Regenerative Design
for Healthful Built Space

Julia Wix
Advisor: Helen Joo

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for Healthful Built Space

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Graduate Thesis
Interior Design & Architecture
Drexel University
2022

Minghu Wetland Park
Turenscape
Lupanshui, China

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“We borrow from nature the space upon which we build.”
- Tadao Ando, *Architect*

Wetlands House
Ryall Sheridan Architects

1

Introduction:
Executive Summary

The overall goal for this thesis is to bring ideals and values of Regenerative Design into interior space. The pimary priority for the project is to regenerate the health and resources of the natural environment through ecological infrastructure. Other priorities include mending and reestablishing the relationship between people and nature, and providing support for those suffering most from the concequences of toxic built environments.

Precedent and case studies explored in this thesis combine ideals of regenerative design with educational and community experiences. This reseatch investigates the role of built space as a gateway, rather than a boundary, for the connection between people and natural environments. The design agenda aims to focus on materials and forms that bring a softness and organicism to built space. Concepts of edges, thresholds, and relationships help to define spatial qualities.

Research outlined throughout comes together to inspire the design of the *Eastwick Center for Environmental Education* that is presented in this thesis. The design of this center involves the creation of a *living building*. Natural resources flow in and out of the site as the building breathes, and the surrounding site is revitalized. The program will also provide regeneration for community, through the creation of a central hub for learning and collaboration. Programmatic spaces are meant to be adopted by users, such as studio and gardens. Interactions with spaces and their processes give a sense of pride and ownership over place.

1

Introduction:
Literature Review

I. Introduction

This literature review supports a design thesis that will offer regenerative design as a solution for the impacts of the built environment on the planet. Rather than creating built space that degenerates the health of its users and surrounding ecosystems, built space should regenerate the health of both people and the planet.

The Industrial Revolution (1760-1840) brought drastic transformation to our planet. From global technological innovations and rapid changes in economies, to territorial expansions and population growth. The results of the Industrial Revolution were the defining factor in the emergence of the recognizable modern-day city. Since then, the climate and our planet's environment continue to be altered. This is a result of actions such as changing agricultural and industrial practices, the removal of carbon from the ground and pumping of greenhouse gases into the atmosphere, as well as exponential population growth, to name a few. All these changes demand more land for agricultural and urban development, which in turn, leads to deforestation, warming of the planet, and severe destruction of natural ecosystems.[1] There is vast and conclusive evidence that these changes to the climate and the unprecedented speed that they are taking place are a direct result of human action.[2]

The effects of industrialization have been a major factor to climate change, which negatively impacts all living ecosystems and the natural environment. These environmental changes have severe consequences to human health, ranging from an increase in infectious diseases, to cancers, and ultimately, to early death. Climate change also has social and economic impacts on people brought about by drought, famine, flooding, epidemics, etc.[3]

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1 Chigbo A. Mgbemene, Chidozie C. Nnaji and Chekwubechukwu Nwozor, 2016. Industrialization and its backlash: Focus on climate change and its consequences. (J. Environ. Sci. Technol., 9: 301-316.), 307

2 IPCC, 2021: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson-Delmotte, V., P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)]. (Cambridge University Press. In Press.), 6

3 Chigbo, 309

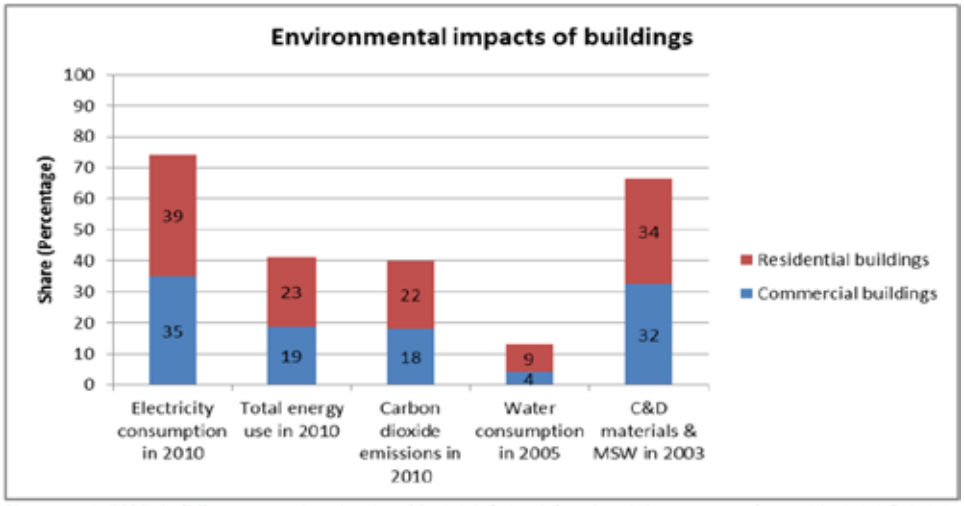
II. Review of Literature

A. Consequences of Built Infrastructure on Human and Ecological Health

The recently released 2021 climate report from the United Nations Intergovernmental Panel on Climate Change (IPCC) provides insight into the current state of our planet, which UN Secretary General Antonio Guterres calls "a code red for humanity". The report states that it is "unequivocal" that human influence has warmed the atmosphere, ocean, and land.[4] The report explains that widespread and rapid changes in the atmosphere, ocean, cryosphere, and biosphere have already occurred. Observed increases in well-mixed greenhouse concentrations since around 1750 are unequivocally caused by human activities.[5] It warns that a human-caused catastrophic 1.5-2 degree global temperature increase will be surpassed within the century unless drastic action is taken. [6]

While it is clear that various human activities and industries all have some level of impact on the environment, architecture of the built environment is amongst the most impactful. According to a 2014 EPA report, buildings and infrastructure comprise 16% of the United States gross domestic product, yet still account for 41% of primary energy consumption and 37% of greenhouse gas emissions.[7] Green building and infrastructure certifications, while becoming increasingly more recognized, only account for one percent of buildings in the United States. These practices are an opportunity to decrease energy and maintenance costs while also providing environmental benefits. Overall, the EPA found that buildings and infrastructure have a significant environmental impact, especially since on average, people spend over 90 percent of their lives indoors.[8] The waste produced, energy consumed, and water withdrawal, both during production and by occupants during a building's lifespan, are significant . [9]

4 IPCC, 6
5 IPCC, 6
6 IPCC, 7
7 EPA. 2014. Building and Infrastructure from a Sustainability Perspective. (Washington D.C, Environmental Protection Agency.), ii
8 EPA, ii
9 EPA, 10



(Sources: 1. EERE, building energy data book, table 1.1.3 & 1.1.9 for electricity consumption, table 2.4.1 & 3.4.1. for CO2 emission, table 8.1.1 for water consumption, and table 1.4.14 for C&D materials; 2. EPA's buildings and their Impact on the environment: Statistical summary for MSW; 3. Kenny et al., USGS, estimated use of water in the United States in 2005)

Not only do building infrastructures have significant environmental impacts, they often have negative impacts for the health and wellness of occupants. The EPA estimates that levels of indoor pollutants can be five times higher, and in some cases more than 100 times higher, than pollution levels outdoors. Indoor air pollutants such as lead and radon have had significant health consequences for users, causing diseases such as cancer and asthma.[10] These pollutants, among many others, can be found in building materials and furnishings which are known to off gas, household cleaning and maintenance supplies, and sources of combustion.[11] One important consequence of toxic interior environments is known as Sick Building Syndrome. The EPA defines SBS as the situation in which building occupants experience acute health and comfort effects that appear to be linked to time spent in a building. These symptoms often include headache, dizziness, nausea, fatigue, sinus irritation, etc. The primary causes of Sick Building Syndrome are inadequate ventilation, chemical contaminants and volatile organic compounds (VOCs), and biological contaminants like bacteria and mold.[12]

10 EPA, 5

11 EPA. 2009. Buildings and their Impact on the Environment: A Statistical Summary. (Washington D.C, Environmental Protection Agency.), 4

12 EPA, 1991. Indoor Air Facts No.4 Sick Building Syndrome. (Washington D.C. Environmental Protection Agency.)

It is also important to discuss racial and socioeconomic concerns that are rooted in the impacts of climate change and the built environment. Throughout the urbanization and industrialization of the United States, discriminatory policies that comprise environmental racism have disproportionately burdened communities of color. That term, environmental racism, was coined by African American civil rights leader Benjamin Chavis in 1982, who described it as racial discrimination in environmental policy-making, the enforcement of regulations and laws, the official sanctioning of the life-threatening presence of poisons and pollutants in our communities, and the history of excluding people of color from leadership of the ecology movements.[13]

Communities of color are frequently located next to sources of pollution, such as major roadways, toxic waste facilities, oil pipelines, industrial power facilities and chemical plants. Environmental discrimination has also concentrated communities of color within substandard housing where these toxic exposures are more likely. Examples of these racially discriminatory policies in the United States include segregation, redlining and gentrification. [14]

One clear example of the impacts of infrastructure on ecological and human health exists along the Schuylkill River in South Philadelphia. The PES Refinery in Point Breeze Philadelphia opened in 1870. Throughout the 20th century, the site has been the source of multiple deadly fires and explosions; the largest explosion occurred in June of 2019 and led to the refinery's permanent closure. Even after its closure, the refinery site continues to be a source of dangerous benzene exposure, endangering residents of the surrounding neighborhoods.[15] Point Breeze, Grays Ferry, and other surrounding neighborhoods are largely working class and minority communities which have been historically disenfranchised. In addition to health risks that result from exposure to toxins, such as cancers and respiratory disease, there are significant psychological impacts relating to stigma, social control, and place identity.[16]

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13 John R. Kyte, Environmental Justice: The Need for Equal Enforcement and Sound Science, 11 J. Contemp. Health L. & Pol'y 253 (1995). 253

14 Kaufman, Joel D, and Anjum Hajat. "Confronting Environmental Racism." Environmental Health Perspectives (129, no. 5, May 20, 2021.), 1

15 Kaufman, Joel D, and Anjum Hajat. "Confronting Environmental Racism." Environmental Health Perspectives (129, no. 5, May 20, 2021.), 1

16 Kondo, Michelle C., Carol Ann Gross-Davis, Katlyn May, Lauren O. Davis, Tyiesha Johnson, Mable Mallard, Alice Gabbadon, Claudia Sherrod, and Charles C. Branas. "Place-Based Stressors Associated with Industry and Air Pollution." Health & Place 28 (July 2014): 31–37. https://doi.org/10.1016/j.healthplace.2014.03.004.

Place identity is defined as the role an individual's physical surroundings contribute to their self-identity.[17] When there are perceived risks to home and environment, one's perception of self is threatened. In the case of refinery pollution, there is a threat to an individual's sense of self and place. This can impact social and community ties.[18] Conditions such as odor from the refinery, dirty and litter-filled streets, and empty lots — a result of lack of investment in these communities — are a source of stigma within South Philadelphia neighborhoods.[19] Stigma refers to negative images associated with place, which can impact stress levels, feelings of shame, as well as an individual's overall sense of self.[20] The fear of being displaced and not having control is also seen in South Philadelphia communities.[21] Structural and political hierarchies reinforce this lack of power and agency for individuals to guide their own lives, which is also a stressor for these communities.[22]

B. Human / Nature Relationship

Concurrent with the increase of negative impacts on the natural environment and human health resulting from built infrastructure, there is also a decline in the role of nature within urban environments. Stephen R Kellert opens his book Building for Life: Designing and Understanding the Human-Nature Connection criticizing the role of nature in contemporary society. He says many believe that the progress of civilization depends on subjugating and converting, if not conquering the natural world, and that many people actually view this progression as the essence of civilization.[23] These trends of constraining and eliminating nature are similarly prevalent within design and urbanization fields. Kellert's book also explores the role of nature and this relationship in childhood development. He concludes that, for children, various direct and indirect interactions with nature produce the greatest maturational benefits when it occurs in stable, accessible, and culturally relevant social and physical environments.[24]

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17 Kondo, 2014

18 Kondo, 2014

19 Kondo, 2014

20 Kondo, 2014

21 Kondo, 2014

22 Kondo, 2014

23 Kellert, Stephen R, 2005. Building for Life: Designing and Understanding the Human-Nature Connection. (Washington D.C. Island Press.), 1

24 Kellert, 88

Important strategies to foster this relationship between humans and nature within the built environment are Biophilia and Biomimicry. Kellert describes biophilia as the physical integration of natural ecosystems into built space to elicit a positive experience of nature within manufactured environments.[25] Biomimicry, on the other hand, is the emulation of design and innovation strategies as seen in the natural environment.[26] Both have been popularized by biologist and author Janine Benyus, who also founded the Biomimicry Institute. In her book Biomimicry: Innovations Inspired by Nature, Benyus explores various innovations through biomimicry within various fields. She defines biomimicry as the emulation of strategies seen in the natural world as the basis for design and innovation of built objects, systems, and spaces.[27] In Stephen R. Kellert's book, he also discusses biophilia and the necessity of incorporating this into modern design. He explains that the fundamental objective of biophilia is to elicit a positive, valued experience of nature within the built environment.[28]

The city of Pittsburg Parks Conservancy and architecture studio Bohlin Cywinski Jackson brought this approach to life in 2018 with the Frick Environmental Center. Using their concept of "Neighborhood to Nature"[29] the building serves as a gateway to Frick Park, the largest public park in Pittsburg which aims to educate and engage.[30] At about 15,600 sf, the program supports public living and gallery space, K-12 environmental education and classrooms, storage, and support space for Parks Conservancy. While the building achieves both Living Building Challenge and LEED Platinum certifications, perhaps its most informative achievement is how the program and design encourage and reinforce a relationship between humans and nature. The site incorporates the surrounding natural environment as well as other interactive features to provide children and families with a "hands-on environmental education, fulfilling the Environmental Center's role as a living laboratory".[31]

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25 Kellert, 124

26 Pedersen Zari, M., & Hecht, K. (2020). Biomimicry for Regenerative Built Environments: Mapping Design Strategies for Producing Ecosystem Services. (Biomimetics (Basel, Switzerland), 5(2), 18. https://doi.org/10.3390/biomimetics5020018), 3

27 Benyus, Janine M. Biomimicry : Innovation Inspired by Nature HarperCollins Publishers. New York: Perennial, 1998.

28 Kellert, 124

29 "Frick Environmental Center / Bohlin Cywinski Jackson" 22 May 2018. ArchDaily. Accessed 31 Oct 2021.

30 "Frick Environmental Center / Bohlin Cywinski Jackson" 22 May 2018. ArchDaily. Accessed 31 Oct 2021.

31 "Frick Environmental Center / Bohlin Cywinski Jackson" 22 May 2018. ArchDaily. Accessed 31 Oct 2021.

C. *Regenerative Design*

Regenerative design incorporates ideas of whole systems thinking and processes that restore, renew, and revitalize sources of energy and materials.[32] The strategy aims to produce significant ecological and social health outcomes rather than simply minimizing energy and water usage or the emission of pollutants.[33] An important leader in the regenerative movement is Carol Sanford, founder of the Regenerative Institute. In Sanford's book The Regenerative Life, she describes a framework for living systems which she calls the Four Paradigms. Sanford defines four different ways of working and knowing. Each paradigm, provides an increasing potential and complexity in regards to system change. She calls these value return, arrest disorder, do good, and regenerate life.

