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Black HOLISTIC: A RESPONSE TO RESPIRATORY HEALTH AND EQUITY THROUGH K-12 ENVIRONMENTS AND COMMUNITY - BASED DESIGN

Azha Parker

BLACK HOLISTIC

In this study, an exploration in educational and architectural domains will be considered for a conceptual prototype of an enabling educational environment that pays focus to asthmatic health amongst students and community involvement.. An ecological approach will also be of use playing a vital role in the current health of black Americans as we see the disproportionate exposure of communities of color and the poor to higher concentrations of environmental harms. Research through healthcare professionals and architects will be used to establish shared theoretical and experiential knowledge with a combination of community based participatory research data. A practice that offers the benefit of cultural relevancy and the involvement of collective, reflective inquiry in which researchers and community stakeholders engage as equal partners. Lakeview Elementary school becomes focus as we work to implement health beneficial strategies upon a site that has experienced a degree of environmental harm.

BLACK HOLISTIC

A RESPONSE TO RESPIRATORY HEALTH AND EQUITY THROUGH K-12 ENVIRONMENTS AND COMMUNITY - BASED DESIGN

REQUEST FOR APPROVAL OF THESIS RESEARCH PROJECT BOOK PRESENTED TO:

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BY

AZHA PARKER

IN PARTIAL FUFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF

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KENNESAW STATE UNIVERSITY
MARIETTA, GEORGIA

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DEDICATION

I would like to dedicate this book to my younger brother and sisters: Jeremy, Aryn, Lauryn, and Ryan, everyday you remind me of the power the younger generation has over our future; inspiring me to take focus on the environments of children.

To my family, my mom and dad, Veronica and Eric ,thank you for completely supporting me in my journey these past 5 years. Allowing me to pursue my interest and reminding me of what I am capable of.

To my friends, thank you for working hard, pushing me to maintain a standard we have set for ourselves all while making me laugh on the hardest days. To Zach, thank you for being my companion through our years in school, helping me when I needed it the most.

I would not have accomplished this degree without the support system I have been blessed with. **Thank you.**

ACKNOWLEDGEMENT

This thesis would not be possible without the support and guidance of my thesis advisor, Dr. Pegah Zamani. Thank you for pushing me and seeing the oppurtunities that I could not. I hope we can achieve much more from this project in the future. Professor Coles and Professor Bedette, thank you for taking out the time to offer your critique and support.

I would not have accomplished this thesis without the guidance of the faculty within KSU's Architecture program, and the support of Garry Harris with the Center for Sustainable Communities. This project was financially supported by the CSC.

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THEOREM

Identifying relationships between health, race and our natural and built environments

This section looks at the systematic problems that America faces towards health and race. Addressing topics such as health disparity, environmental injustice, and educational equity in order to identfy the interlacing between such topics.

SUSTAINABILITY WITHOUT EQUITY ONLY SUSTAINS INEQUITY

Environmental Injustice becomes a major issue as we see the disproportionate exposure of communities of color and poor to higher concentrations of environmental harms. This becomes a direct factor to the inequity of health within these communities .The cause of environmental injustice or environmental inequity include discriminatory siting, misguided regulatory policy, unequal regulation enforcement, and unequal political power. Low-income and minority communities are often more likely to have less political power, and communities with less political power less likely to have their voices heard by regulators. We look at Flint, Michigan, it is indisputable that in Flint, the majority of residents are black and many are poor. The water contamination in Flint was born out of a decision to switch the city's water source to the Flint River in April 2014. The explicit goal was to save Flint, which was on the brink of financial collapse, millions of dollars. Environmental decisions are often related to political power. In some cities, garbage incinerators have been built in African-American neighborhoods that do not have the political clout to block them. Many of those advocates assert that environmental racism is a major reason black people in Louisiana's factory-laden "Cancer Alley" contract the disease at higher rates, or why the most polluted ZIP code in Michigan is in a southwest pocket of Detroit that is 84 percent black.

INADEQUACY IN THE STATE OF OUR SCHOOLS DUE TO INEQUITY

A large and growing body of evidence demonstrates that school facilities have a direct impact on student learning and student and staff health. But too many students attend school facilities that fall short of providing 21st century learning environments due to underfunding. Most troubling is the inequity of K–12 public school facilities from community to community. Because the vast majority of capital construction is funded by local taxpayers, the ability of school districts to pay for major facilities, renewals, or new construction is tied to the wealth of the community. That reality embeds inequity into a state's school facility conditions, except in the small number of states that have reformed their educational facilities finance policies and practices. Some children learn in state-of-the art school buildings, with the most modern labs, classrooms, and computer centers available. But too many students suffer in buildings that were out of date decades ago and are an embarrassment in the world's richest country. Because local wealth is the primary source of capital construction funds, underinvestment disproportionately affects children from low income families. The results affect both students' well-being and their educational opportunities. **The State of our Schools** is a joint publication of the 21st century school fund that effectively addresses the shortfalls and inequities will require disrupting traditional approaches to planning, managing, and funding public school facilities.

SIGNIFICANT DIFFERENCE IN QUALITY OF HEALTH WITHIN RACIAL GROUPS

Health disparity is a result of multiple factors Populations can be defined by factors such as race or ethnicity, gender, education or income, disability, geographic location (e.g., rural or urban), or sexual orientation. Our environments also play huge role in the health of others. It is unfortunate that the environments of minorities are more likely to experience instances of environmental injustice and inequity in building conditions. The combination of things leads to higher mortality rates in communities of color. Higher rates of chronic disease are prevalent as well . As we see black Americans having higher cases of spreadable illness, cancer, diabetes, sickle cell disease, and asthma (amongst children). Many of these diseases being instilled within the genetic makeup of African Americans due to the hundreds of years of living within inhumane conditions.

DISREGARD FOR HEALTH RESILIENCE WITHIN COMMUNITIES OF COLOR

Resilience in health is more than the facilities alone. Currently, healthcare is seeing a shift from a model that focuses on providing services to those who are ill to a broader focus on the health and well being of a community and the environment. Resilient and sustainable design strategies are integral to this transition to a different model of care. Resilience does not occur under special or particularly complex conditions but"from the everyday magic of ordinary, normative human resources in the minds, brains, and bodies of children, in their families and relationships, and in their communities".

THESIS OBJECTIVES

1
TO IMPLEMENT

design strategies that pay specific focus to early disease prevention

Creating design strategies through research on diseases that disproportionately effect African American communities. Making connections in terms of architectural design and health related research that can either directly prevent these illness or create synergetic spaces that influence the child's mindset towards health. These investments eventually paying health dividends not just for racial minorities, but for everyone.

2
TO REDEFINE

our schools, taking a focus towards public health and architectural design

Through a multitude of studies we begin to implement a series of design strategies that have a direct correlation to the prevention of diseases that heavily impact African American communities. These strategies would be placed into a k-12 educational setting being translated to different space types.

