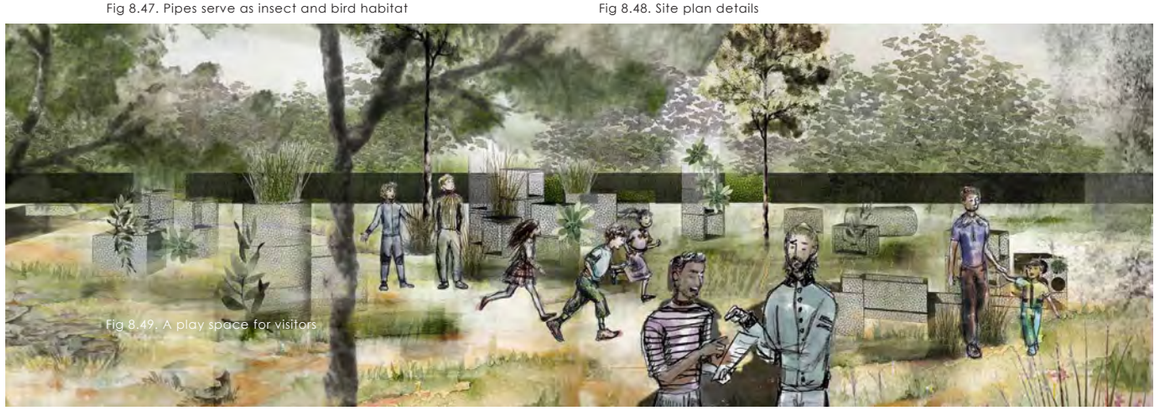


Fig 8.49. A play space for visitors

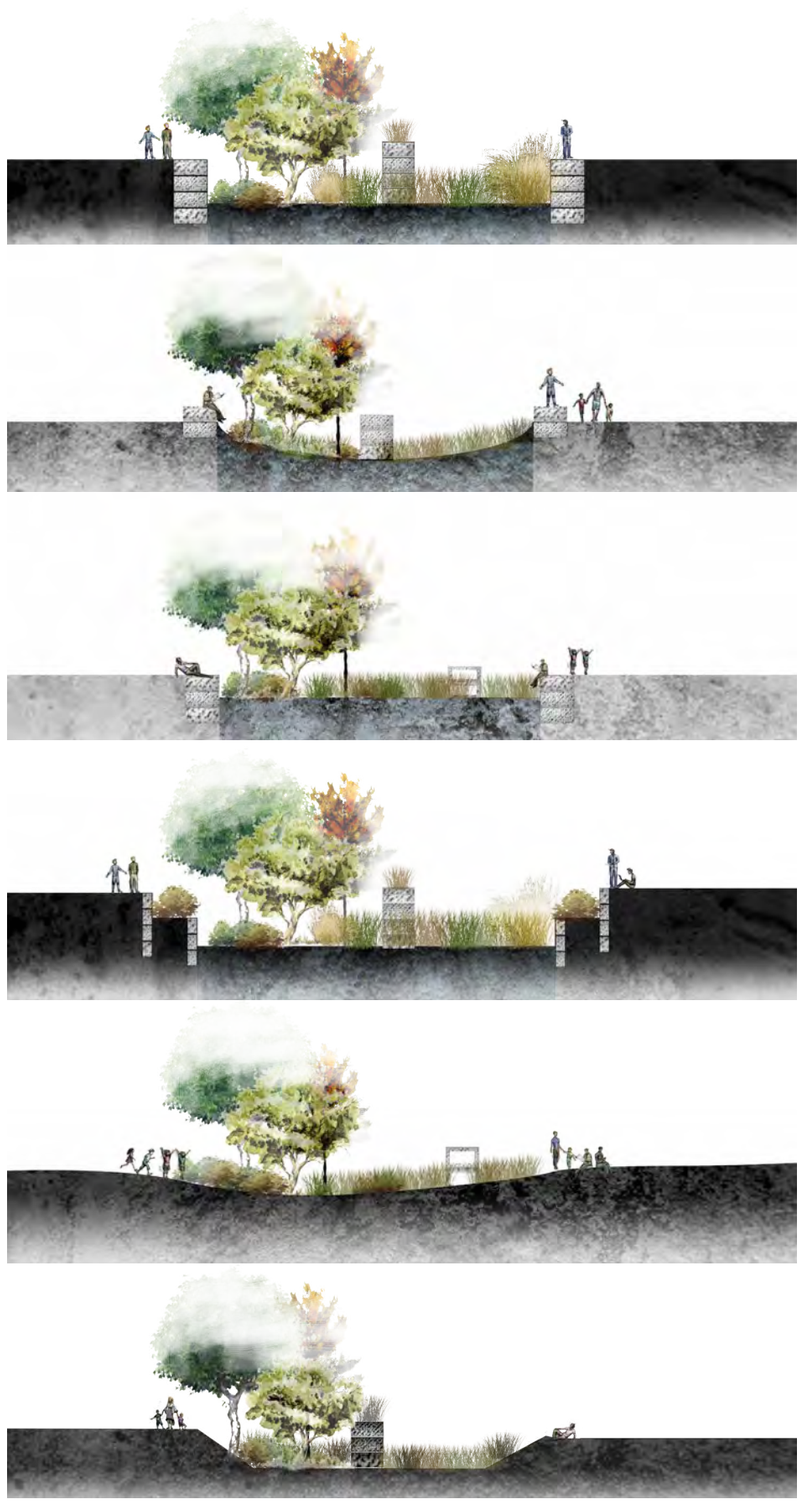


Fig 8.50. Sectional studies show different edge treatments for the Frederick sunken garden

8.5 PLANTING

Generally speaking, three types of landscape are being planted:

1. The basins, or gardens that form the focus points of the landscape
2. The interstitial terrain where different ecosystem species overlap, blend and fade.
3. Strategically located raingardens and a butterfly garden in Dickman Park

8.5.1 Planting the Interstitial Terrain

The planting of the interstitial terrain is outside the scope of MSD. Owned differentially by the City of St. Louis, the Church of Our Lady of the Holy Cross, and Daley International, it has to be managed by UVEI and funded separately from MSD. This terrain is the necessary glue that joins the basins together and takes advantage of the whole 90-acre site to evolve a singular landscape. In keeping with the sustainability objectives of the City, the recommendations of The Nature Conservancy and the Missouri Botanical Garden, and the many surveys and inventories conducted by diverse groups, as well as the results from landscape design research and the UVEI Baden Greenspace survey, a planting strategy has been developed for the whole Baden site. The goal of planting in interstitial spaces is to develop, through a long period of time, a permeable, and open, high-crown woodland of tree species found in the region, that supports an understory of multi-species habitat, including variable human occupation.

This is best done using the following steps:

1. Develop a general planting plan for the site, showing high-level plant regimes for the basins, raingardens and interstitial terrain.
2. Develop a phasing schedule that shows the preparation, installation and maintenance (including controlled burns) of specific plant communities, and links these to funding.
3. Identify implementation partners and sponsors whose organizations' key initiatives target urban greening initiatives or support urban biodiversity and water management (etc.).
4. Develop projects and specific planting plans, taking into account the roles various partners can play in each project. Appropriate roles for various interested partners may include the following:

private homeowners	subsidized to plant their own yards; participate in the development of the community landscape
companies	plant their own lots and parcels in keeping with the neighborhood planting theme, and participate in the development of the community landscape
public "owners"	plant their own land and develop incentives and subsidies for other groups
institutions	plant their own land and organize and facilitate interaction between the other members of the implantation community (could establish an implementation task force)

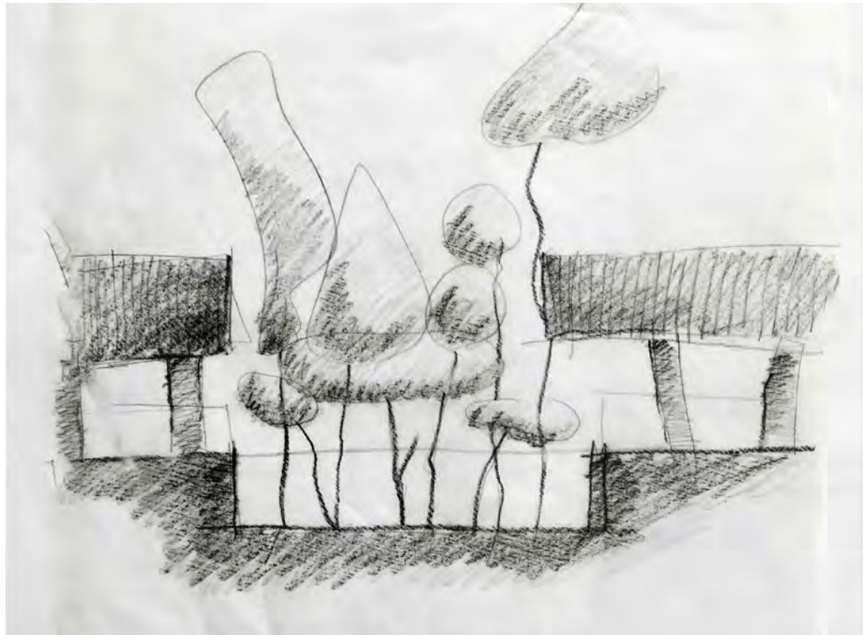
Such protocols provide guidance, or at least offer opportunities for conversations about how the community space should become as structurally robust, as visually attractive and as open to wide community use as possible. Brochures can be developed with guidelines for planting and maintenance, and sources for appropriate plants that different stakeholders and participants can grow.