Value Return, which can also be thought of as extraction of value, focuses on the idea of me and mine and the exploitation of resources without consideration for the consequences. This paradigm typically assumes working out of self-interest and accumulation of wealth which results in environmental and social issues, such as sweatshops or unregulated oil drilling.[34]

In the Arrest Damage paradigm, there is an understanding of negative consequences. The restraints on predatory self-interest are introduced. One expands the scope of awareness to include relationships within systems, which uncovers the effects of one's actions on others. This often results in one seeking to correct the systematic problem created. The primary limitation of the Arrest Damage paradigm is the delay in action and the lack of a holistic approach. Rather than changing the source creating damage, additional steps are taken to lessen the negative impacts. Many governmental regulations, such as those protecting the environment, exist under this paradigm as they are designed to limit the negative impacts of human actions.[35]

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32 Pedersen Zari, M., & Hecht, K, 2

33 Pedersen Zari, M., & Hecht, K, 2

34 Sanford, Carol. The Regenerative Life: Transform Any Organization, Our Society, and Your Destiny. Boston, MA: Nicholas Brealey Publishing, 2020.

35 Sanford

The Do Good paradigm includes a desire to make the world better, moving more towards an ideal. This view guides a lot of work by philanthropic organizations and religious communities. Where this paradigm falls short is in that what one person thinks is good might not be in agreement with what another person thinks is good, or, in agreement with what the system truly requires. The setback is that often this paradigm values abstract ideals, which are always more complex than the living reality.[36]

The final paradigm, Regenerate Life, can be understood as a standard for the future of building. The intention shifts from just doing good to actually serving to facilitate the evolution of the system. There is an awareness of the interconnected parts of a system, and personal identity fades away, replaced with a resonance with other beings in the system. Under this premise, all built structures would "regenerate life" of the living system in which they operate.[37]

36 Sanford
37 Sanford

Bringing these concepts to natural ecosystems and built space is the Minghu Wetland Park in Lupanshui, China. The public park was designed by Turenscape and completed in 2012.[38] The Park sits within an industrial city within a valley surrounded by hills along the Schuichenge River. Prior to the park's development, the site suffered pervasive pollution and was prone to flooding. The city attempted to address the flooding in the 1960s by channelizing the river, but adding concrete to restrict the river had the opposite effect.[39] The goal of the new park's design was to revitalize the city's ecological infrastructure while speaking to its industrial history. Turenscape developed an overarching holistic strategy to create ecological public space, addressing the multiple problems with the site, including water pollution, stormwater and flood management. They did this by reintroducing the natural environment and ecological habitats to the industrialized riverfront. By removing the concrete embankment of the channelized river, existing streams, wetlands, and low-lying land were integrated into a stormwater management system creating a series of water retention ponds to sustain river flow, while also maximizing the river's self-purification capacities.[40] Continuous public spaces, including pedestrian and bike paths, were incorporated into the plan to increase public access to the riverfront. By employing regenerative strategies that consider the entire system, both living and built, and how each part of the system contributes to the overall function, a deteriorated water system and wasteland was transformed into a high performance riverfront. This intervention allowed successful integration of urban recreation with ecological space, also considering the relationship between ecology and people.

III. Conclusion

Through the research referenced in this literature review, the natural environment, and human relationship to it, has been harmed by systems from the built infrastructure. The results will be catastrophic if we do not drastically change the way built space is designed. In my design thesis, I will be exploring regenerative design and its umbrella strategies as solutions for a more holistic interiors experience. Design considerations can include the softening of edges, concepts of thresholds, and holistic systems. It is essential that we transform the way we design our built environments, both for the health of our planet and ecosystems, as well as the health of ourselves.

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38 "Minghu Wetland Park / Turenscape" 21 Jan 2015. ArchDaily. Accessed 31 Oct 2021. <https://www.archdaily.com/590066/minghu-wetland-park-turenscape> ISSN 0719-8884

39 "Minghu Wetland Park / Turenscape" 21 Jan 2015. ArchDaily. Accessed 31 Oct 2021. <https://www.archdaily.com/590066/minghu-wetland-park-turenscape> ISSN 0719-8884

40 Mairs 2019

The Discovery Center
DIGSAU

1

Design Precedents:
Minghu Wetland Park

Architects: **Turenscape**

Location: **Lupanshui, China**

Year Completed: **2012**

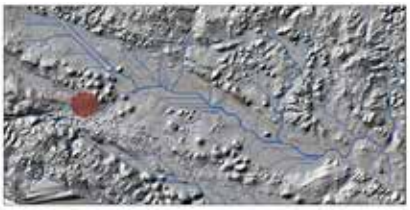
Typology: **Public Park**

Site: The park is located in an industrial city within a valley surrounded by hills along the River Shuichenge. The river was previously channelized, therefore full of concrete & hardscapes. The site faces pervasive pollution and is prone to flooding, as the city experiences significant rainfall.

Concept: The design aimed to revitalize the city's ecological infrastructure while speaking to the industrial history of the site. The project aimed create a public green space that creates a healthy ecosystem to provide natural and cultural services and transform the city into a livable human habitat.

Forms & Materials: Wave-like contours were constructed to feed and filter water, while pockets of islands provide for wildlife habitats. Additional organically shaped bridges and paths wind throughout the site for pedestrian use. Steel and stone walls speak to the industrial and agricultural history of the site.

Strategies: A holistic regenerative approach considers all of the site's processes and needs to address many issues simultaneously, including soil and water contamination, waste land, channelized river, stormwater runoff, and population needs. Transformation of a previously toxic site into a green ecological infrastructure encourages urban renewal, increases land value, and enhances vitality of place. The integration of urban recreation and ecological space supports the local community.



The surface flows of storm water

The regional sotrmwater management system

The concept of the regional ecological infrastructure

The regional ecological infrastructure

Bio-swales on gentle slope

Terraced bio-swales on steep slope

1

Design Precedents:
Frick Environmental Center

Architects: **Turenscape**

Location: **Lupanshui, China**

Year Completed: **2012**

Typology: **Public Park**

Site: The park is located in an industrial city within a valley surrounded by hills along the River Shuichenge. The river was previously channelized, therefore full of concrete & hardscapes. The site faces pervasive pollution and is prone to flooding, as the city experiences significant rainfall.

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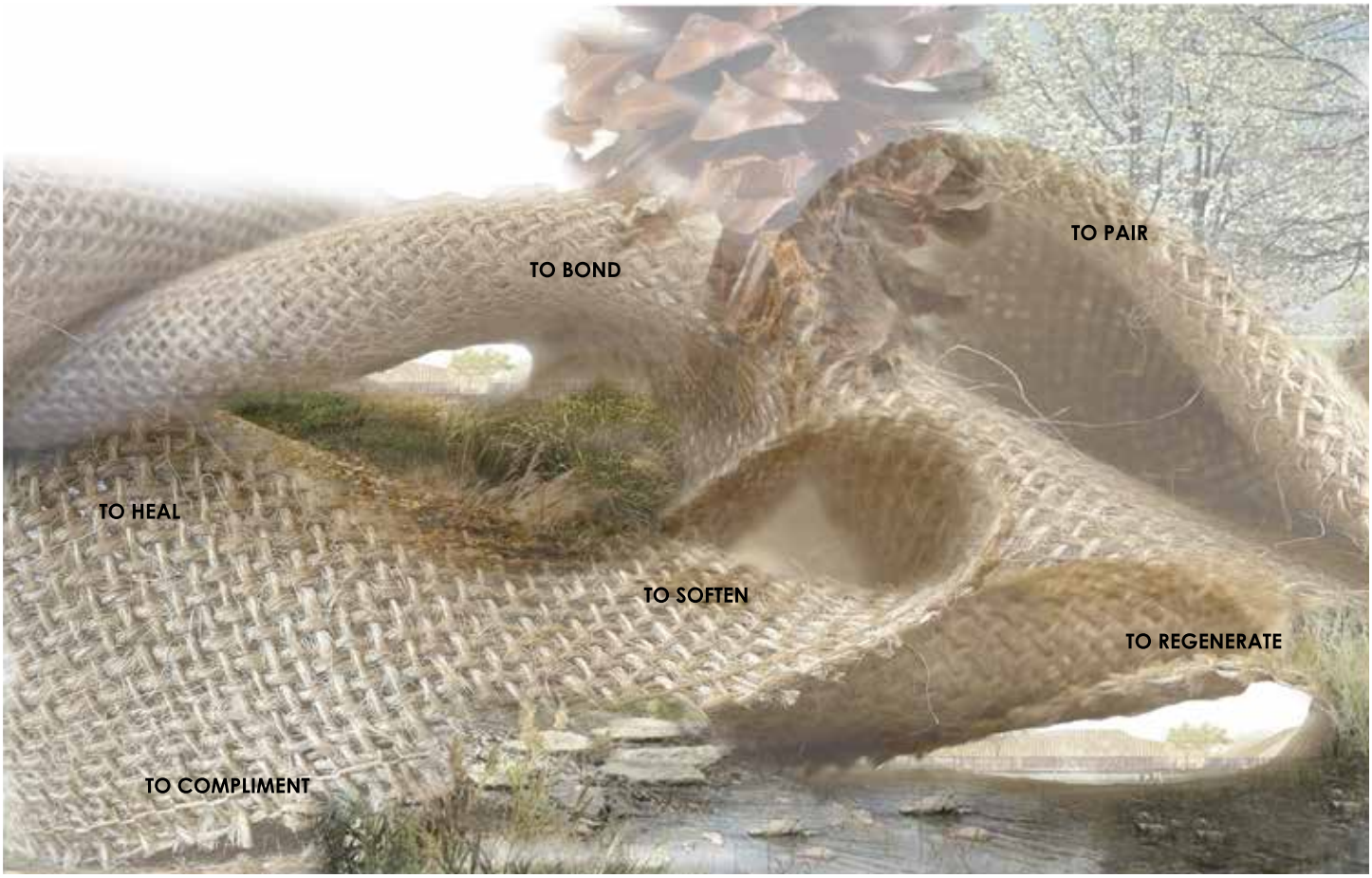
2 Design Agenda

Primary Priority:
Built space is regenerating health and resources of the natural environment

Secondary Priority:
Mending & reestablishing relationship between people and nature

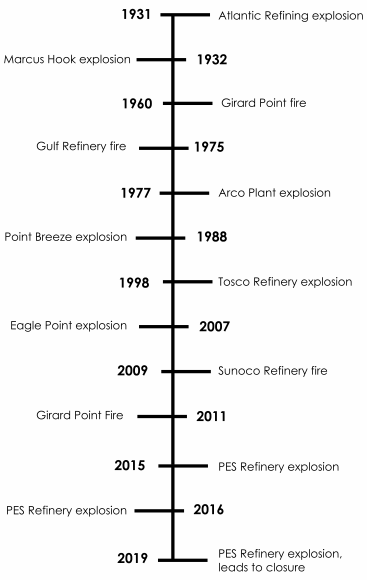
Tertiary Priority:
Provide support for those suffering most from consequences of pollution & harmful environments

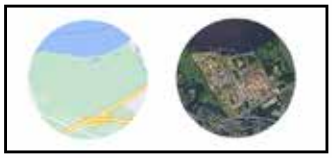


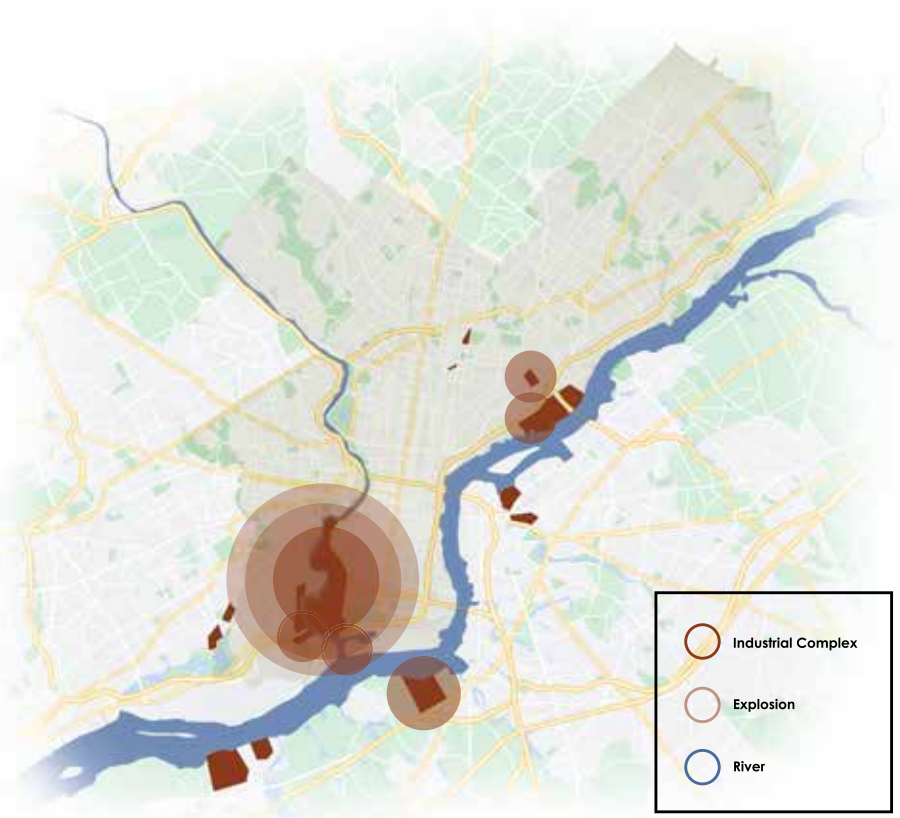
The design agenda aims to focus on materials and forms that bring a softness and organicism to built space. Concepts of edges, thresholds, and relationships help to define spatial qualities.