3
TO INTERACT

with existing neighborhoods through culturally sensitive community connection from our schools

How does design interact with its surroundings? Programmatic pieces will be placed that will push into immediate neighborhoods with the goal of health promotion and lifestyle wellness. Using schools as a common ground between the student, parent, and community create the oppurtunity for community outreach that has a focus of health promotion in a holistic sense. Recognizing the sensitivity between the African American community and public health service and planning accordingly.

4
CREATE RESILIENCE

in terms of health through the development of a design prototype

Health resilience within the African American Community becomes the number one goal . Using an existing school as prototype to assist in strengthening public health.

THESIS PURPOSE

The overarching aim of this thesis is to investigate the causes of higher amounts of absenteeism due to asthmatic disease within African American students as it pertains to building related illness and environmental harms. With this information, design decisions will be made to respond asthma symptoms amongst students and introduce new outlooks towards health within the communities non-intrusively. Looking at Lakeview Elementary School in Portsmouth, Virginia as a case. This majority African American school sits adjacent to a prexisiting landfill that has been capped before construction of the school. This site will act an example, showing the relationships between asthmatic health and environmental health and ways both can be mitigated through community design.

01.3 ADDRESSING ENVIRONMENTAL EQUITY

WARREN COUNTY PCB

"Sustainability without equity sustains inequity." Inequality in America has been prevalent since early slavery. As we move towards a more progressive future efforts are being made to improve the lives of those who have been effected by these inequalities. Inequality too can be interpreted in different ways. When considering inequality, important questions are: inequality of what? Income, oppurtunity, education, and living conditions. The focus of this these focuses on the relationship of inequality and the environment and how the have detrimentally become a cause of the poor health of black communities.

The term environmental injustice surfaces in the 1980's in the protest of waste in Warren County, North Carolina. Warren County PCB Landfill was a PCB landfill located in Warren County, North Carolina, near the community of Afton south of Warrenton. It was used as a place to dump contaminated soil as a result of an illegal PCB dumping incident. 31,000 gallons of PCB-contaminated oil was drippied along some 240 miles of highway shoulders in 14 counties. These toxins spread into the environment for 4 years with no action taken to mitigate the issue.

"SACRIFICE ZONES"

African Americans are 79 percent more likely than whites to live in neighborhoods where industrial pollution is suspected of posing the greatest health danger. In 2007, as documented in United Church of Christ Toxic Wastes and Race at Twenty report, African Americans and other people of color are more concentrated near hazardous wastes facilities today than two decades ago. People of color now make up 56 percent of the residents living in neighborhoods within two miles of the nation's commercial hazardous waste facilities; they comprise a whopping 69 percent in neighborhoods with clustered waste facilities. (Robert, 2008)

Georgia's "anti-concentration" law is the only state law requiring some consideration of environmental justice principles. The law, passed in 2004, restricts the number of solid waste facilities that may be sited within a two-mile radius of three or more other solid waste facilities.

ENVIRONMENTAL JUSTICE HOTSPOTS

In 2012, Atlanta-based environmental law non-profit, GreenLaw, published a report on the intersection of pollution and demographics in the Atlanta Metropolitan Area, which included 14 counties. They analyzed publicly available data to identify eight types of air, water, and land pollution, which were then cross-referenced with seven demographic characteristics to see how pollution and demographics were related. The report very clearly showed that "race is the characteristic with the strongest correlation to pollution" Deganian, D. & Thompson, J. (March 2012).

African Americans are 79 percent more likely than whites to live in neighborhoods where industrial pollution is suspected of posing the greatest health danger.

PATTERNS OF POLLUTION

Minority rates rise with the number of nearby pollution sources. Areas with a minority population 50 percent or higher have more than double the number of pollution sources than areas where minorities make up less than 10 percent of the population.

Households in which English is not the primary language, designated as "linguistic isolation" by the U.S. Census Bureau, are more than twice as likely to live in a high pollution area.

Areas with linguistic isolation rates over 20 percent have more than three times as many pollution sources in close proximity on average as blocks where less than 5 percent of households are linguistically isolated.

Areas with poverty levels above 20 percent contain on average almost six pollution sources, compared to areas with poverty rates under 5 percent that have only two.

Areas with vacant housing rates above 15 percent have three times as many pollution sources as areas with rates below 5 percent.

(L) By Author | Environmental Justice Hotspots in Metro Atlanta

Through the recording of violations of environmental laws enforced by the EPA and EPD Greenlaw's "Patterns of Pollution" 2012 report, 14 counties in the metro Atlanta region are observed to analyze general patterns of pollution [figure 1], compare demographic traits of high pollution and low pollution blocks, and identify environmental justice hot spots. These violations include, among other things, sanitary sewer overflows, hazardous waste permit violations, and air permit exceedances. Paulding and Cherokee County have the highest ratios of violations to pollution points due largely to Clean Water Act violations. Cobb, Fulton and Gwinnett counties have the fewest reported violations relative to the number of pollution points. This still excluding all Clean water act violations in DeKalb county. Deganian, D. & Thompson, J. (March 2012).

01.4 ADDRESSING HEALTH EQUITY

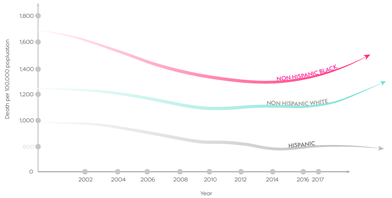
65%
of African Americans do not have confidence in medical scientists to act in the public's best interest

20%
More likely to experience serious mental health problems

63%
of African Americans have a negative stigma towards mental illness

THE EFFECTS OF COVID-19

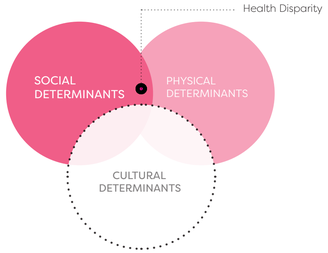
Black communities account for disproportionate number of Covid-19 deaths in the US 60,000 excess deaths were occurring annually because of health disparities, primarily among African Americans. Large reductions in death rates occurred between 1960-200, but the disparity between higher mortality rates of Blacks did not change with this.[Figure 1.2]



[1.2.1]By Author | Covid Multiplier for Vulnerable People in 2020

HEALTH AND EQUALITY

Different factors multiply the likelihood of dying of COVID-19, vulnerability types include: housing, unemployment, incarceration, poverty, food insecurity, and neighborhood stress. In every single one of these categories black Americans rank the highest. The socioeconomically vulnerable are more likely to die from corona-virus, to lack testing, and to develop a severe case, or die from it. The occurrence of Covid-19 has given designers the oppurtunity to address issues on structural racism iconic diseases, and tackle issues around behavioral health, which is also apart of the chronic disease spectrum.