8.5.2 Planting the Basins

Developing the three basins as gardens does not mean using exotic species. As with the interstitial terrain, native plants are proposed throughout. The garden plants comprise native canopy and understory trees, shrubs, grasses and forbs. Where applicable, macrophtyes (plants that grow in wet conditions) are proposed. It is not suggested that the gardens operate as natural or regional ecosystems, though they will fulfill some tasks of these. But, they are gardens; they require maintenance.

The plants for the three gardens should be selected on the basis of the following requirements:

1. Their broad visual appeal
2. Their adaptive role in the colonization-succession continuum in which they naturally occur
3. Their eco-structural role in the plant community for which they are proposed (as forage plants, as shelter for birds and animals, and as pollinators, etc.)
4. Their hardiness, or ability to withstand the rigors of life in a public space
5. Their contribution to the spatial qualities of the garden
6. Their overall ecological performativity



9.0 FUNDING AND IMPLEMENTATION

MSD provides two main funding opportunities for the Baden Pilot Project.

1. The CityShed Mitigation Program

This contributes $230 million to address issues of basement back-up and overland flooding, primarily through voluntary homeowner buy-outs along trunk sewers in floodplain areas, where impervious area can be converted to permanent greenspace. The conversion of impervious area to greenspace reduces CSO volume, and the detention of stormwater flows in basins also significantly reduces CSO volumes due to their large storage capacity. Through the CityShed program GI facilities may be constructed on properties where overland flood control facilities will not be developed. In the Baden plan, these properties would include those where parking lots, raingardens, the church landscape and the orchard are proposed.

2. The Green Infrastructure Pilot Program

This contributes $100 million over 23 years for CSO volume reduction. The GI Pilot Program funds projects in two ways: *directly* as with the Neighborhood Scale Bioretention program which finances projects that are owned and maintained by MSD;[30] and *indirectly* as with the Early Action Grants program. Indirect projects are owned and funded by MSD partners rather than by MSD itself, although MSD provides full or partial construction costs. They have two components:

1. *CSO Grant Program*
   This uses the EAP Foundation (Employment Assistance Programs) to support the implementation of GI in redevelopment projects within the CSO GI program area.

2. *Targeted Partnerships*
   This enables the pursuit of partnerships with entities that have the greatest potential for large numbers of GI facilities that will reduce CSO volumes, eg City of St. Louis, schools and universities, churches and community centers, MDOT, Great Rivers Greenway.

Pooling Funds

There is potential for both direct and indirect green infrastructure funding at Baden (Fig 9.1). Theoretically, the CityShed and GI sources can be combined, but currently there is no accounting template for pooling funds (as of 5/16/16). Because the two funding packages are different MSD has to come up with ways to enable them to draw from both at once.

9.2 Funding the Basins

MSD typically constructs only detention ponds, as retention ponds do not assist with volume reduction. MSD only receives volume reduction credit for the freeboard of a pond. The freeboard is the stormwater detention capacity beyond that of everyday standing water. Thus MSD will only pay for the freeboard infrastructure in the project, not the retention ponds themselves. This is complicated by variable depths, step and wall structures, materials, and drainage infrastructure (Fig 9.2).

The CityShed program will finance detention ponds; the GI package will finance the freeboard of retention ponds (the part of the pond above the high-water level). This means that funding has to be found for the construction of the water-filled zones of the retention ponds. The same division of resources applies to streams, swales and rain gardens that might act as connectors from pond to pond in a networked system. MSD indicated that there may be some opportunity for the CityShed program to construct GI connectors, rain gardens and other facilities where basins are not being constructed (the glue). The funds need to be separately sourced, but it is possible that they could be co-located.