Design Probe 1: Scale

Mapping



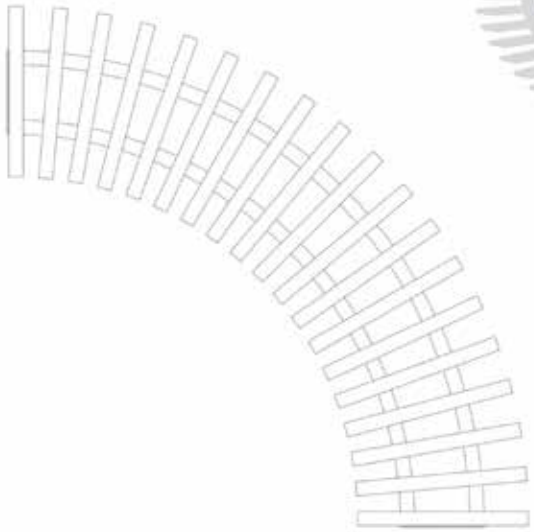


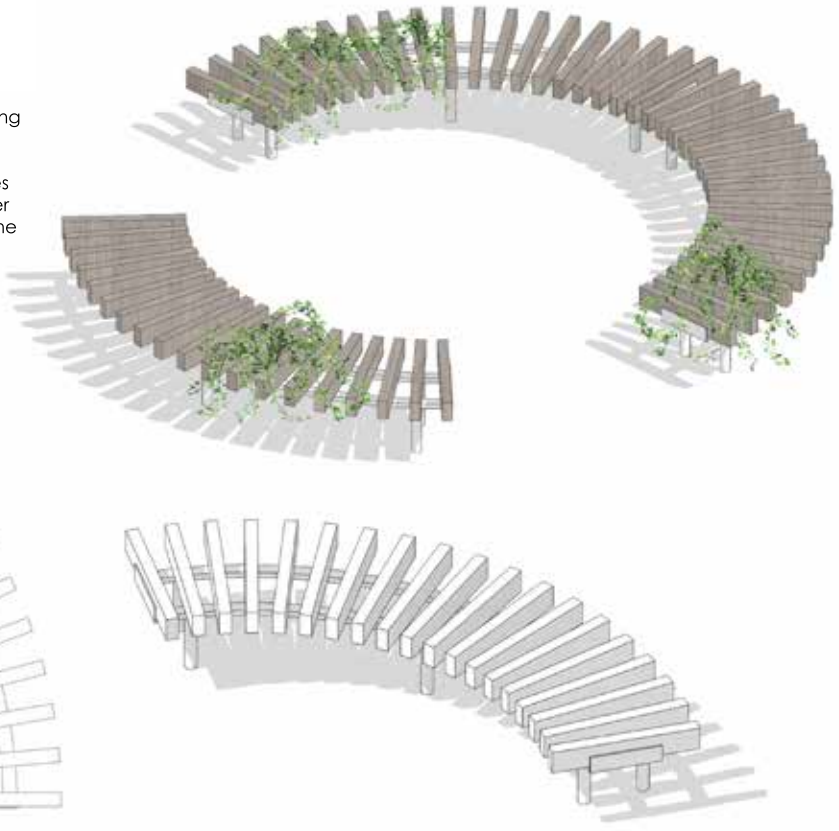


Design Probe 1: Scale

Sitting Green

Form, materials, and function are all based off of living systems. The object combines built and natural environments. The benching uses a nested systems approach through creating units that are themselves systems, but also function together to create a larger system as well as a part of the ecosystem in which the benching lives.





2

Design Agenda:
Material Probe

This probe explores the synthesis of natural and synthetic materials as they exist as well as their potential.

2

Design Agenda:
Experience Probe

Present

Experience

Unattentive
Overwhelmed
Alone

Perception

Sterile
Unadaptable
Dull

Attitude

Uninspired
Stigma
Stuck

Potential

Experience

Engaging
Flexible
Collaborative

Perception

Unique
Mindful
Immersive

Attitude

Valued
Motivated
Supported

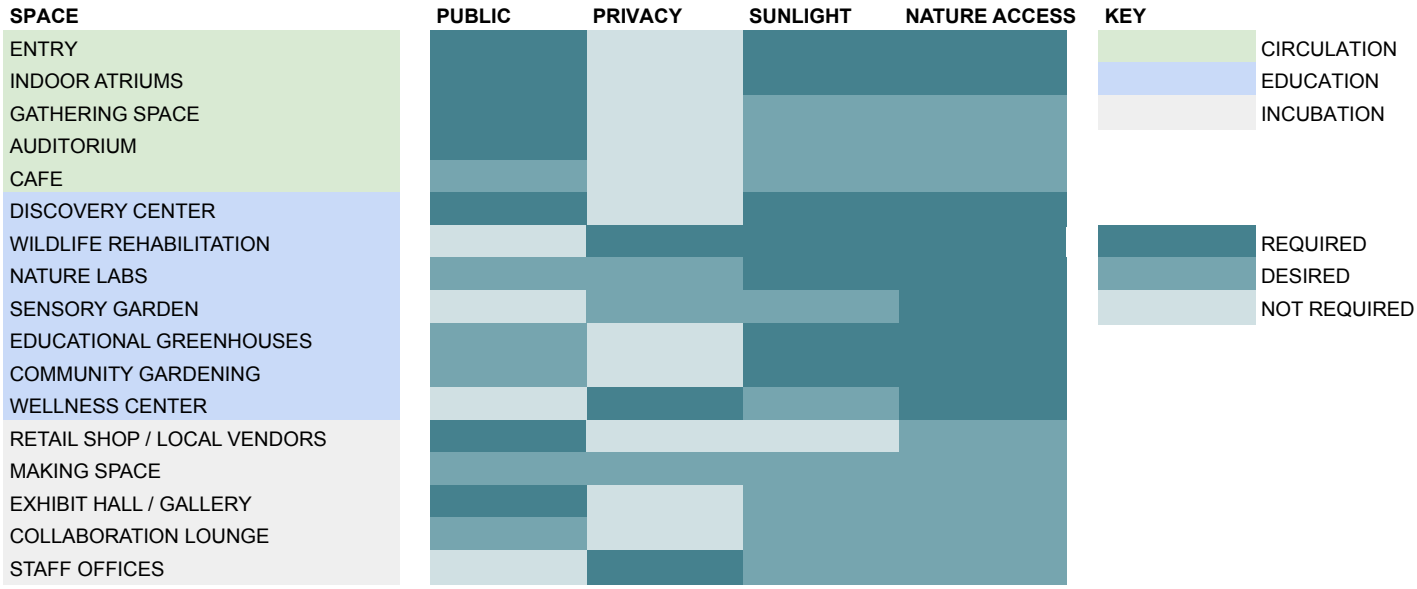
Master List of Spaces

Entry	1,200
Atrium	2,400
Informal Gathering	2,000
Auditorium	4,000
Cafe	1,200
Discovery Center	1,200
Wildlife Rehabilitation	2,000
Nature Labs	6,000
Sensory Garden	1,200
Greenhouses & Gardening	1,500
Wellness Center	1,200
Retail Shop	1,200
Making Space	2,000
Gallery	1,000
Collaboration Lounge	1,100
Staff Offices	1,000
Net SF	29,000
Circulation (30%)	1.33
Total SF	**38,570**

Circulation

Education

Incubation



3

Case Study:
Schuylkill Center for Environmental Education

Architects: **SALT Design Studio**

Location: **Northeast Philadelphia**

Year Completed: **2000**

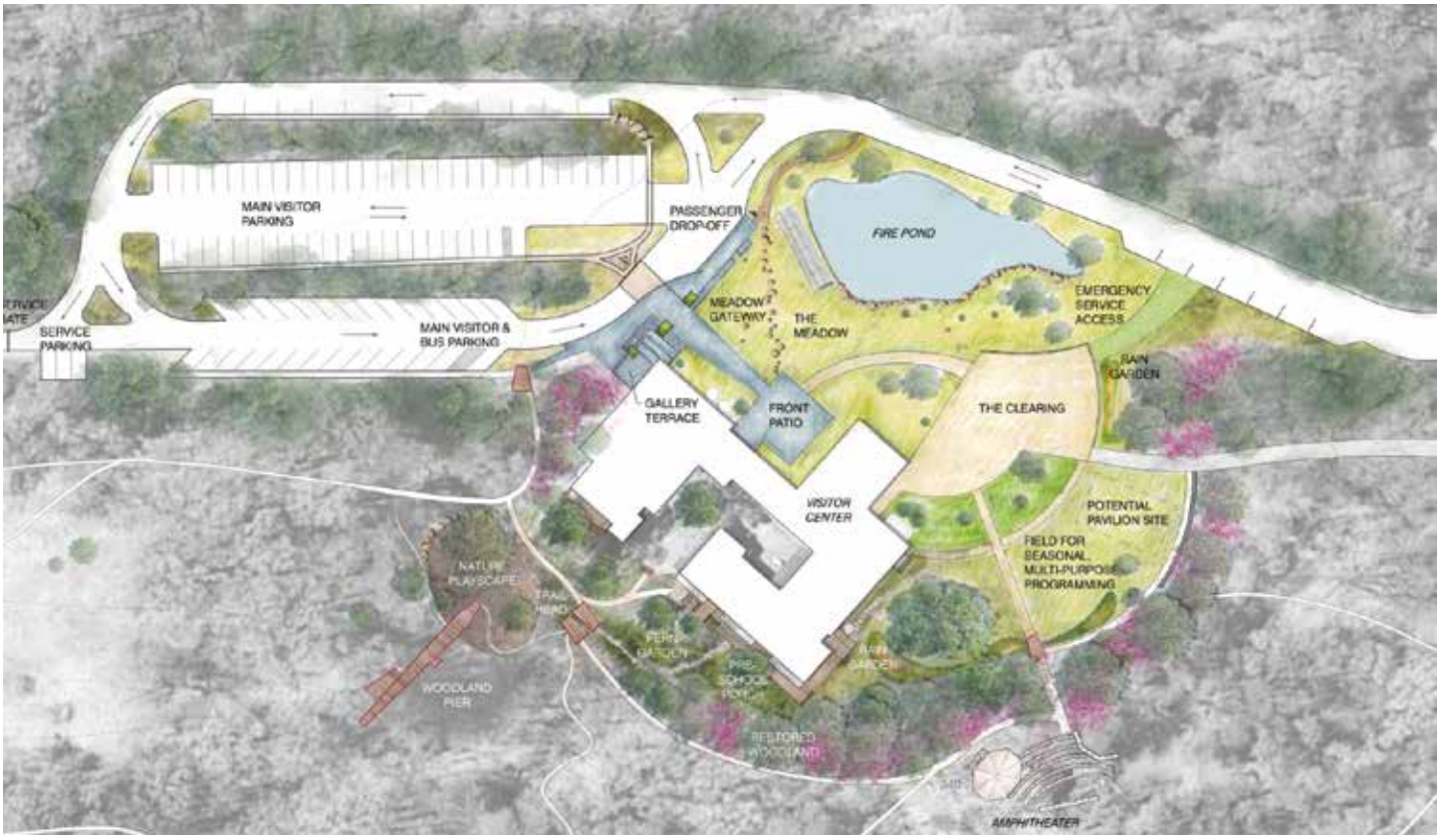
Typology: **Public Park, School**

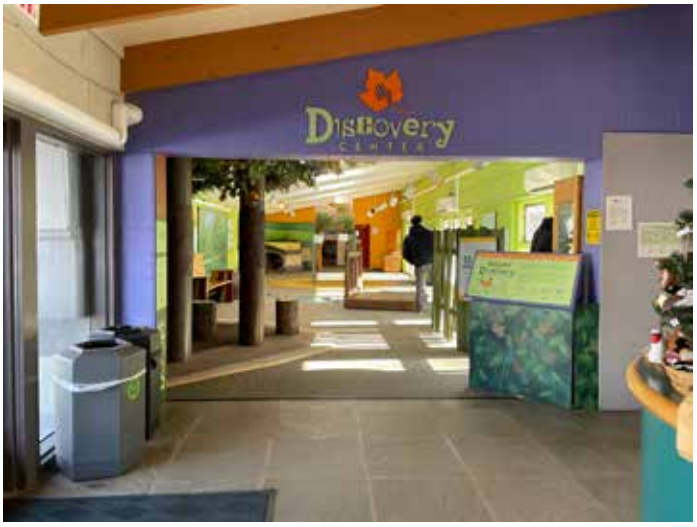
Site: Located at 8480 Hagy's Mill Road in Manayunk, the 20,000 sf building sits on a 340-acre nature preserve with nine different hiking loops that allow visitors to connect with and explore the natural environment.

Concept & Vision: "The Schuylkill Center inspires meaningful connections between people and nature. We see our forests and fields as a living laboratory to foster appreciation, deepen understanding, and encourage stewardship of the environment. As a leader in the next generation of environmental education, the Schuylkill Center will create a world where all people play, learn, and grow with nature as part of their everyday lives."

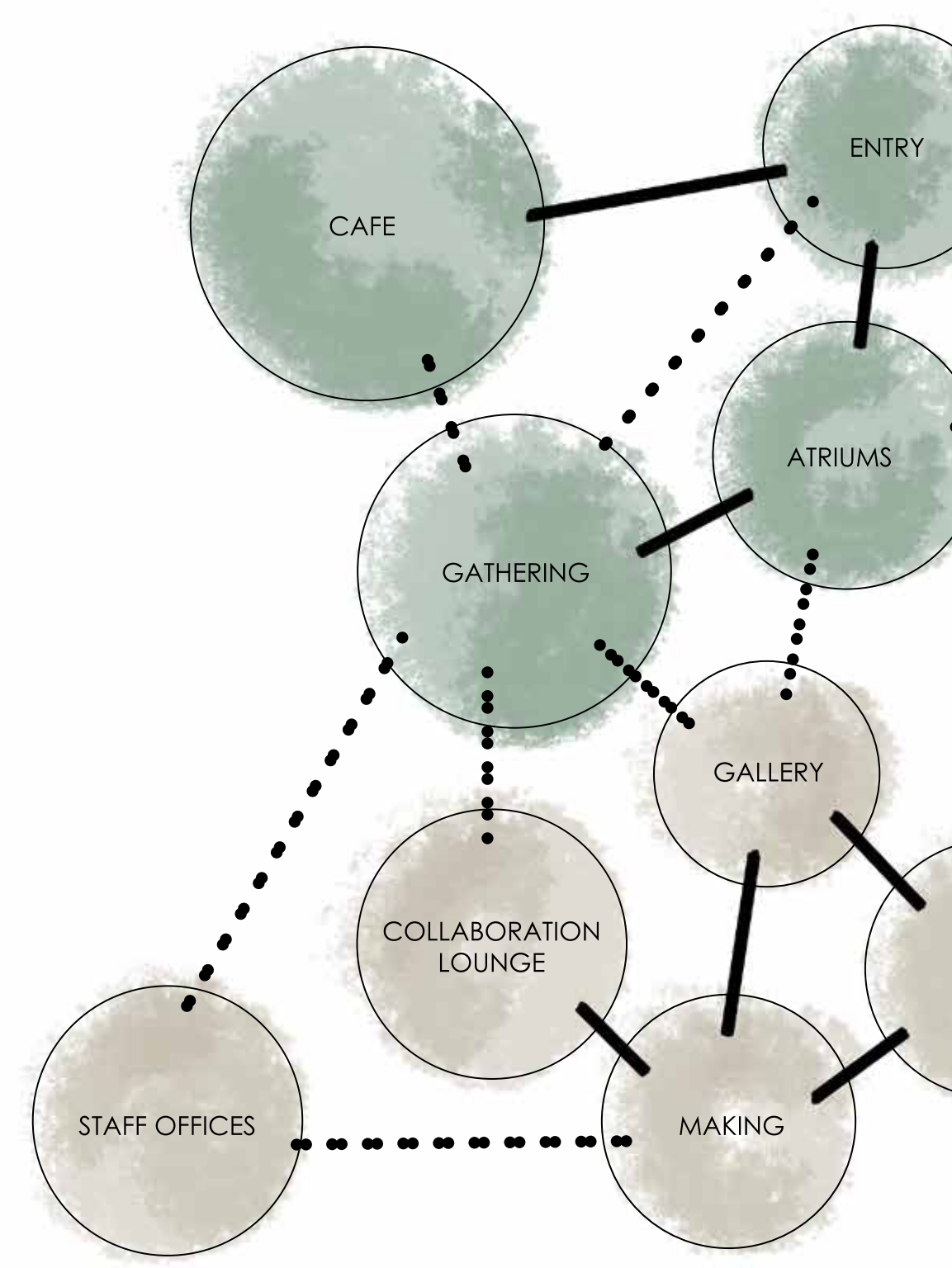
Colors & Materials: Overall, the materials and furnishings appear very economical and includes many natural materials such as masonry, stone, wood, and tile. Muted tones in the space highlight the surrounding landscape by not overpowering them. The Discovery Center brings in greens, purples, and oranges for a pop to bring excitement and energy to the space for children.