[1.3]By Author | Determinants of Health

DISTRUST IN PHYSICIANS

A historical perspective on the negative associations of health authorities and administrations within the black community strongly contributes to the current gap in health. This background will help in making decisions that influence design framework in terms of affective community-based design infiltration. Over many years members of the black community have developed a distrust in medicine based on centuries of inhumane. This idea reaches to the times of slavery treatment when gynecological research was performed on female slaves. Post-slavery African Americans could expect poor medical conditions unless being used for research. Discourse on race tends to focus on the lived experience of Black people, because of the "peculiar institution" of slavery in America. Medical historian Todd Savitt documents examples of racism in medicine to illustrate his observation that "some white Southerners claimed and many others believed that blacks were medically different from whites and so in need of special treatment." (Casper,2019)

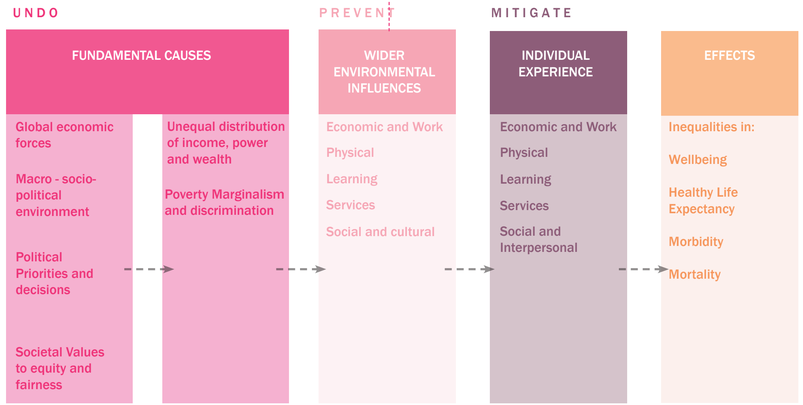
STIGMA IN MENTAL HEALTHCARE

In the 18th and 19th century, physicians in the United States generally believed that fundamental differences in physiology between blacks and whites influenced the manifestation and, therefore treatment, of disease in their bodies. Physicians in the antebellum South also capitalized on the large population of enslaved persons for experimentation and the development of clinical procedures whose use has extended into modern practice. There is no wonder there is a contemporary fear and mistrust that many black people have towards medicine, and the beginnings of their legitimate discontent with the healthcare system.

CULTURALLY RESPONSIVE ARCHITECTURE

Culturally responsive architecture is not about the aesthetics that architects feel fit the demographic of people they are representin. It focuses on the functioning of a space and how aspects of this can derived from the culture of the demographic.

African Americans are 79 percent more likely than whites to live in neighborhoods where industrial pollution is suspected of posing the

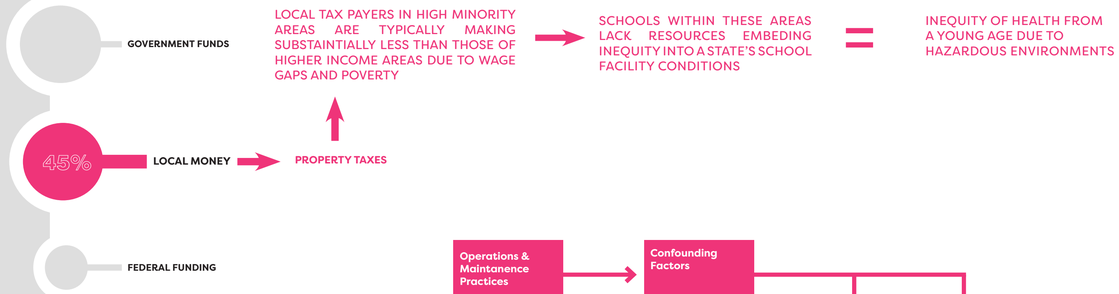


The diagram expresses the fundamental causes of health inequalities as it is an unequal distribution of income, power, and wealth.

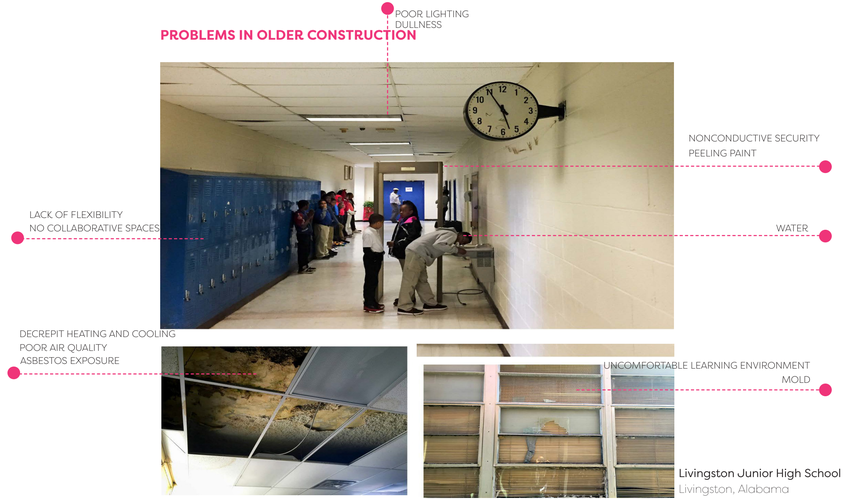
[1.5]By Author | Causes of Health Disparity

01.5 THE STATE OF OUR SCHOOLS

The State of our Schools is a joint publication of the 21st century school fund that effectively addresses the shortfalls and inequities will require disrupting traditional approaches to planning, managing, and funding public school facilities. Encouragingly, a number of states and communities already have begun this work. Instances of innovation and inspiration abound — within the K–12 sector and beyond. They point to a rich landscape of opportunities, if communities can harness their will to address these common challenges. While this report provides a national overview of the issues, challenges, and opportunities, decisions about school facilities are ultimately local.This is because the vast majority of capital construction is funded by local taxpayers, the ability of school districts to pay for major facilities renewals or new construction is tied to the wealth of the community. That reality embeds inequity into a state's school facility conditions, except in the small number of states that have reformed their educational facilities finance policies and practices.



[1.4] By Author | Covid Multiplier for Vulnerable People in 2020



Livingston Junior High School
Livingston, Alabama

[1.5] By Author | Livingston Junior High School

The school acts as a primary aspect in childrens lives for most of their years. The child learns, eats, socializes, and partakes in physical activity in some sort of way within an educational facility. This is arguably where the most childhood development occurs. Through school design there become many oppurtunities through function and program where synergetic learning comes into play through architceture. Livingston Junior Highschool, a majority African Amaerican school in Livingston, Alabama is an example of the inequity within school facilities due to school funding.

EVOLUTION OF SCHOOL HEALTH PROGRAMS 01.6

Health and education: This timeline accounts for instances where individual public health ideals and circumstances have influenced education. This can be broken down into three categories: Policy, Research, and Environment.