9.3 Funding Baden

The UVEI Baden Pilot Project qualifies as a Neighborhood Scale Facility with Targeted Partnerships. That is to say it qualifies for funding through MSD and from elsewhere. MSD has agreed to identify which areas can be funded through CityShed and which through the GI Pilot Project program. Additionally, MSD's Project Clear encourages the management of rainwater "where it falls." The UVEI Baden Pilot Project, a neighborhood scale stormwater retrofitting initiative, qualifies as a Project Clear (PC) opportunity by being - in PC's words - "any combination of plantings, water features, catch basins, permeable pavements and other activities that manage stormwater as close as possible to where it falls" (MSD 2016).

There are two primary considerations for UVEI, then. First, they should ensure that as much as possible of the Baden Neighborhood Open Space Plan is funded through MSD. Second, they should develop a diverse network of partners who work together to fund the supplementary elements.

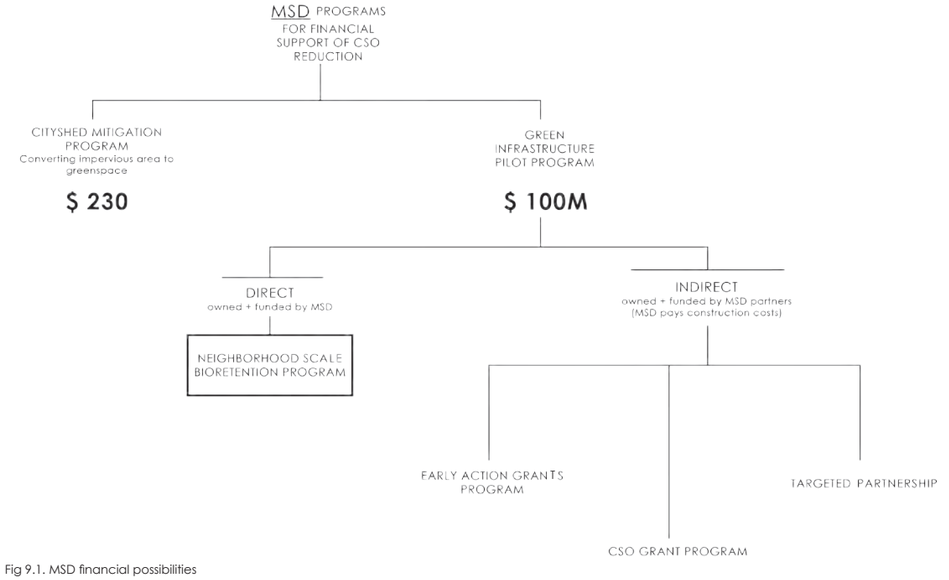


Fig 9.1. MSD financial possibilities

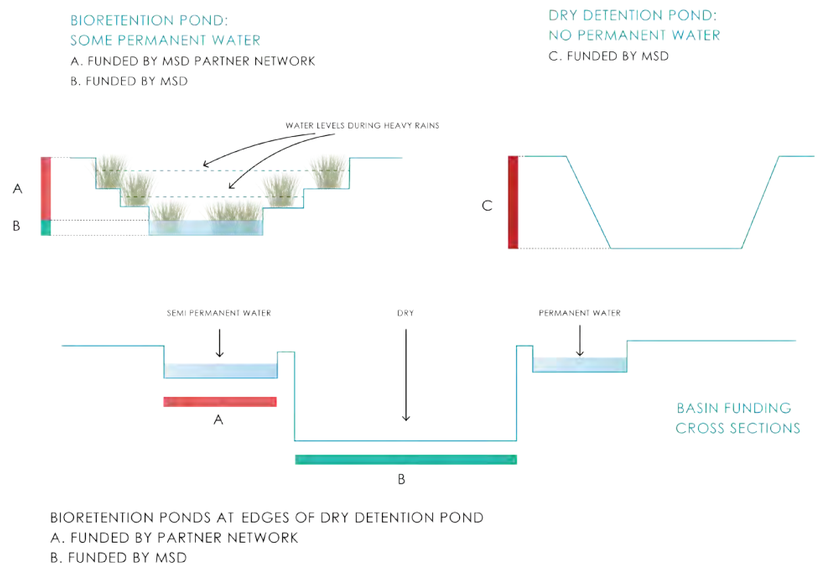


Fig 9.2. Cross sections showing funding implications

30 There are neighborhood-scale facilities and site-scale facilities. Both are CSO reduction operations constructed by MSD on buy-out land (and LRA-owned land) to reduce run-off. The former, however, are owned and run by MSD, the latter are maintained LRA, developers or partners. The MSD's CSO Long Term Control Plan Update (2011) notes that "Site-scale and neighborhood-scale facilities are particularly attractive techniques in that they take advantage of redevelopment of vacant and underused properties …" (CSO LRCP Update 2011, 12.4)