Key Programs:
- Hiking & Bird Watching
- Public Gathering
- Environmental Art Program
- Wildlife Clinic
- Nature Preschool & Kindergarten
- Day / Summer Camp & After School Program

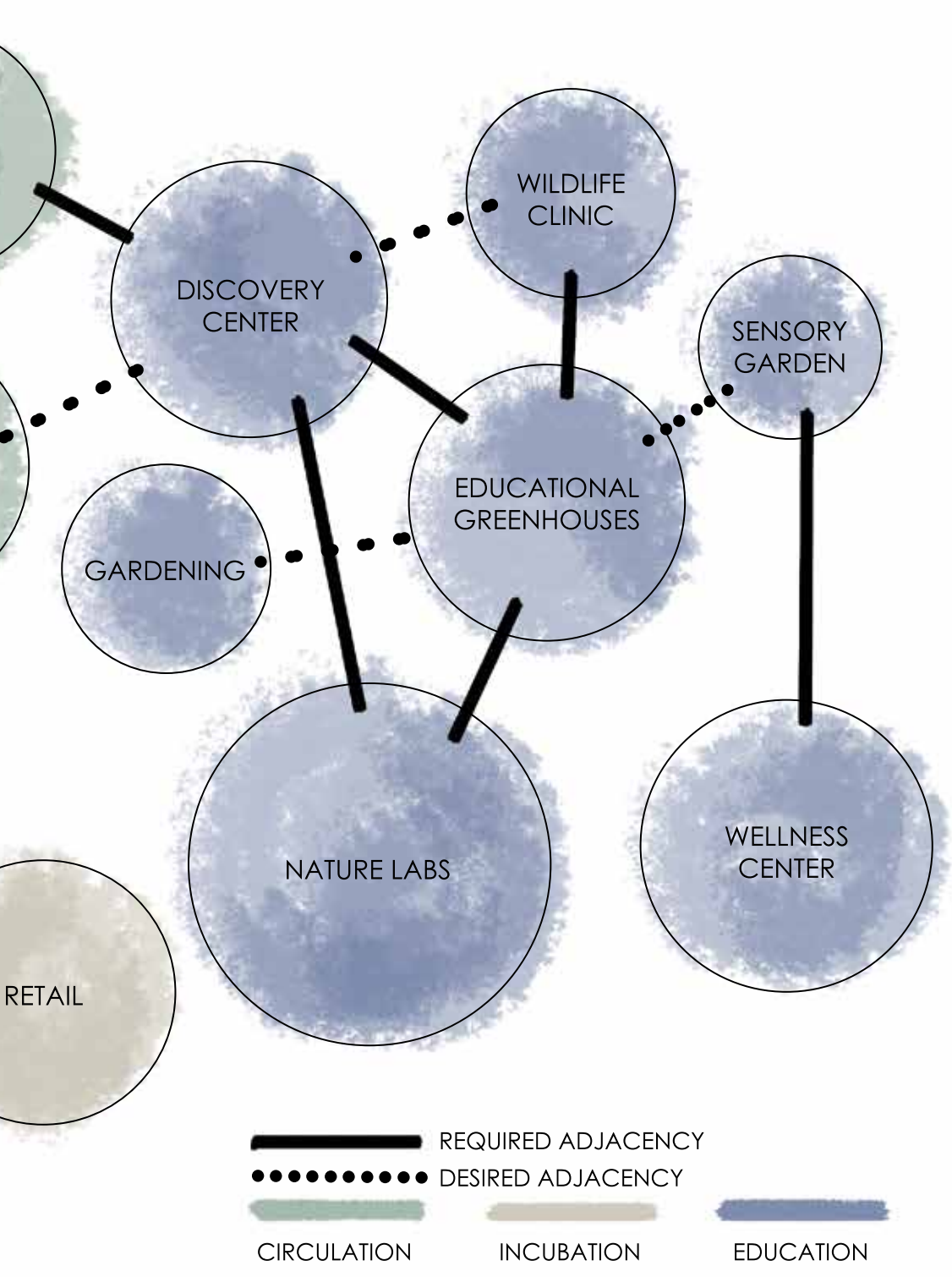

MAIN VISITOR PARKING
PASSENGER DROP-OFF
FIRE POND
SERVICE PARKING
MAIN VISITOR & BUS PARKING
MEADOW GATEWAY
THE MEADOW
EMERGENCY SERVICE ACCESS
RAIN GARDEN
GALLERY TERRACE
FRONT PATIO
THE CLEARING
VISITOR CENTER
POTENTIAL PAVILION SITE
FIELD FOR SEASONAL MULTI-PURPOSE PROGRAMMING
NATURE PLAYSCAPE
WOODLAND PIER
AMPHITHEATER


Discovery

3


CAFE
ENTRY
ATRIUMS
GATHERING
GALLERY
COLLABORATION
LOUNGE
STAFF OFFICES
MAKING

Program:
Diagramming



Eastwick, Philadelphia

Eastwick is a neighborhood in southwest Philadelphia, directly between the airport and the PES refinery site. It is a historically disenfranchised area. In 1957, the Philadelphia Redevelopment Authority finalized plans for the Eastwick Urban Renewal Plan, which was the country's largest urban renewal plan at the time. But, there was little to no community involvement, and so many residents opposed the plan because it would displace them. The development was eventually halted in the 1970s because of environmental factors, such as the noise pollution, air pollution, and flood zones. This left large areas of the plan undeveloped. In the end, the project displaced thousands of residents and hugely disrupted the Eastwick community and effects are seen to this day.

The Lower Eastwick Public Land Strategy is a Master Plan created for the area by Interface Studio in 2018. Interface worked to understand the history of Eastwick and held many roundtable events and worked with various community organizations to best understand what the community needs and wants from these spaces. Their key findings and proposals for the area are green infrastructure and wetland preservation, residential homes, senior living, commercial and mixed use space, and a central community educational or institutional hub. The overall goal of the plan is to bring the community together by creating a central hub of connection and activity. It is important to draw from the Master Plan because it gives a context for the project that would provide connections to the community.

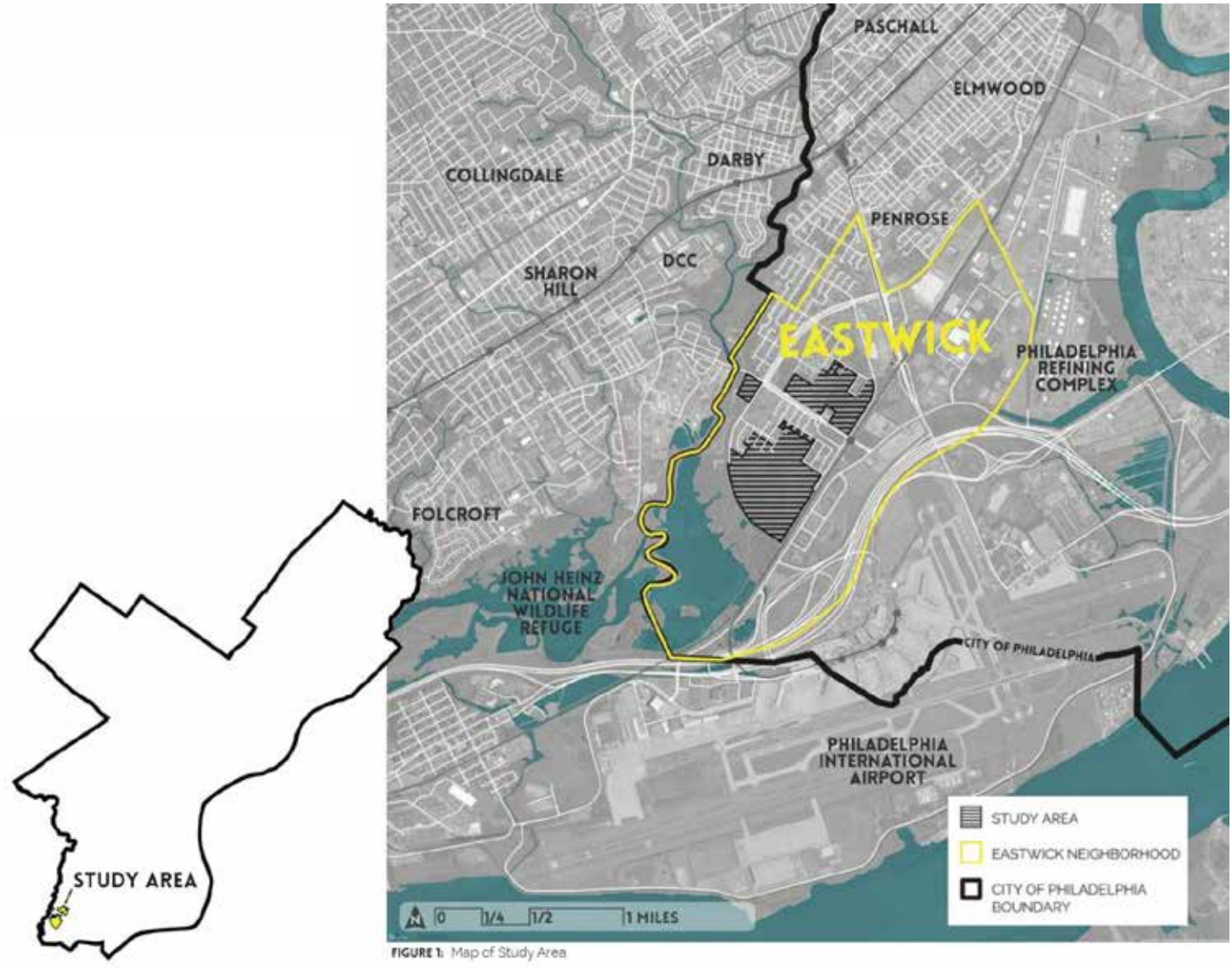
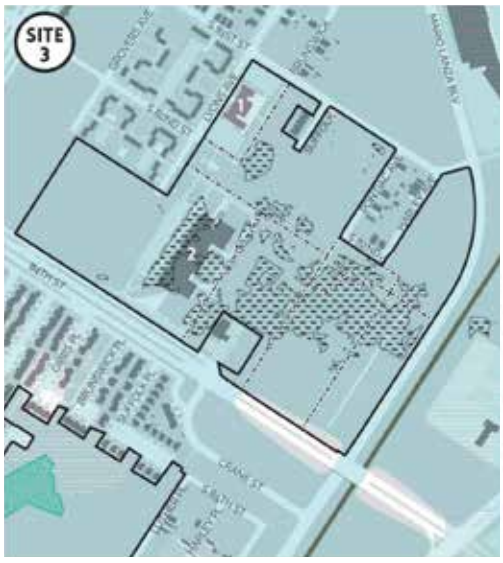
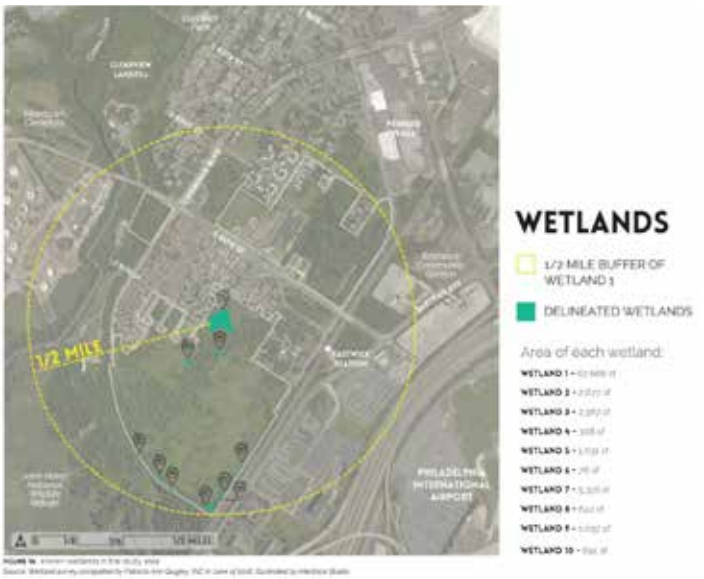


FIGURE 1: Map of Study Area





Source: Interface Studio

4

Site:
George Wharton Pepper Middle School

Architects: **Caudill Rowlett Scott, Bower & Fradley**

Location: **Eastwick, Philadelphia**

Year Completed: **1976**

Size: **200,000 sf, 4 Floors**

Architecture Style: **Brutalism**

Description

George Wharton Pepper Middle School is located at 84th & Lyons in Eastwick, tucked between the John Heinz National Wildlife Refuge, I-95, and industrial Southwest Philadelphia, with planes from the airport buzzing overhead. Conceived in 1968 as the focal point for a new Eastwick Community Educational Complex, Pepper is right next to Communications Technology High School. The development was to have housed both Eastwick High School and Pepper Middle School, as well as a new parochial school. However, the large scale urban renewal plan for Eastwick never saw completion, so the resulting campus only saw the construction of Pepper, an enormous concrete structure placed amongst green space and a large recreation center.