Health and architecture: This timeline accounts for instances where individual public health ideals and circumstances have influenced our built environments specifically in the U.S.

Environemtal Injustice This timeline accounts for instances whee environemental injustice in addressed and mitigated within the U.S.

POLICY
RESEARCH
DESIGN

POLICY
RESEARCH
DESIGN

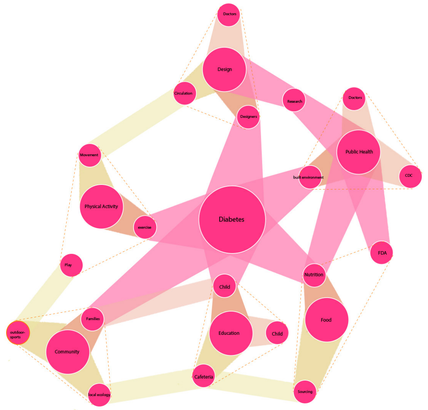
POLICY
RESEARCH
DESIGN

1840
Rhode Island passes legislation to make education compulsory, or llaw, other state soon follow in their footsteps.
1850
Beginning of the modern school era
1901
New York State legislature to pass the Tenement Law of 1901
The development and spread of "open-air classrooms" to prevent and combat the widespread rise of tuberculosis
1914
Locust Point Demonstration
1919
The National Education Association published the report Minimum Health Requirements for Rural Schools
The emergence of the school nurse
1928
The Sixth Yearbook of the Department of Superintendents of the National Education Association outlined the following content guidelines for health education
1930
'New Deal' funding encouraged schools of public health to provide practical training programmes linked to local communities and health departments.
World War II
1946
The National School Lunch Act is pased to provide funds and surplus agricultural commodities to assist schools in serving nutritious hot lunches to school children.
1948
The first national conference on undergraduate and graduate professional preparation in school health education
1950
Standards for school health services were reviewed and revised by the American Public Health Association, the American Nurses Association, and the American School Health Association.
"There is not very much use in taking people from a hospital, apparently restored to health," he wrote, "and sending them back to some slum, putting them into a dark room, where they never see daylight, or letting them live over an open sewer; we all know that in two or three weeks we shall have them back in the hospital, in as bad a condition physically as they were before."
Agknowledgement of environmental racism
1980
President Jimmy Carter signed executive order 12232, which established a federal program "to overcome the effects of discriminatory treatment and to strengthen and expand the capacity of historically black colleges and universities to provide quality education"
1982
environmental justice movement at Warren County, North Carolina
1988
the creation of the Division of Adolescent and School Health (DASH) of the Centers for Disease Control and Prevention (CDC
1992
the Office of Environmental Equity was created
1993
School Health: Policy and Practice was issued by the Committee on School Health, American Academy of Pediatrics
2000
The National Environmental Policy Commission to address environmental justice, public health, and economic development.
The School Health Index is developed by the Center for Disease and Control.
2017
According to a 2017 report by the NAACP and the Clean Air Task Force, Black Americans are exposed to 38% more polluted air than non-Latino white people and they are 75% more likely than the average American to live in fenceline communities
TUBERCULOSIS OUTBREAK
1895
1950 - 1966
1980
1850
Shattuck publishes General Plan for the Promotion of Public and Personal Health, describing health and and social conditions in Massachusetts.
1865
The association of New York issues a report, Sanitation of the City.
1902
Lillian Ward demonstrates in New York that nurses working in schools could reduce absenteeism due to contagious diseases by 50 percent in a matter of weeks
1904
there were 115 sanatoriums with the capacity for 8,000 patients expanding to 839 sanatoriums with the capacity for 136,000 patients in 1953
1908
the first "fresh-air school" was established in 1908 with the building of a school in Providence, Rhode Island.
1918
almost every state enacted laws related to health education and physical education for school children
The New York Board of Education introduced a new requirement that all children entering school must undergo a physical examination without clothing.
1930
White House Conference on Child Health and Protection called for the elimination of treatment in schools and for school physicians and nurse supervisors to increase contact with physicians in private practice..
SITE OF NEW GRACE HOSPITAL
1940
The Hill-Burton Act made federal funds available for hospital construction in underserved areas—quantified as 4.5 beds per 1000 persons of population.
1948
National School Health Bill, which was designed to provide federal aid to school health, was defeated
1948
APHA-CHH developed guidelines for inspecting housing and neighborhoods
Renewal Policies
About 80% of those displaced by urban renewal were African Americans, ranging from 60% in New York City to 100% in Baltimore, Maryland.
1958
Healing Architecture was published, summarizing evidence-based knowledge of the physical framework and its influence on our well-being at hospitals
1960
that concern for the health and welfare of children and young people led to a reconsideration of the possibility of delivering diagnostic and treatment services at the school site.
1965
the War on Poverty shifted legislation and funding to promote neighborhood or community health centers (CHCs) in economically disadvantaged communities.
Congress narrowly passes legislation to split off a new Department of Education from the existing Department of Health, Education, and Welfare.
1980
The environmental justice movement became a national social and racial protest that galvanized communities across the country seeking social justice and environmental protection
OUR COMMON FUTURE
1987
a defining report, the United Church of Christ Commission for Racial Justice explored the idea of environmental racism in "Toxic Wastes and Race in the United States".
1990
"The Michigan Conference on Race and the Incidence of Environmental Hazards"
1992
the environmental justice activities around the country led to a call by President George Bush Sr. for the establishment of an Environmental Equity Working Group
1995
5 de Leeuws identified eight possible structural models of schools of public health, with a range of university and ministry of health models as well as a standalone research institute
1998
The Center for Envioronmnetal Equity & Justice established in Florida
2020
the American Council for an Energy-Efficient Economy (ACEEE) published a fact sheet stating that, "historically, many marginalized groups have been underserved, overlooked, and underrepresented in local clean energy planning and policymaking."

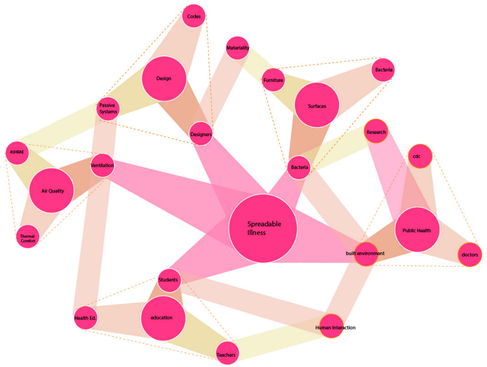
[1.6] By Author. | Historical Context of Health in Schools

01.7 DISEASE PREVENTION

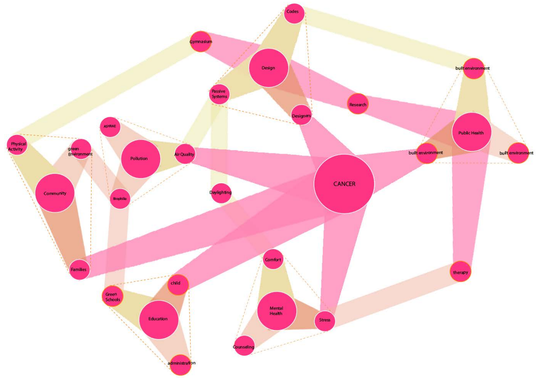
TRANSDISCIPLINARY MODELS : DESIGN AND HEALTH ECOLOGIES
Health ecology is a fairly new discipline of study which evaluates humans and wellness in regards to their total environment.