10.0 Conclusions

"Regenerating underutilized public space in collaboration with community members as co-builders is a rare event in urban areas. By working with impacted neighborhoods to understand their direct needs, parks can be successfully built from the ground up" (Orff, K. 2016: 174).

The UVEI Baden Pilot Project is extremely important to St Louis. In this developing ecological community it is possible to test the potential and techniques of green infrastructure, and the capacity of communities like Baden to participate in its development. The Open Space Plan is a guide only. It sets the stage for community-driven design and citizen science to propel the evolution of the pilot, and create a vocal, committed constituency for urban nature and stewardship.

The Baden Pilot project offers a template for integrated long-term green infrastructure implementation, by "piggy-backing" on MSD's water management program for St Louis. Such an initiative provides a wide range of social and environmental benefits for the community of Baden. Social benefits include local employment, public health, visible water management, place-making, passive and active recreation, and educational benefits, as well as property value enhancement. Environmental benefits include flood resilience, increased biodiversity, floral and faunal habitat, pollinator plantings, and the treatment of water where it falls.

The Open Space Strategy outlined in this report has four physical components:

1. The detention basins designed and constructed by MSD
2. The GI enhancement of these basins (a number of options for each basin has been explored)
3. The supplementary terrain outside the basin zones, which includes raingardens, butterfly garden, orchard, bioswales and other possible amenities.
4. Dickman Park, which forms the heart of the plan as an already functioning open space. Its role in the Open Space Strategy is to provide a central setting for informal gathering and programmed events.

The Partridge-Oriole, Tille-Newby and Frederick St basins are in design phase now, and construction is expected to begin in 2018. These basins will be funded by MSD through their CityShed program. All of the additional urban greening infrastructure, bioretention pond freeboard, habitat, bike paths, gardens and other facilities may be funded through partnerships that the community and/or UVEI forms with developers and not-for-profit organizations. These partnerships can take advantage of MSD incentives such as the Early Action Grants and Targeted Partnerships programs.

11.0 Recommendations

11.1 Community Benefits Agreements and Land Trusts were described in Section 3.0. If a Trust were formed it could pursue a Community Benefits Agreement with a developer (or developers) for the implementation of green infrastructure, and take advantage of funding available through MSD's Targeted Partnerships scheme.

Consider the formation of a hybrid Community and Conservation Land Trust.

11.2 The whole open space system can be thought of as a working landscape that involves an active and engaged citizenry, committed to managing and stewarding resources over the long term.

Create an implementation network and forge agreements with developers and organizations to enable the local labor resource to become involved in ongoing implementation and maintenance.

11.3 Urban hydrology should be revealed to those who create the water system in the first place, and who rely on it for their daily provision of clean, safe water. The hydrological cycle of precipitation, water flow, transevaporation and discharge has been driven underground and generally cut off from view except in flood events.

One way to reveal the Baden water system to its users would be to apply for a grant to develop a community education campaign about it, complementing MSD's installation of the three detention basins, and the roll out of the green infrastructure plan.

11.4 Residents should be able to see some of the impacts they have on the water system, how it works, how the basins operate, and how the planned green infrastructure system functions to assist with this operation.

A community tool could be developed, using maps, podcasts, and water-walks for the interpretation of the urban water network.

11.5 The plan shows how it can be understood as a holistic condition interweaving connection above, over and through green infrastructure that incorporates Dickman Park, but is much bigger than Dickman Park. Currently this tissue is referred to (in this report) as "the open space system." It needs a meaningful name that locates it in the Baden community and announces its presence to the world.

Consider a community competition for naming the whole contiguous greenspace.

11.6 Working in greenspaces - in gardens - is rewarding, healthy, and contributes to the greater good. A bioswale could be somebody's back garden, a basin could be adopted by a group of people who go out and get their hands dirty.

Consider the adoption of some areas of the open space system by householders and community members.