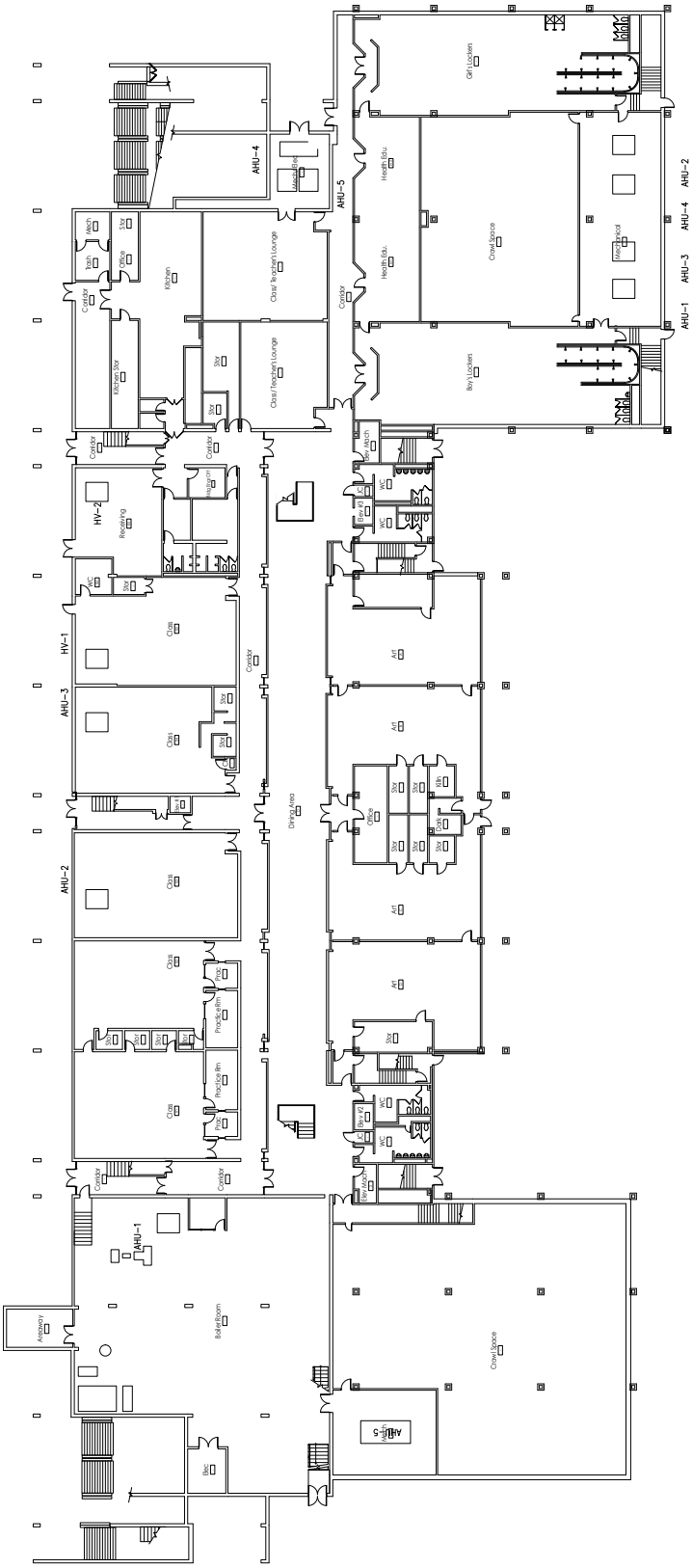
The recreational grounds accommodate a playground, three baseball diamonds, four tennis courts, and five basketball courts. The John Heinz National Wildlife Refuge is a ten minute walk away, and the Eastwick Community Garden nearby.


N
Industrial Park
Darby Creek
SITE
Eastwick Community Garden
John Heinz National Wildlife Refuge
Eastwick Station
Airport

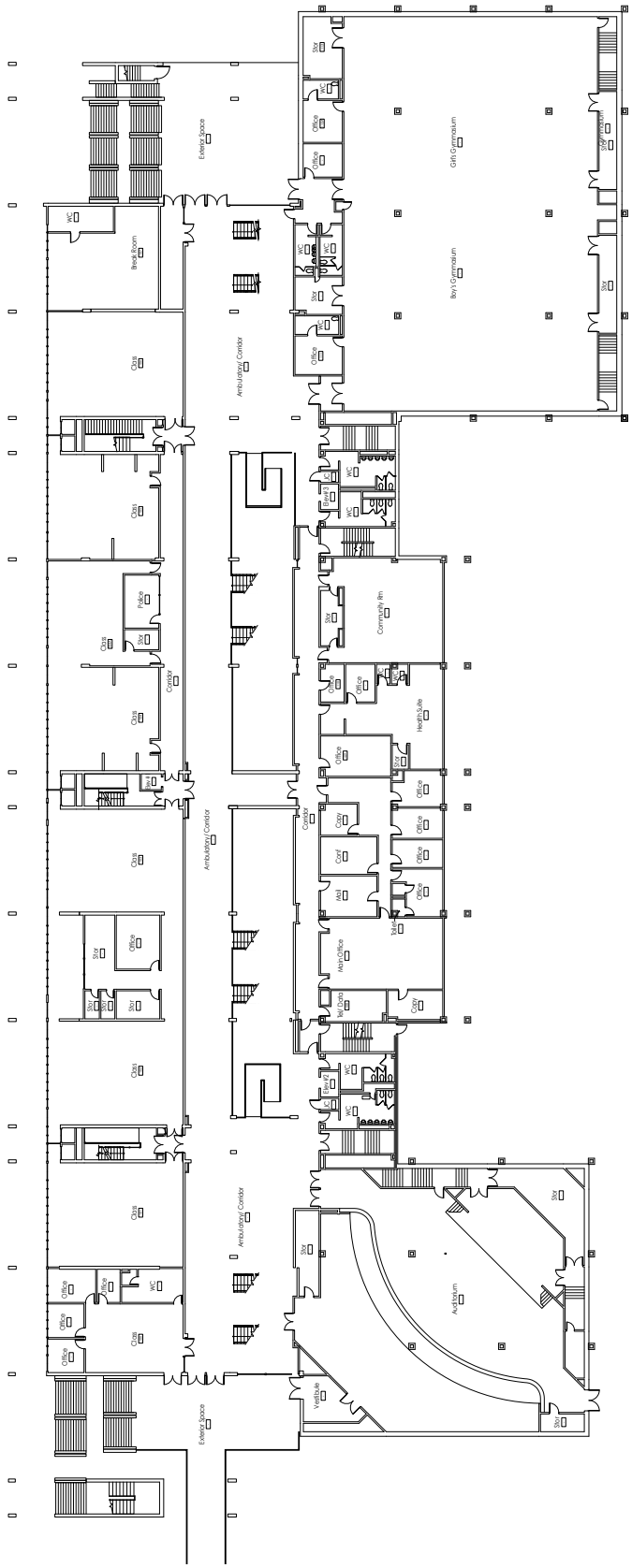

N

4

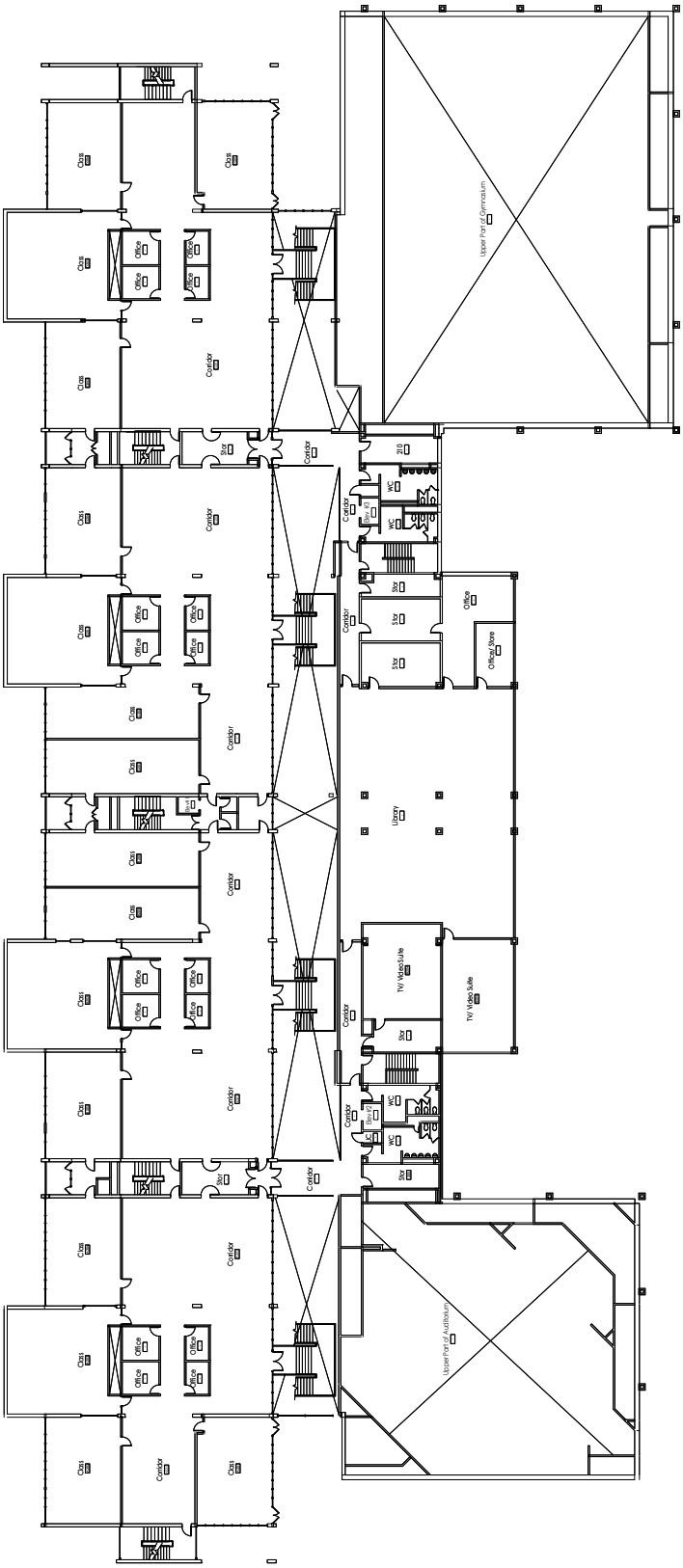
Site:
George Wharton Pepper Middle School