[17] By Author | Diabetes Transdisciplinary Model

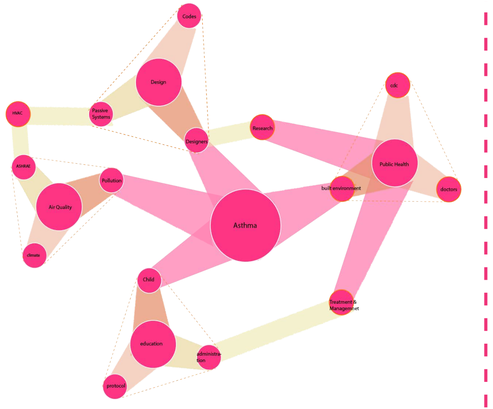


[18] By Author | Spreadable Illness



[19] By Author | Spreadable Illness

FOCUS



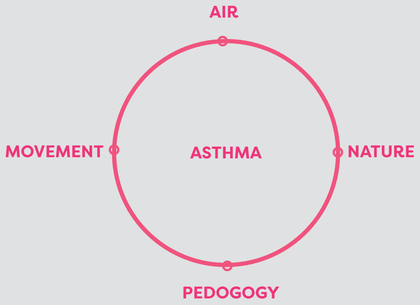
[19]By Author | Asthma Transdisciplinary Model and Health Focus

Asthma rates vary greatly from neighborhood to neighborhood but disproportionately affect communities of color and low-income communities.

"Longstanding and rising income inequality, combined with a history of racial residential segregation, has led to startling health inequities between neighborhoods," notes New York City Health and Mental Hygiene Commissioner Mary Bassett, MD. "Poor health outcomes tend to cluster in places that people of color call home and where many residents live in poverty."19

01.8 ASTHMA AS A BRI

Air, Movement, **Nature**, and **Pedagogy** become topics of focus when design for respiratory disease within k-12 settings. Movement and physical activity playing a key role in the lung and cardiovascular health of the student ,allowing students to strengthen their lungs and fight disease. However, students with asthma are limited to the amounts of physical activity they partake in, modified instances of movement should be considers in these situations.



AIR

Air Quality & Thermal Comfort
Air plays a major role in the respiratory health of children. This aspect of design directly effects those with Asthma. Using more natural ventilation and opportunities for the creation of cleaner air would be ideal. Using architecture to implement cost effective ways to improve air quality within our buildings and outdoor spaces.

MOVEMENT

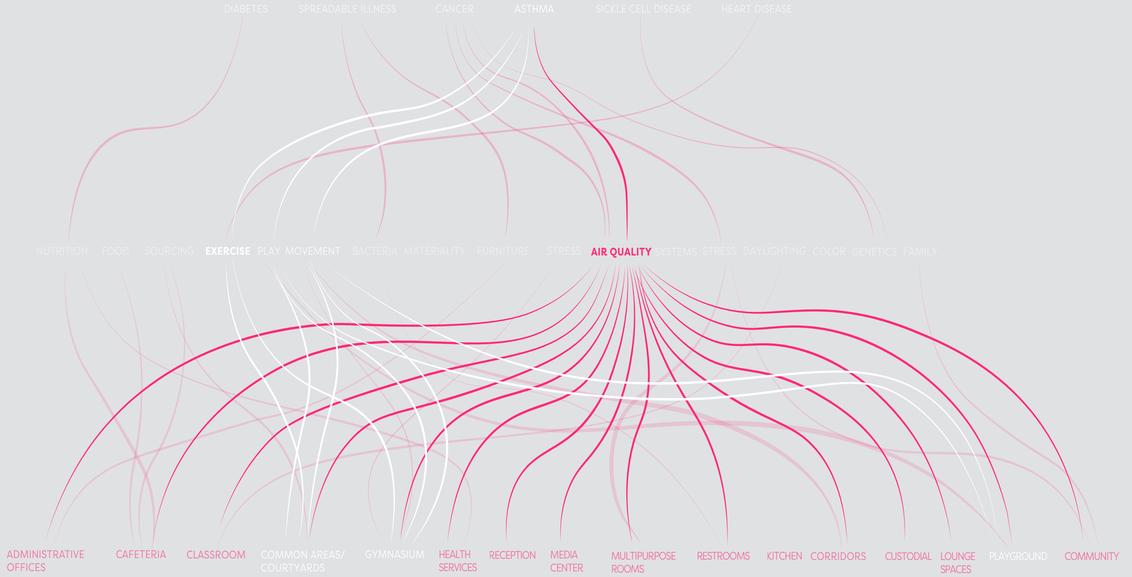
Asthma & Physical Activity
The relationship with asthma and physical activity is complicated. As asthma hinders the child from participating in heavy activity, but activity is a must for children to strengthen their bodies and more importantly their lungs. With this understanding we want to create spaces that promote physical activity through design in environments that work to diminish irritation and exacerbation.

NATURE

A Conflicted History with Nature
More than 30 years into the movement for environmental justice, and more than a decade into a global, multiracial campaign led by groups like 350.org to raise awareness about climate change and push governments into action, many Americans still do not associate black people with environmental engagement. But this notion of African-Americans existing apart from natural environments is more than just a contemporary stereotype ripe for satire; it all but ignores crucial aspects of American experience. The truth is that African-Americans' relationship to the environment is complicated and runs deep. Carolyn Finney has asserted in the book "Black Faces, White Spaces" that the notion of black people being aliens in the outdoors is a "whitewashing" of history.

PEDAGOGY

Cognitive Development through experience
"When designing for innovation in k-12 there should always be a consideration of Pedagogy. What will the children learn?" -Kendall Nicholson Thinking of solutions towards asthma that allow the children to gain knowledge through their experiences with the built environments created.



Asthma is a chronic disease that can be affected by any space a child is in, making it a extremely important issue to address in terms of architecture and design.