11.7 GI managers are on the frontline of urban change and are drivers of design innovation. The open space plan sets out a range of options for development. A GI manager would help the community decide the most appropriate approaches to each of the microsites within the larger system, in concert with MSD, bringing the tools of landscape design, economics and policy together to develop phased implementation and maintenance plans. Important roles for this person include;

- Ensuring the careful grading and contouring of terrain adjacent to the basins to permit infiltration and recycling of water by gravity
- Respecting the root zones of existing large trees during the grading and contouring of the basins, the laying out of paths and gardens and the operation of earthmoving equipment
- When planting takes place, ensuring that planted areas are developed in a succession of phased implementation to create layers of plantings that take advantage of different growth rates to provide integrated habitat and diverse experiences

Consider the appointment of a green infrastructure manager. This may take the form of the reallocation of time within an existing portfolio, or it could be a part time appointment.

11.8 The project needs a group that could coordinate with the GI Manager to work out how the landscape system would operate, who is responsible for what parts of it, who maintains it, and how and when. (This could include such necessary jobs as picking up trash and weeding invasive species). Perhaps ROBA could instigate this, or develop a sub-group.

Consider the role of Community Based Stewardship, a volunteer model, such as the Friends of the Park suggested

by the Environmental Justice class (Section 3.2.3).

11.9 There is potential in an embedded community water management system such as the Baden Pilot Project for a Watershed Steward responsible for ensuring the operation of the system, managing mosquito and fish populations, caring for macrophytic (water-associated) plants and maintaining water flow and water quality.

Consider the appointment of a Baden Pilot Project Watershed Steward.

11.10 There is an opportunity to promote the role of citizen scientists in the monitoring of micro-projects and to enable the growth of participatory action research as a model for community vigor and restoration.

Identify locations - the orchard, butterfly garden, planted water basins - as opportunities for the development of citizen science projects, monitoring the growth of plants, water sequences, habitat creation and subsequent occupation by birds and insects.

Continue to develop relationships with institutional scientists studying pollination, invasive species, water infiltration through pervious materials, and other aspects of urban ecology.

11.11 Professionals could assist with developing design criteria for the community orchard, to ensure the selection of appropriate fruiting species, the due consideration of harvesting and distribution, and Botanic Garden personnel could suggest links to the stewardship of the existing and planned community gardens.

Draw up a community competition for the design of the community orchard.

11.12 Programmed events that contribute to the development of the greenspace will enable people to get involved in specific projects so that the overall direction of the greenspace is managed and planned, with as little random and ad hoc planting (for instance) as possible. Programmed implementation events enable a coherent landscape to be constructed over time, even as it responds to innovations and chance interventions.

Existing community groups could integrate their events program with the phased implementation of the greenspace.

11.13 The plan includes flexible spaces that accommodate multiple types of people and play. In these zones there are rocks to climb, steps and ramps to facilitate sitting, observation and walking, space-specific play structures created by the children themselves, raised plant beds for children to grow their own plants, places of discovery, and shared gathering areas for picnics, biking and playing.

Consider the sponsorship of the free play zones that are included in the plan.

11.14 Specific areas of the proposed greenspace could be designed in more detail, phased implementation plans drawn up, and implementation partners and resources identified and engaged.

Consider a Stage Two to the Baden Open Space Design Plan, in which community stakeholders partner with professionals to continue planning and design.

Acronyms

BES	Baltimore Ecosystem Study
BMP	Best Management Practice
CSS	Combined Sanitary Sewer
CEL	Centre for Experiential Learning
CSO	Combined Sewer Overflow
CSS	Combined Stormwater System
EAP	Employment Assistance Programs
EECE	Environmental, Engineering, and Chemical Engineering
EPA	Environmental Protection Agency
FASF	Ferguson Academic Seed Fund
GI	Green Infrastructure
I-CARES	International Center for Advanced Renewable Energy and Sustainability
LID	Low Impact Development
LRA	Land Reutilization Authority
MBA	Master of Business Administration
MBG	Missouri Botanical Garden
MDC	Missouri Department of Conservation
MLA	Master of Landscape Architecture
MPH	Master of Public Health?
MSD	Metropolitan St. Louis Sewer District
PC	Project Clear
PA	Physical Activity
RA	Research Assistant
RWFDC	Riverview West Florissant Development Corporation
ROBA	Revitalization of Baden Association
SLACO	St. Louis Association of Community Organizations
UVEI	Urban Vitality and Ecology Initiative
WU	Washington University in St. Louis

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