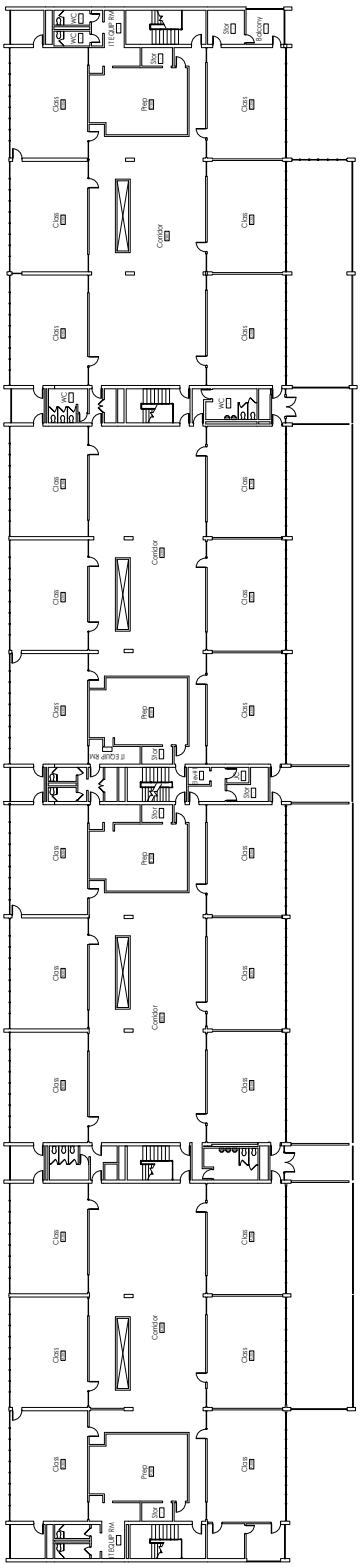
Existing Ground Level



Existing First Level

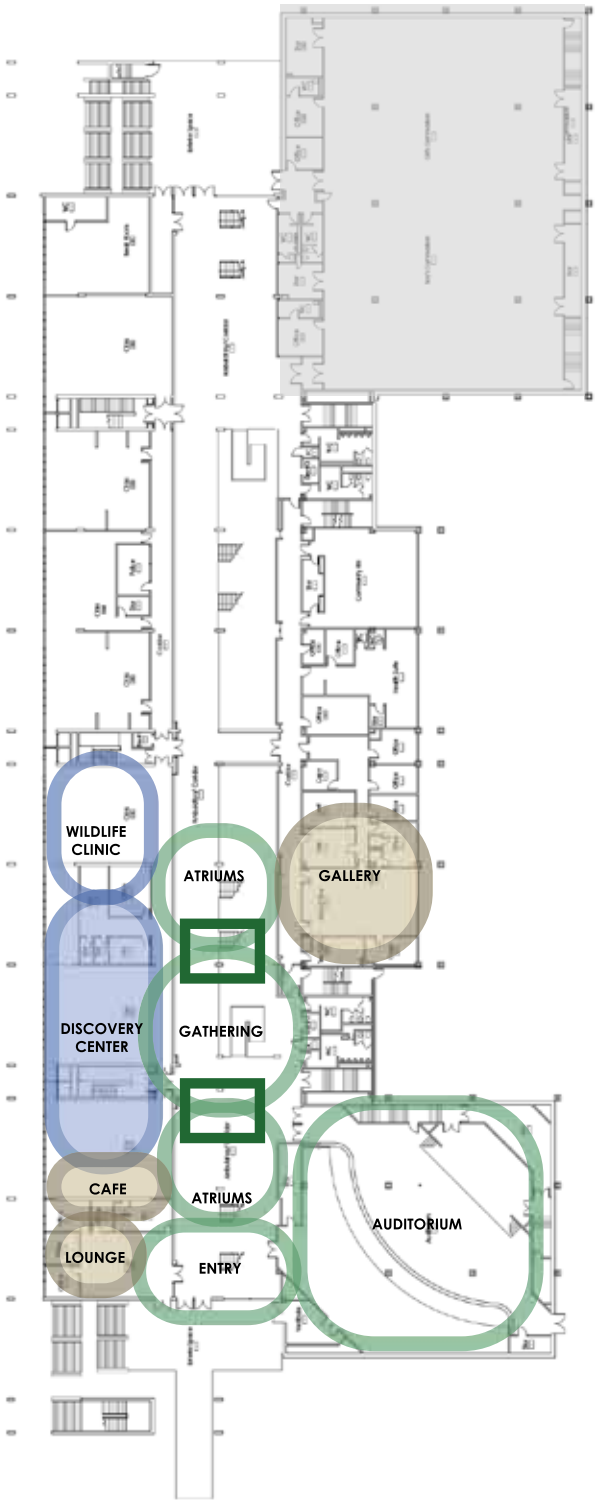


Existing Second Level



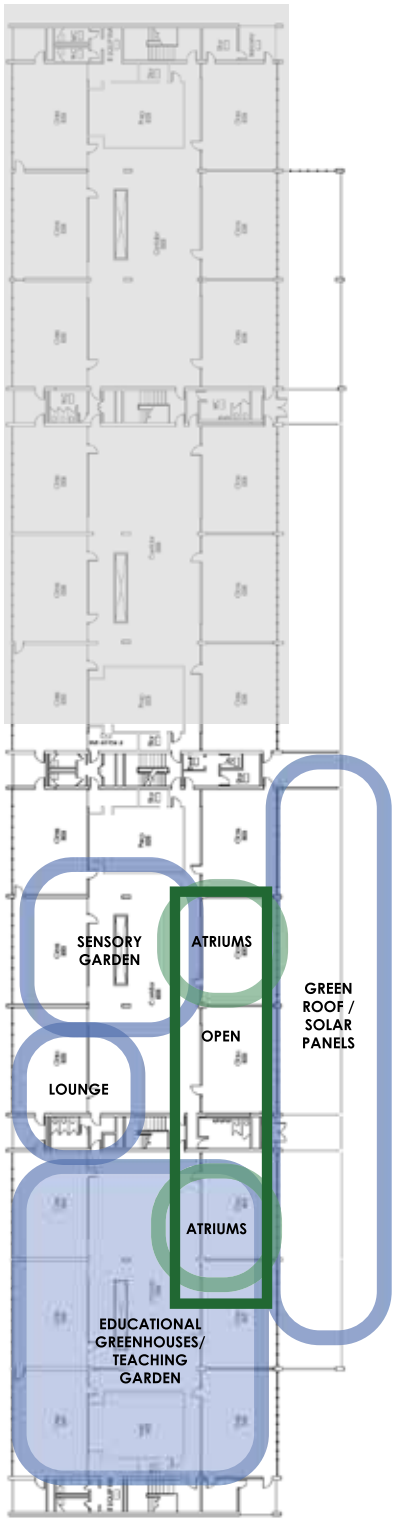
Existing Third Level

Site & Program:
Eastwick Center for Environmental Education

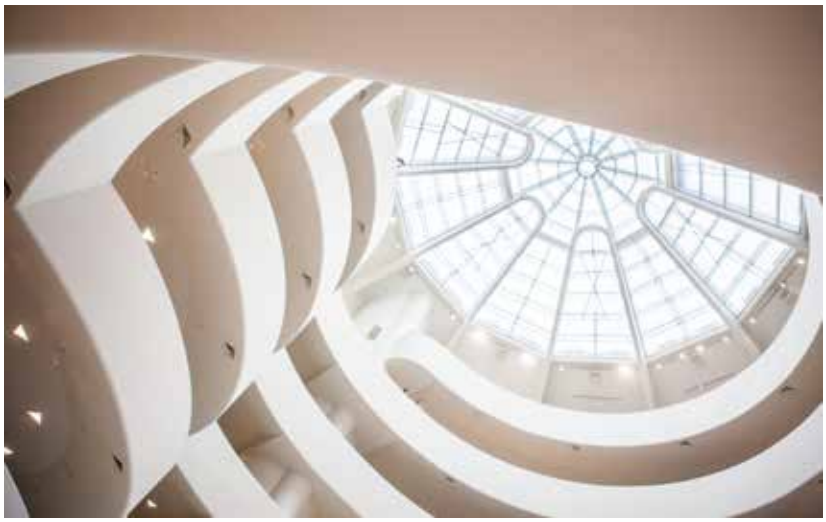


Proposed Level 1

Proposed Level 2



Proposed Level 3



Inspiration

4

Regenerative Strategies:
Water, Energy, Land

Living Machine

Living Machine is a wastewater treatment system that harnesses natural wetland systems in the form of constructed wetlands. The system uses living organisms like plants to clean water incorporating the same processes that are used traditionally. Living machines essentially harness the power of natural systems in our built environment while offering a unique aesthetic and educational opportunity.

Energy Production

Regarding energy, it is vital that the building generates its own energy needs at the minimum. While this will require energy to be produced on site through renewable methods, this also refers to the building design and how that influences the amount of energy consumed by the building.

Building Envelope

Lastly, the building envelope can be a very important strategy for regeneration. A successful green roof, for example, not only reduces hardscapes, but can also act to sequester carbon and clean ambient air.

Research to Design Statement

The overall goal for this project is to bring ideals and values of Regenerative Design into interior space. Using research outlined in this thesis, the final design involves the creation of a *living building*. Natural resources flow in and out of the site as the building breathes, and the surrounding site is revitalized. The program will also provide regeneration for the Eastwick community, through the creation of a central hub for learning and collaboration. Interactions with spaces and their processes give a sense of pride and ownership over place. Programmatic spaces are meant to be adopted by users, such as studio and gardens.

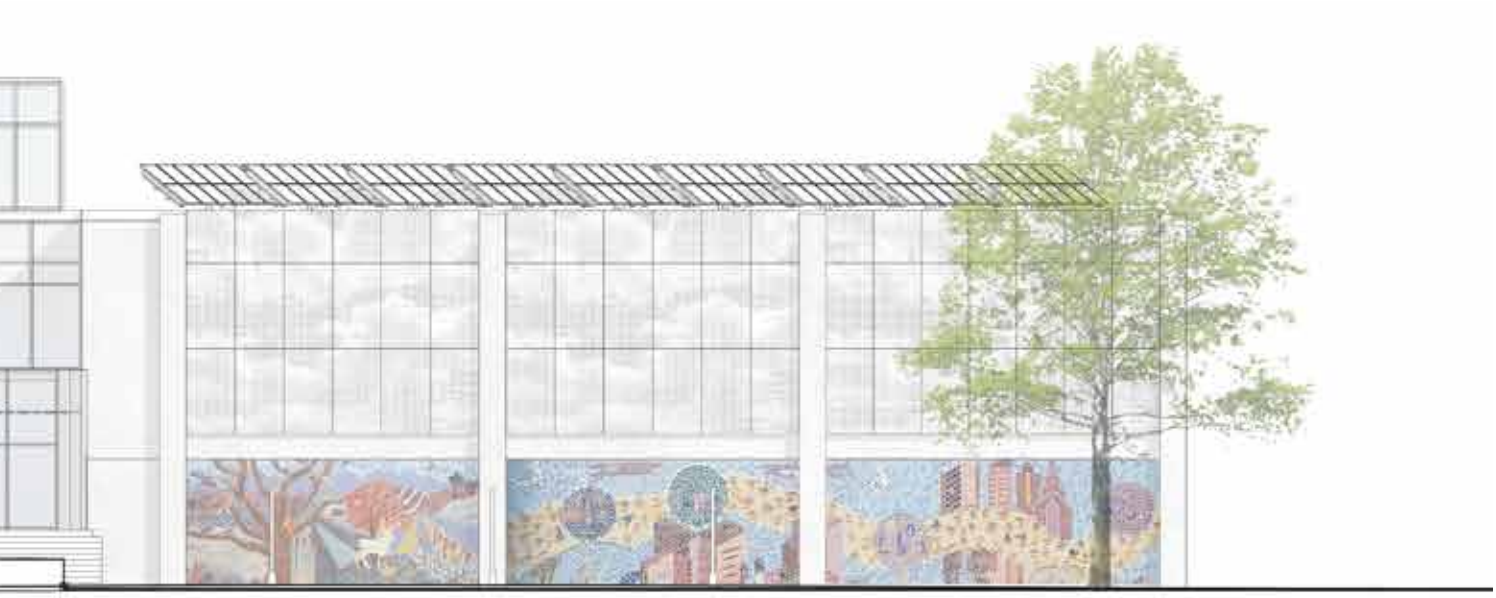
5 Final Design

Eastwick Center
for Environmental Education

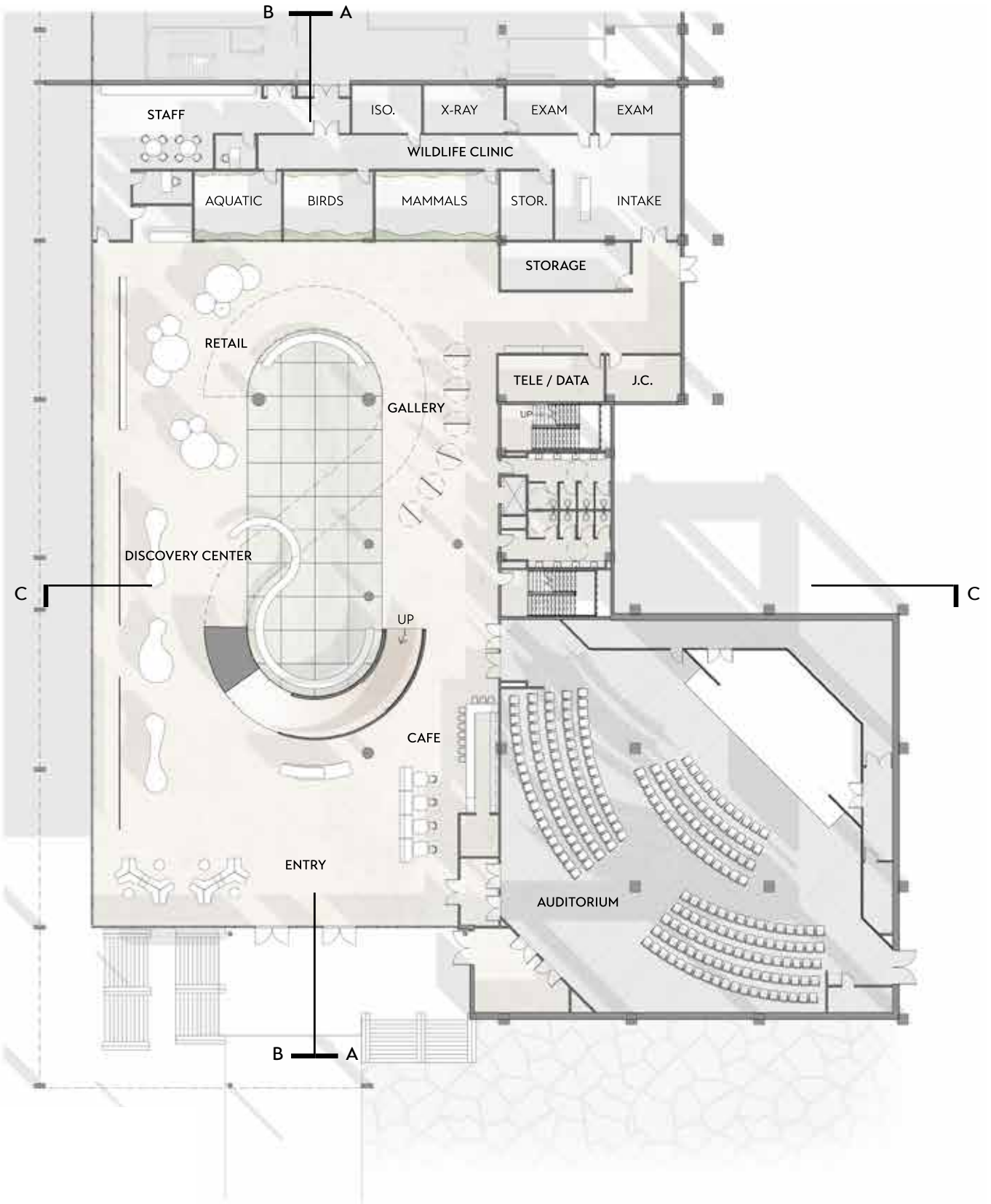
The Eastwick Center will serve as a welcoming gateway to an imagined environmental research facility that would occupy the rest of the building, similar to Philadelphia's *Pennovation Center*. Its goals are to immerse users into experiences with nature, both educational and sensory in order to encourage the building of relationships with nature.