01.9 ASTHMA & CAUSES (MICROANALYSIS)

ASTHMA IS THE MAIN CAUSE OF SCHOOL ABSENTEEISM DUE TO CHRONIC DISEASE

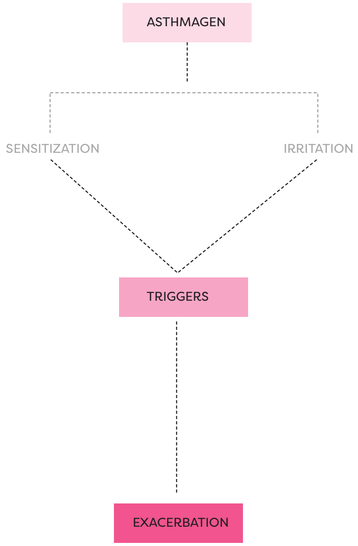
ASTHMAGEN A specific agent which causes the onset of asthma in someone who did not previously have the condition. Asthma onset is commonly broken down into two major causes: sensitization or irritation. Asthmagens are not limited to common environmental allergens such as dust mites, but also include many substances that can be found at work or in the home.[Figure 1.14]

SENSITIZATION Sensitizer-induced asthma, more commonly known as allergic asthma, is caused by an immune system response, which is clinically observed through the creation of a specific antibody. immunoglobulin E (IgE).e IgE antibodies trigger inflammatory reactions in the airways, which results in asthma symptoms over time. With continued exposure, symptoms worsen, more IgEs are produced and the immune system becomes conditioned to the inflammatory response.

IRRITATION Irritant induced asthma does not involve the immune system and specific mechanisms for onset are largely unknown. Commonly, irritant-induced asthma is induced by single or intermittent high level exposures, and occurs without a latency period. This form of irritant-induced asthma is called Reactive Airway Dysfunction Syndrome (RADS).12 However, recent research has revealed evidence for irritant-induced asthma via acute exposures with a latency period, though the mechanism of causation is still unclear. 13

TRIGGER Substances that provoke symptoms in those with asthma, such as coughing, wheezing, bronchoconstriction. These triggers are not necessarily asthmagens.

EXACERBATION Once asthma develops, airway responsiveness can increase to a variety of stimuli. This continued inflammation can lead to worsening of asthma symptoms as well as lead to "irreversible changes in lung structure, known as airway remodeling." In some cases, the development of hypersensitivity has led some to confuse these additional stimuli, which may only exacerbate an existing asthma condition, with asthmagens (i.e. chemicals that contribute to asthma onset). (Vallette,Jim,2013)



[1.13] By Author | Asthma

[1.14] By Author | VOCs that act as Asthmagens

2

GROWING FRESH AIR

Air. Nature. Pedogagy. Movement.

Understanding relationships between theses ideas and their significance to design. Looking to plants and nature to control air quality for indoor and outdoor spaces. Using plants to dilute toxins in our natural environments takes an extra step when designing for asthma. This information also being use to incorporate biophilic design within our K-12 facilities.

02.1 MOVEMENT (COMMUNITY OPPURTUNITY)

PHYSICAL ACTIVITY DESIGN GUIDELINES 5 CORE PRINCIPLES

The guidelines created by the CDC can be translated into simplistic ideals that connect to one another with the ultimate goal of promotion of physical activity that transcends beyond the building. Acting as a point of engagement both (mental and physical) for the students and existing community with regards to culture. This will be done without The Active Design Guidelines was developed by a partnership of the New York City Departments of Design and Construction, Health and Mental Hygiene. These guidelines provide architects and urban designers with a manual of strategies for creating healthier buildings, streets, and urban spaces, based on the latest academic research and best practices in the field. These ideals can be traced back to the English Sports Council, Sport England, and David Lock Associates publishing of *Active Design* in 2007. The guidelines were created to improving accessibility, enhancing amenity and increasing awareness and later were revised to create concerns about building longevity and ecological costs. A factor that has been recognized as a cause of health disparity within African American Communities.

Maximize opportunities for physical activity (both unintentional and intentional) as part of the school routine.

Educational Culture + Physical Activity

Consider school spaces and features as opportunities to promote children's natural inclination to move, play, and explore.

Educational Programming + Physical Activity

Apply theory- and evidence-based behavioral science practice to enable the school community to engage in higher levels of default physical activity.

Architectural Design + Physical Activity

Conceive and articulate school spaces as community assets, and identify nearby community spaces as school assets, to multiply the benefits of school-based Healthy physical activity initiatives. [2.1]

Educational Programming + Community Culture + Physical Activity

Leverage inherent synergies with current trends in sustainable and universal design, which respectively define good design based on sensitivity to environmental impacts, and accommodation of all user needs and perspectives.

Environment + Architectural Design + Physical Activity

MANIPULATIVE MOVEMENT

Develops fine-motor skills and coordination and involves controlled use of the hands and feet. Examples of manipulative movement include

Grasping
Throwing and catching
Ball footwork

NON-LOCOMOTOR MOVEMENT

Develops balance and coordination skills and focuses on the relationship of the body to a place or object. Examples of non-locomotor skills include:

Balancing
Pushing and pulling
Twisting
Sitting and rising

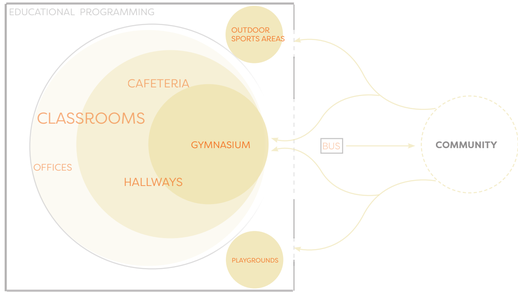
LOCOMOTOR MOVEMENT

Develops gross motor skills and constitutes any movement of the body from place to place. Examples of this type of movement include:

Crawling
Walking
Running
Stepping
Skipping and jumping
Climbing

EDUCATIONAL PROGRAMMING + COMMUNITY CULTURE + PHYSICAL ACTIVITY

Many strategies used to within our Active design guidelines can be distilled into one category. Movement throughout the building is the primary connection between architecture and physical activity and can be activated within any large amount of space and constant circulation. This becoming oppurtunity for any educational facility program for design improvement.



To articulate school spaces as community asset and nearby community spaces as school assets the issue of safety must first be addressed to create a working system that allows for oppurtunity of community engagement. A system that does not negatively effect students' wellbeing. Looking from a cultural standpoint of the community and design implications of the facility we are able to identify safety as a control of access through barriers and time constraints.

[2.1] By Author | Movement and Shared Spaces

- The school facility shall accommodate the use of some portions of the school after regular school hours without impacting security of other portions of the school.
- Joint-use space shall be safe, secure, and include separately keyed activity spaces (gym, cafeteria, and classrooms), accessible restrooms, and storage areas.
- Community use of school facilities shall not conflict/interfere with school programs.
- Joint-use facilities (parks, swimming pools, libraries, child care, and senior citizen facilities, etc.) Shall be integrated into the campus in a safe and secure manner and
Have access to an accessible restroom.