Exterior Elevation

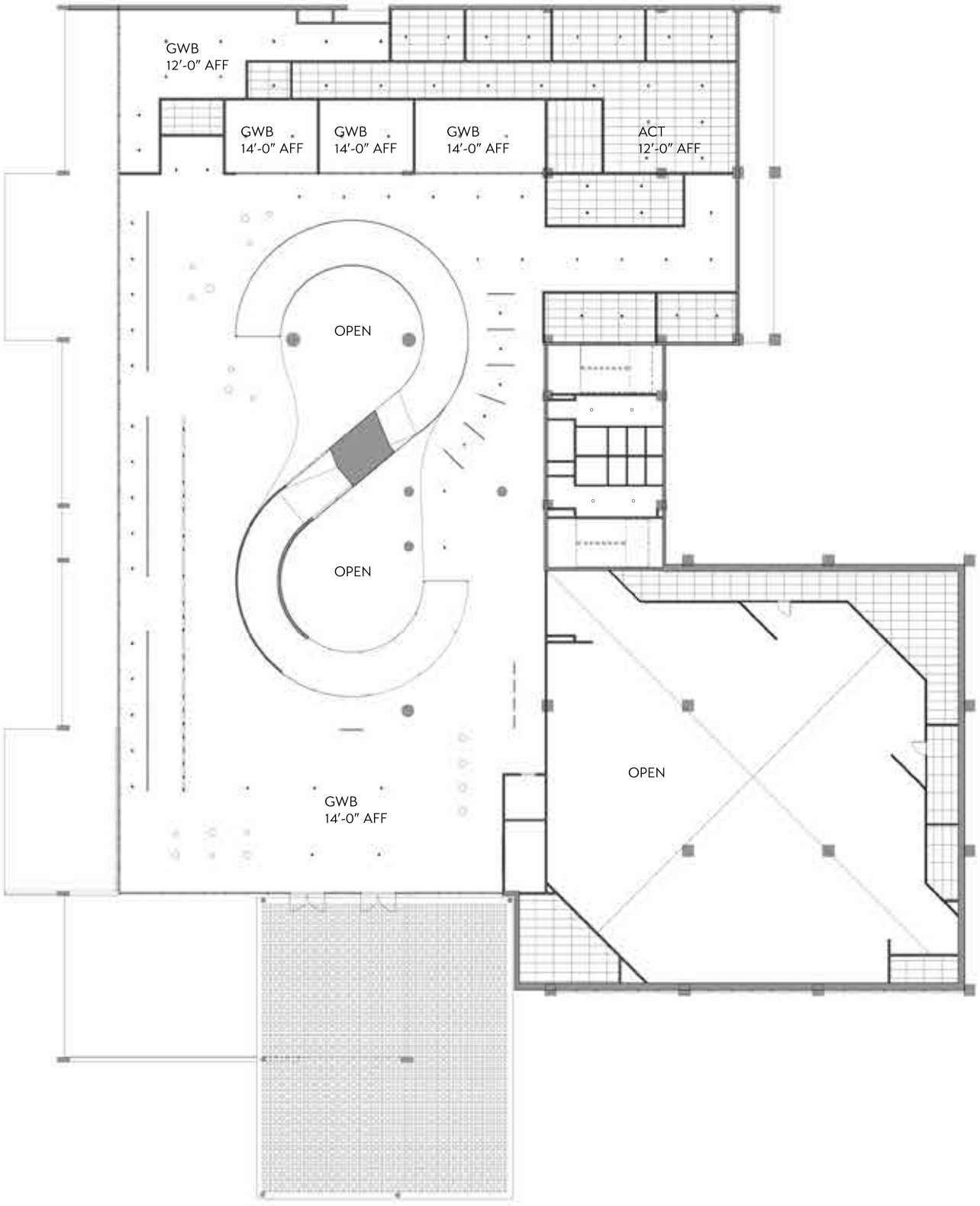
Site Plan



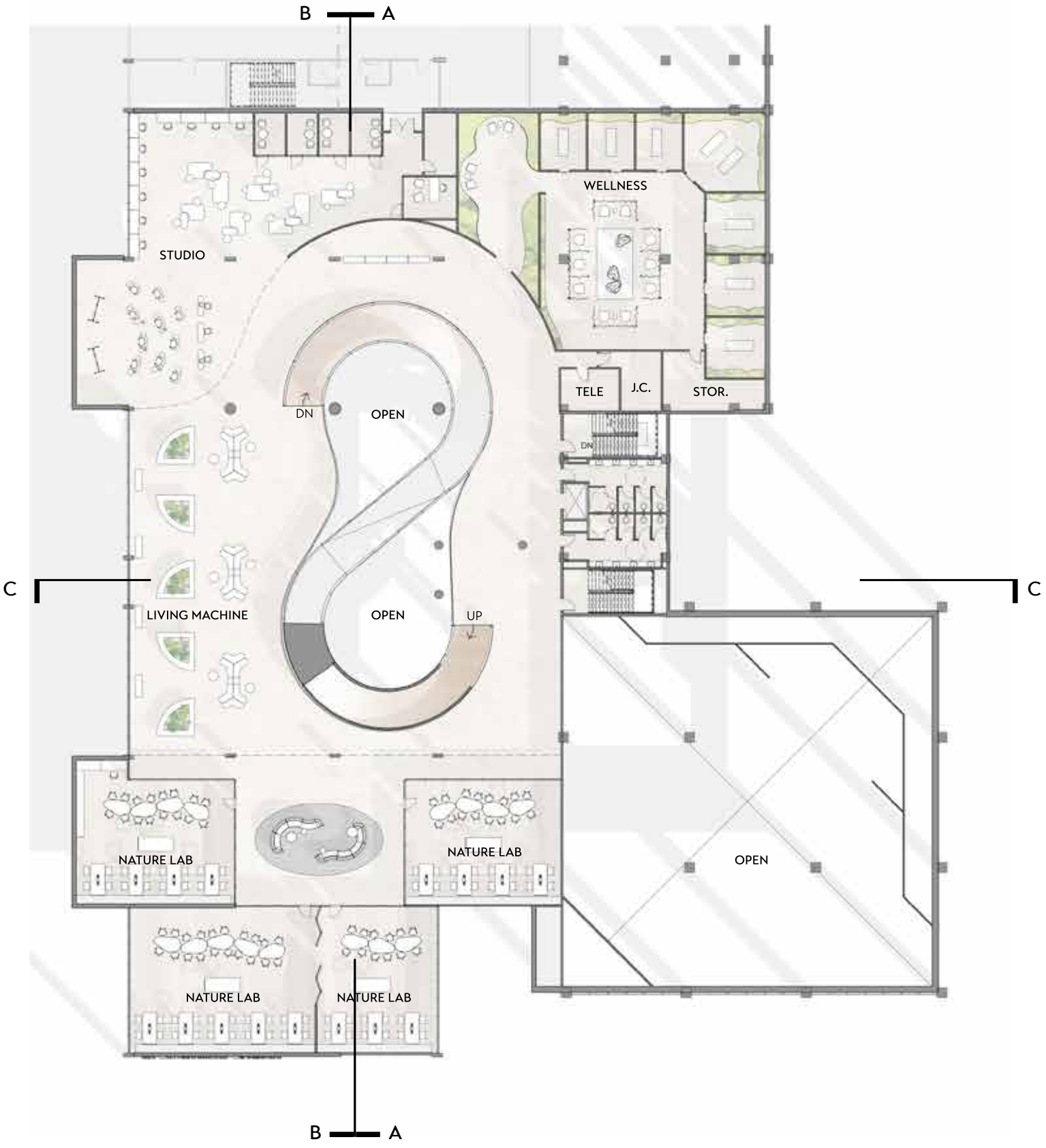
Exterior Facade Perspective


B
A
STAFF
ISO.
X-RAY
EXAM
EXAM
WILDLIFE CLINIC
AQUATIC
BIRDS
MAMMALS
STOR.
INTAKE
STORAGE
RETAIL
TELE / DATA
J.C.
GALLERY
UP
DISCOVERY CENTER
C
C
UP
CAFE
ENTRY
AUDITORIUM
B
A

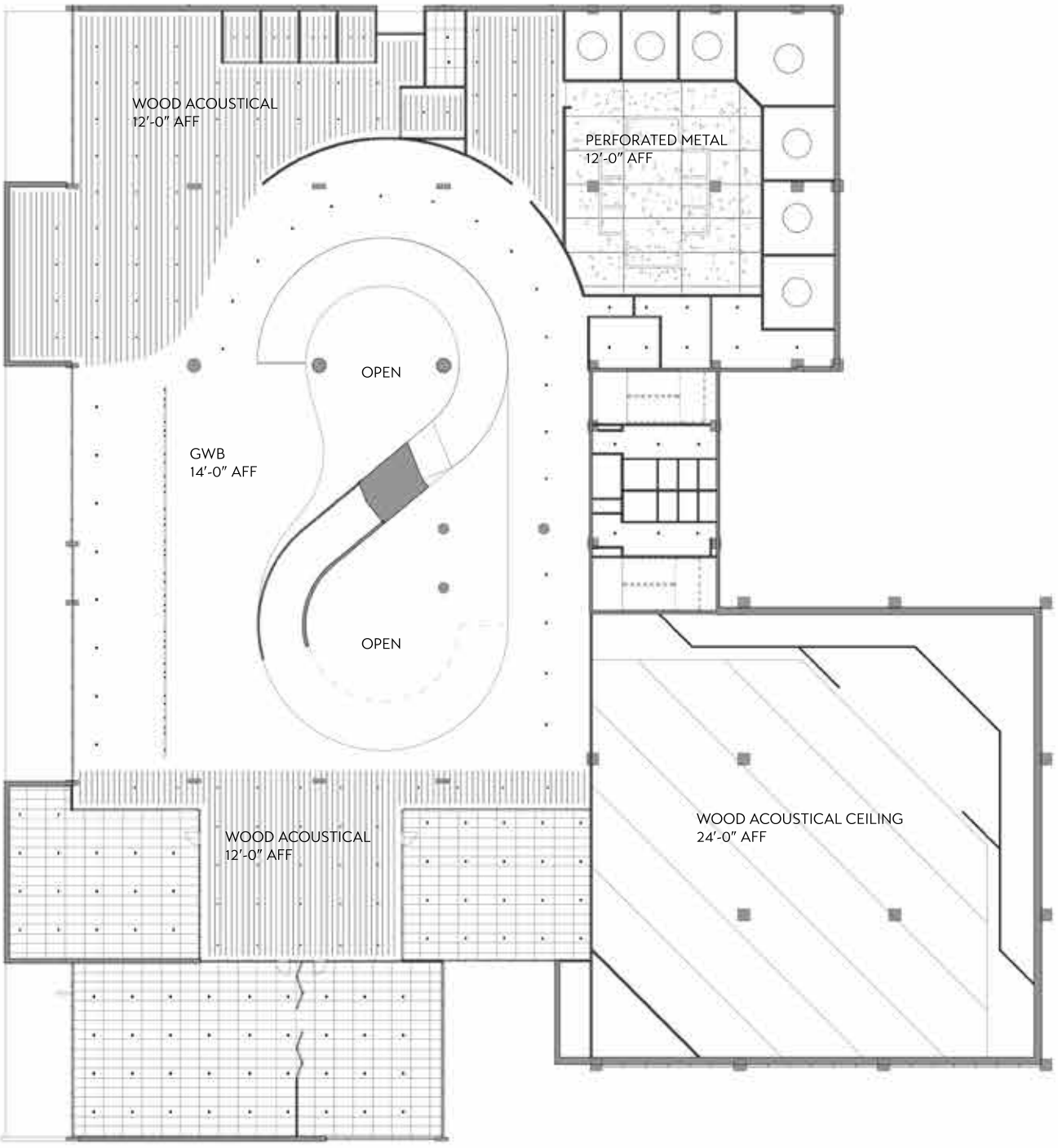
Level 1 Plan



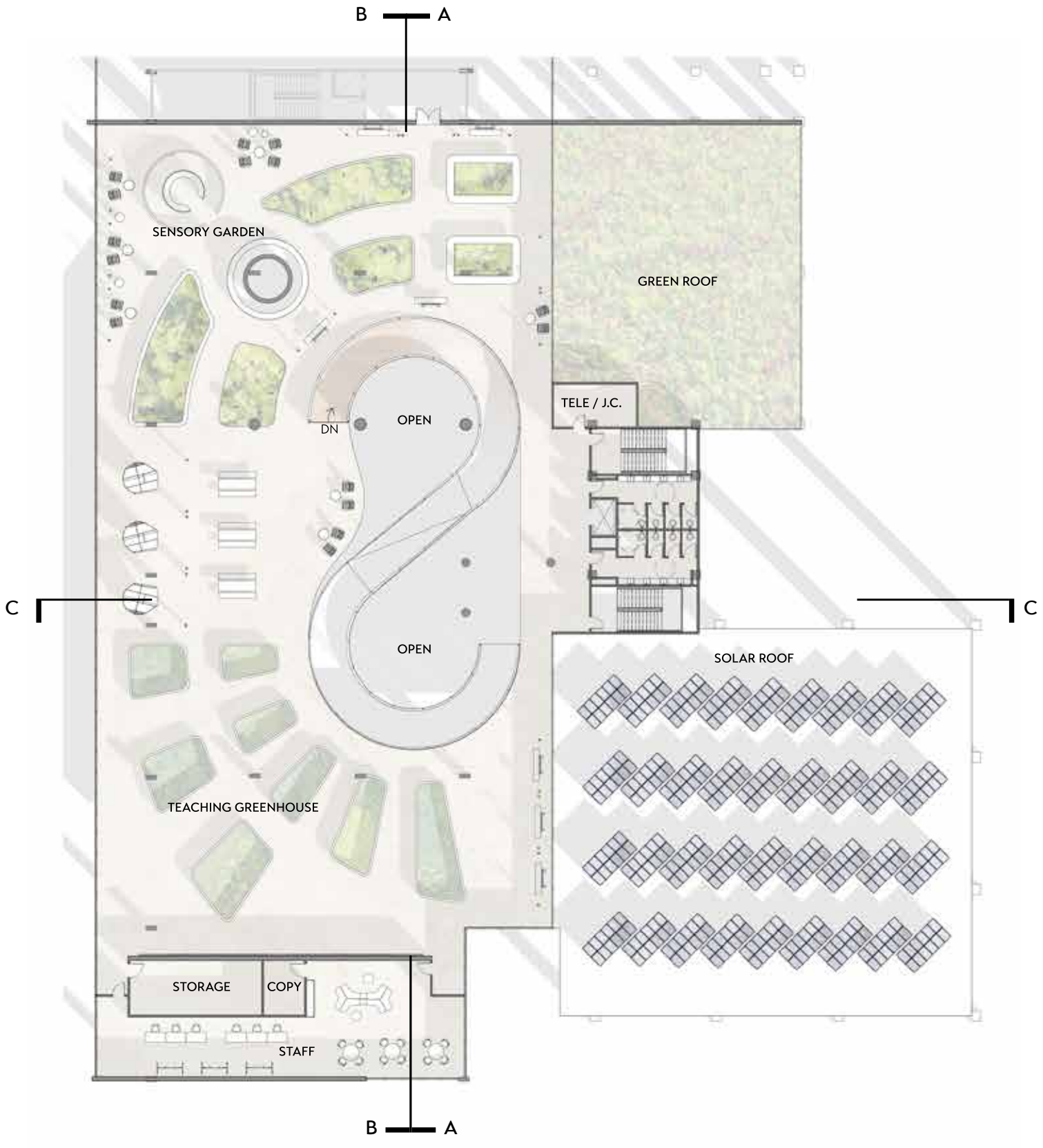
Level 1 Reflected Ceiling Plan


B
A
STUDIO
WELLNESS
DN
OPEN
TELE
J.C.
STOR.
DN
C
C
LIVING MACHINE
OPEN
UP
NATURE LAB
NATURE LAB
OPEN
NATURE LAB
NATURE LAB
B
A

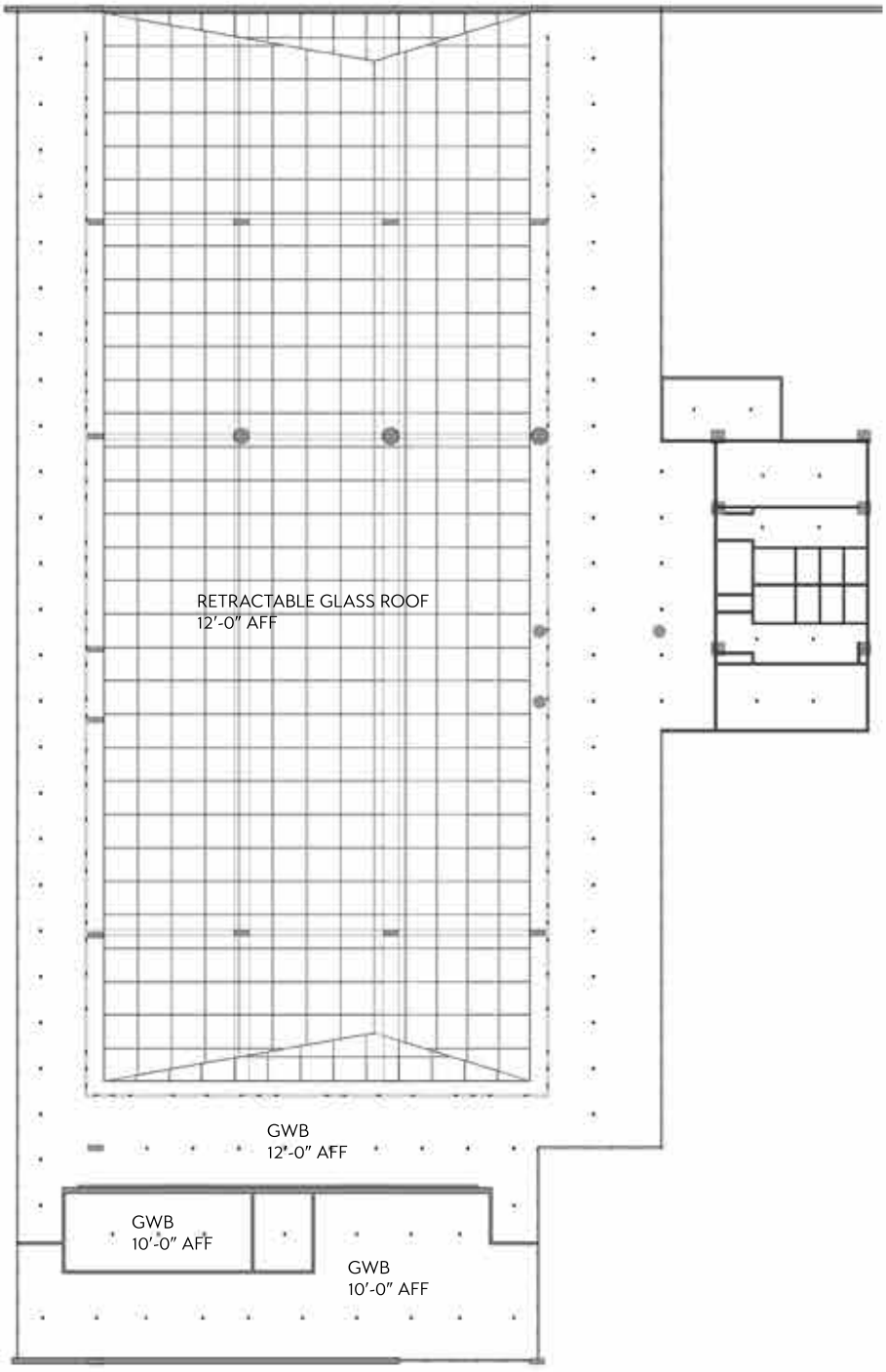
Level 2 Plan



Level 2 Reflected Ceiling Plan


B
A
SENSORY GARDEN
GREEN ROOF
TELE / J.C.
DN
OPEN
OPEN
C
C
SOLAR ROOF
TEACHING GREENHOUSE
STORAGE
COPY
STAFF
B
A

Level 3 Plan



Level 3 Reflected Ceiling Plan

Section A-A

Interactive Exterior Perspective

Reception Perspective

Section B-B

Cafe Perspective

Discovery Center Perspective

Atrium Perspective

Section C-C

Wildlife Clinic Perspective

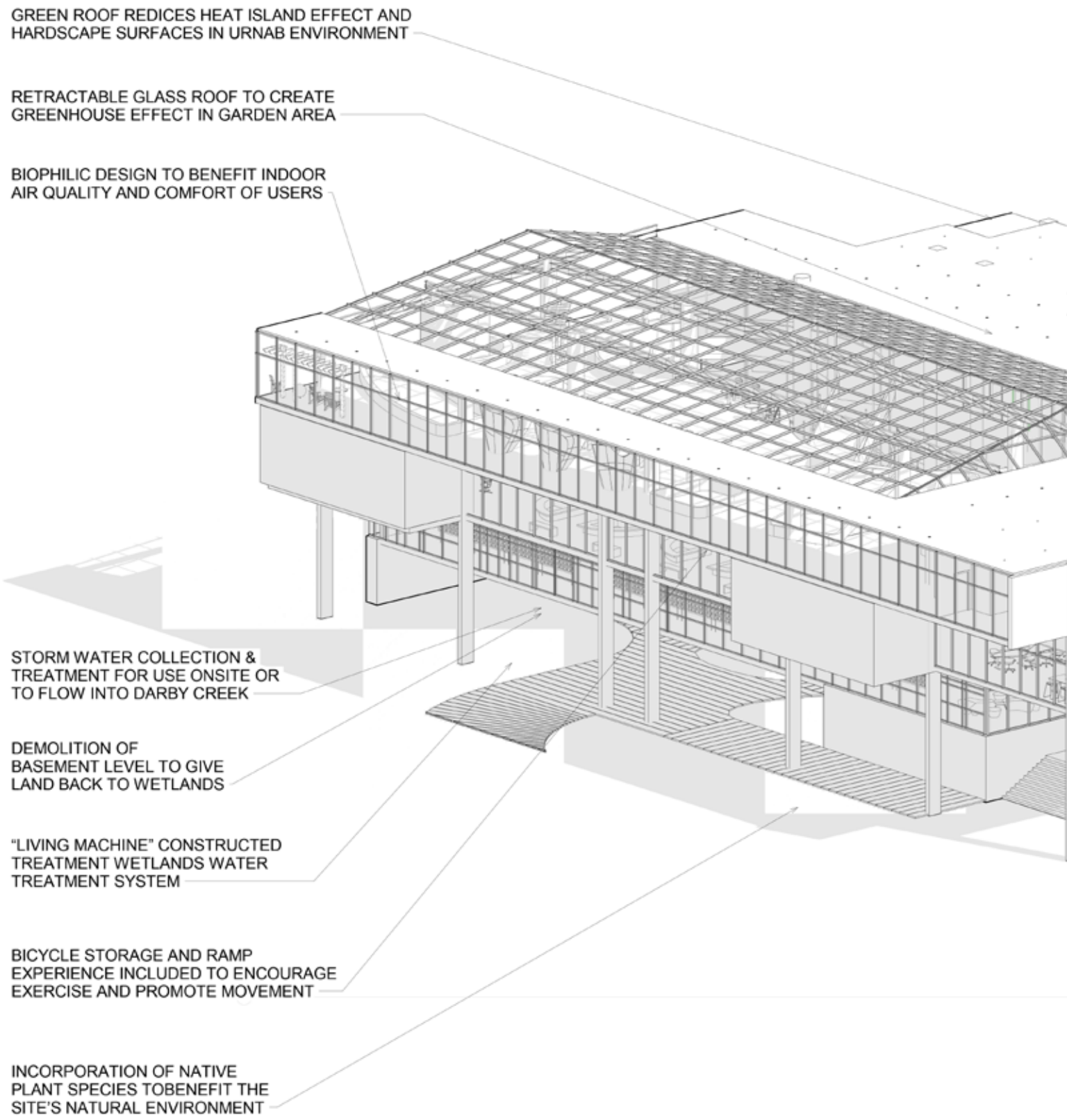
Auditorium Perspective

Nature Lab Perspective

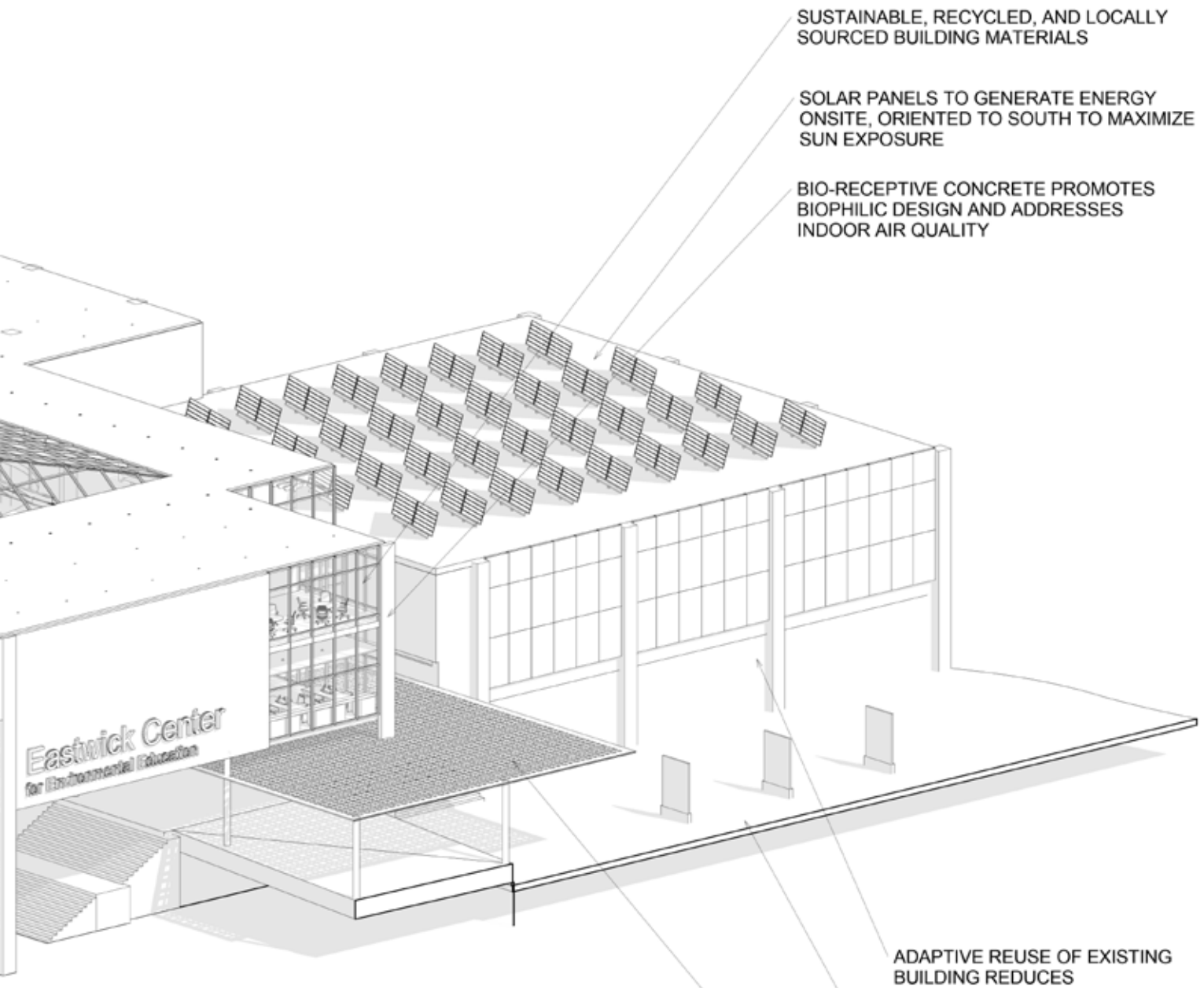
Studio Perspective

Wellness Area Perspective

Sensory Garden Perspective



Regenerative Design Strategies



SUSTAINABLE, RECYCLED, AND LOCALLY SOURCED BUILDING MATERIALS

SOLAR PANELS TO GENERATE ENERGY ONSITE, ORIENTED TO SOUTH TO MAXIMIZE SUN EXPOSURE

BIO-RECEPTIVE CONCRETE PROMOTES BIOPHILIC DESIGN AND ADDRESSES INDOOR AIR QUALITY

ADAPTIVE REUSE OF EXISTING BUILDING REDUCES CONSTRUCTION WASTE

PERVIOUS PAVERS TO ALLOW NATURAL HYDROLIC BALANCE AND REDUCE FLOODWATER RUNOFF VOLUME

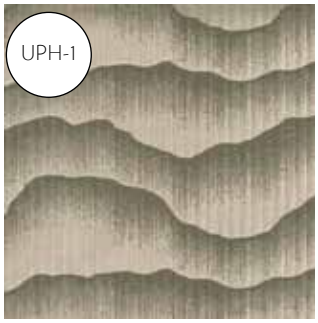
LIGHT SHELF TO REFLECT LIGHT FURTHER INTO BUILDING WHILE REDUCING GLARE AND HOTSPOTS

Level 1 FFE

Level 2 FFE

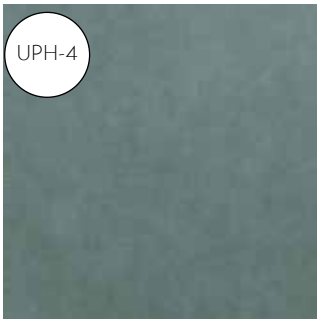
Level 3 FFE

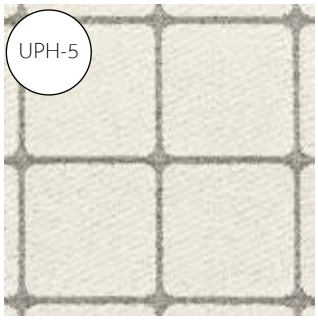

PORCELANOSA


UPH-1


UPH-2


UPH-3


UPH-4

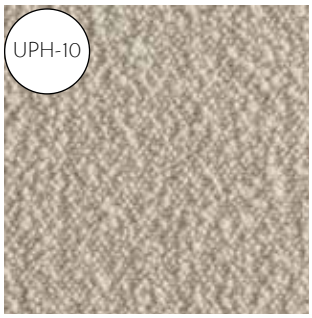

UPH-5


UPH-6


UPH-7


UPH-8


UPH-9

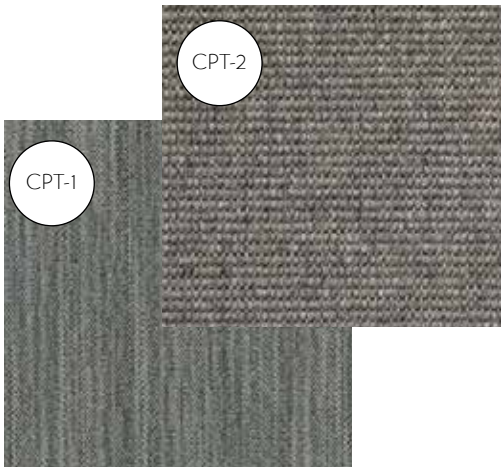

UPH-10


UPH-11


UPH-12


WC-2
WC-1

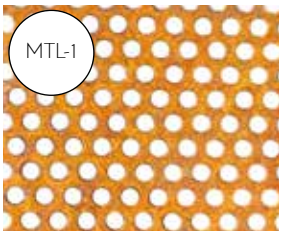

WIN-1
WIN-2


CPT-2
CPT-1


FL-1


FL-2


FL-3



Finish Schedule

Code	Material Type	SKU	Manufacturer
UPH-1	Upholstery	Cirrus / Charcoal	Posh Textiles
UPH-2	Upholstery	Cirrus / Ivory	Posh Textiles
UPH-3	Upholstery	3937-103 / Dapple / Shoji	DesignTex
UPH-4	Upholstery	STB9400 / Stable / Sea Biscuit	Wolf Gordon
UPH-5	Upholstery	6594-05 / Piet / Grid	Brentano
UPH-6	Upholstery	3773-101 / Ink / Terrain	DesignTex
UPH-7	Upholstery	4213-03 / Compass / Basket	Pollack
UPH-8	Upholstery	6106-01 / True Horizon / Desert	Pollack
UPH-9	Upholstery	32148-3333	Kravet Contract
UPH-10	Upholstery	4240-01 / Shepherd / Lamb	Pollack
UPH-11	Upholstery	PIV9377 / Piave / Whiskey	Manufacturer
UPH-12	Upholstery	4206-08 / Geneva / Midnight	Pollack
WC-1	Wall Covering	MRY3181 / Mantaray / Carbon	Wolf Gordon
WC-2	Wall Covering	ARC201 / Arcadia / Wheaten	Wolf Gordon
WIN-1	Window Treatment	283790 / Lull / 002 Brulee	Maharam
WIN-2	Window Treatment	ShearWave5000 / Linen Pearl	Phifer
CPT-1	Carpet	38580 / Collective V Tile	Shaw Contract
CPT-2	Carpet	650131 / Kent / 005 Brindle	Maharam
FL-1	Floor Tile	00204 / Odyssey Tile / Maui	Shaw Contract
FL-2	Concrete Floor	Custom	Philadelphia Polished Concrete Inc.
FL-3	Bio-Based Floor Tile	Striations / Atmosphere	Armstrong
MTL-1	Perforated Metal	Custom Cor-Ten Steel	SSAB
MTL-2	Perforated Metal	H-Clad / Custom Perforated Aluminum	Hendrick Architectural
MTL-3	Decorative Metal	6277 Alumasteel	Wilsonart
WD-1	Acoustic Wood	Akupanel Brown Oak	Wood Upp
WD-2	Acoustic Wood	Microperf / Ash	ASI Architectural
WT-1	Wall Tile	M106 / White Cliffs	Daltile
WT-2	Wall Tile	Piedra Natural / Natural	Porcelanosa
WT-3	Wall Tile	L221 Crema Europa	Daltile

Thank You

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