BARRIERS TYPES

Time is a metaphorical barrier that directly affects the entry and exit of others within a facility. This can be used to control the demographics of the space according to appropriate time frames.

TIME

Boundaries include walls, doors, gates,etc. Any physical barrier that creates control of entry and exit.

BOUNDARIES

02.2 AIR (STRATEGIES)

PASSIVE VENTILATION FOR THERMAL COMFORT

To maintain thermal comfort within a space passive ventilation is ideal to create the most energy efficient source of cooling and heating. **Natural Ventilation Techniques for Environmental Passive Architecture:** discuss the different types of natural ventilation, providing a base for design that can be used and modified to the advantage of the designer. Much research has already been made in this area of design so the goal would be to use these strategies to create structures that efficiently controls air flow within a space. To enhance air quality an additional layer will be added to this knowledge.

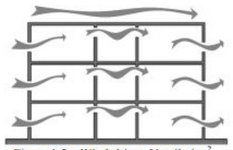


Figure 1.5 – Wind-driven Ventilation[2]

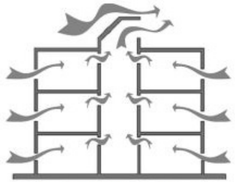


Figure 1.6 – Buoyancy-driven stack ventilation[3]

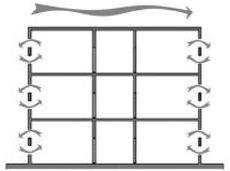


Figure 1.7 – Single-sided ventilation[2]

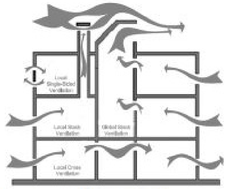


Figure 1.8 – Mixed Natural Ventilation Strategies[3]

[2] Image Source: M

VENTILATED FACADES

double-skin façades are adaptable to cooler and warmer weather. Making them great for different climate types and indoor thermal comfort.

Pros +

Reduce cooling and heating demand

Allow clear views and natural light
Improve insulation, whether thermal and acoustic

Allow natural ventilation and air renewal,creating a healthier environment

Cons -

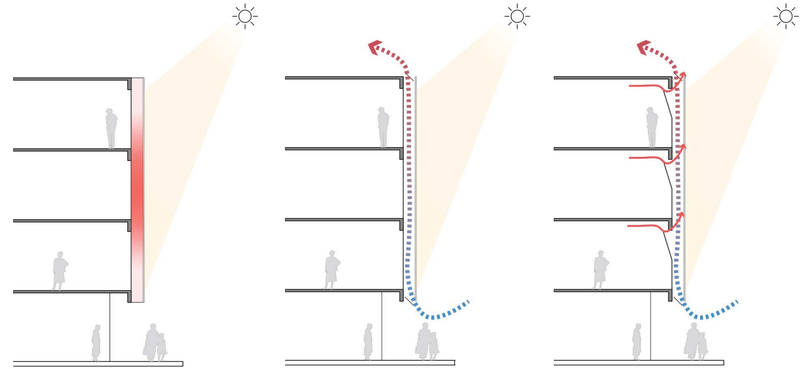
Much higher initial cost of construction

Space consumption

Maintenance demand

It may fail to function properly if the context changes significantly (shading by other buildings, for example)

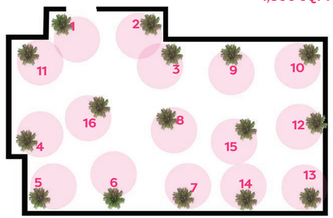
1. Load bearing wall
2. Fixing system
3. Ventilation cavity
4. Façade panels



[2] Image Source: E

02.3 NATURE

1,800 SQFT



[2.4] Author | Indoor Plants not to scale

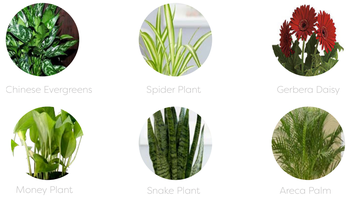
ASTHMA AND PLANT RELATIONSHIPS

[2.5] Author | Indoor Plants

BIODIVERSITY AND POLLEN : Outdoor Plants

NASA's Clean Air Study has proven that in addition to absorbing carbon dioxide, some plants have the ability to naturally remove VOCs from the air. The study concluded that in an 1,800-square-foot house, occupants should incorporate 15 to 18 houseplants in 6 - to 8-inch diameter containers to improve air quality. The larger and more vigorously they grow, the better. [Figure 2.4]

Recommended Plants



BIODIVERSITY AND POLLEN

This "biodiversity hypothesis" creates a sense of resilience within these children as it becomes a long term solution to the respiratory health and strength of the child. Trees and vegetation filter particulates from the air but release pollen. Pollen grain development vary throughout different plant species. Lighter pollen grains are easily picked up by winds and carried for cross-pollination making the tree type more allergenic to those with respiratory issues. When looking to biophilic design to control respiratory disease it seems to be an immediate fix. However, studies show that the effect of nature on different demographics has different results on the respiratory health and allergic sensitization.

MONOECIOUS PLANTS ARE IDEAL

Because Monoecious plants have both male and female anatomy on the same plant. These plants don't depend on long distances for wind pollination, so the pollen does not get distributed as much as other plants that need air to pollinate. This means less pollen and child interaction minimizing allergen induce attacks. Looking at tree, plant, and buchery types in our site beforehand will be extremely beneficial in determining plants that respond to the sensitivity of children with asthma while also considering plants that are native to the environment.

Monoicous plants are those species that bear both sperm and eggs on the same gametophyte. one that has male and female flowers on the same plant, or that has flowers on every plant that contain both male and female reproductive components. Also known as "one house" or Bisexual.

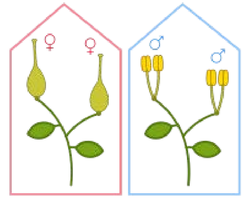
IDEAL

Dioecy is a characteristic of a species, meaning that it has distinct male and female individual organisms. Dioecious reproduction is biparental reproduction. Dioicous plants are those that have gametophytes that produce only sperm or eggs but never both. The terms are used largely but not exclusively in the context of bryophytes.

NOT IDEAL

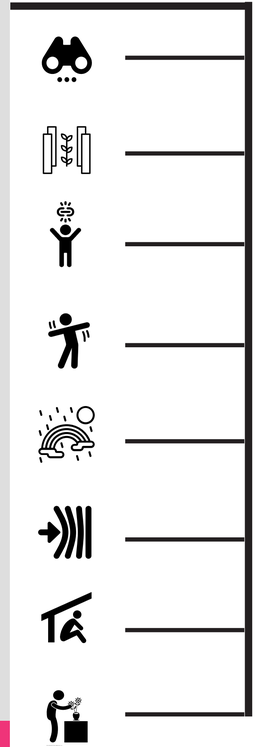
MONOECIOUS (BISEXUAL)

DIOECIOUS (UNISEXUAL)



[2.7] Image | https://en.wikipedia.org/wiki/Plant_reproductive_morphology

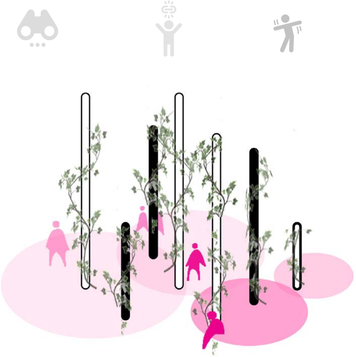
LOOKING AT BIOPHILIC DESIGN

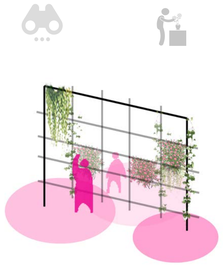


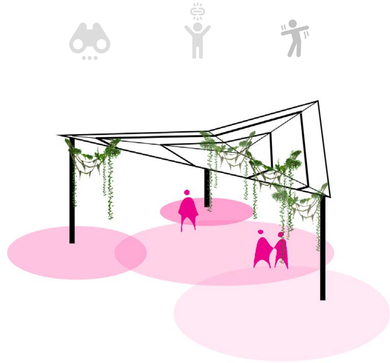
14 Patterns of Biophilic Design describe seven attributes of biophilic design that seem particularly relevant for children

Biophilic design patterns are flexible and replicable strategies for enhancing the user experience that can be implemented under a range of circumstances. Just as lighting design for a classroom will be different than for a spa or home library, biophilic design interventions are based on the needs of a specific population in a particular space, and are likely to be developed from a series of evidence-based biophilic design patterns, ideally with a degree of monitoring and evaluation for efficacy.(Terrapin Bright Green LLC,2014)

BIOPHILIC DESIGN AT HUMAN SCALE







02.4 PEDAGOGY

Nature plays a very important role in the development of children. Dr. Stephen R. Kellert's **Building for Life**, Designing and Understanding the Human – Nature Connection, he explores the relationships between nature and child development. The three different interactions with nature that a human is able to have : **Direct**, **Indirect**, and **Vicarious** all contribute to the **affective, evaluative**, and **cognitive** development of the child. In the age of technology we see a decline in the interactions between children and nature.

Cognitive
- Knowledge
- Comprehension
- Application
- Analysis
- Synthesis
- Evaluation

Affective
- Receiving
- Responding
- Valuing
- Organizing
- Characterization

Evaluative
- Humanistic
- Symbolic
- Aesthetic

Direct

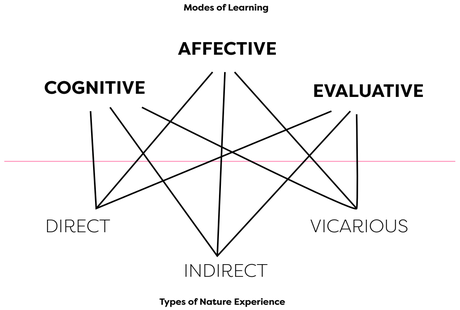
Involves actual physical contact with creatures and habitats largely independent of human input and control. The experience of relatively self-sustaining natural features and processes—for example, walking in a forest ravine, swimming or fishing in a free-flowing stream.

Indirect

Indirect contact involves interactions with elements of nature that require ongoing human input, intervention, and control, such as tending a potted plant, a manicured lawn, or a fish aquarium.

Vicarious

Symbolic or vicarious contact does not involve actual physical experience of the natural world but, rather, the metaphorical, symbolic, or vicarious encounter of nature, such as the simulation or mimicking of natural forms in buildings and constructed landscapes.



[2.9] Author | modes of learning and nature experiences

Direct - Cognitive

Direct - Evaluative

Direct - Affective

Indirect - Cognitive

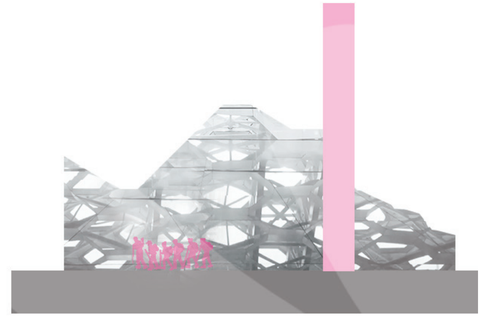
Indirect - Evaluative

Indirect - Affective

Vicarious - Cognitive

Vicarious - Evaluative

Vicarious - Affective



[2.9] Author | Learning and Nature Experiences

3

CASE STUDIES: IN-DEPTH ANALYSIS

This section will focus on the site in a macro to micro scale. Paying close attention to environmental factors such as light and wind and their impact on the existing institution. This analysis will help in gaining a well-rounded understanding about the natural and man-made systems, and how they may effect the design of the space.

SELECTION CRITERIA

Choosing Case Studies to Exemplify Didactic Elements

These case studies have proven to align with the ideas presented in earlier sections. Taking on naturous learning strategies and biophilic design as a way to teach students and their immediate communities. The idea of sustanability becomes common to as the conciousness of the environment becomes a must when considering environmental equity as the goal of this thesis.

Nature Based Learning

Projects that create spaces meant to inform and educate the student and/or community about the naturl environment. The project implements strategies that can be be identified in Kellert's "Building for Life". Creating relationgships bewteen the different interactions with nature and modes of learning among humans.

Natural Ventilation Tactics

Buildings that implement strategie of natural ventilation. The project is concious of thermal comfort and works to use more natural, energy saving systems to create better ventilation within a space. These range from passive ventilation strategies to the incorporation of new technologies to enhance air circulation within the space.

Implementation of Biophilic Design

Buildings that work to increase occupant connectivity to the natural environment through the use of direct nature, indirect nature, and space and place conditions. The characteristics can be traced back to our 7 components to sucessful biophilic design in earlier sections.

Environmental Concern

Environemental concern and sustainbility within our buildings becomes extremely important when considering it effects on the natural environment.

3.1 CALIFORNIA ACADEMY OF SCIENCES

Renzo Piano
Location: San Francisco, United States
Date of Completion: 2008
Typology: University (Cultural/Science Institution)

Overview

Architect Renzo Piano achieved innovative, imaginative energy savings in his design for the Living Roof. Not only does the green rooftop canopy visually connect the building to the park landscape, but it also provides significant gains in heating and cooling efficiency. The six inches of soil substrate on the roof act as natural insulation, and every year will keep approximately 3.6 million gallons of rainwater from becoming stormwater. The steep slopes of the roof also act as a natural ventilation system, funneling cool air into the open-air plaza on sunny days. The skylights perform as both ambient light sources and a cooling system, automatically opening on warm days to vent hot air from the building.

Too Warm -

Too Warm -

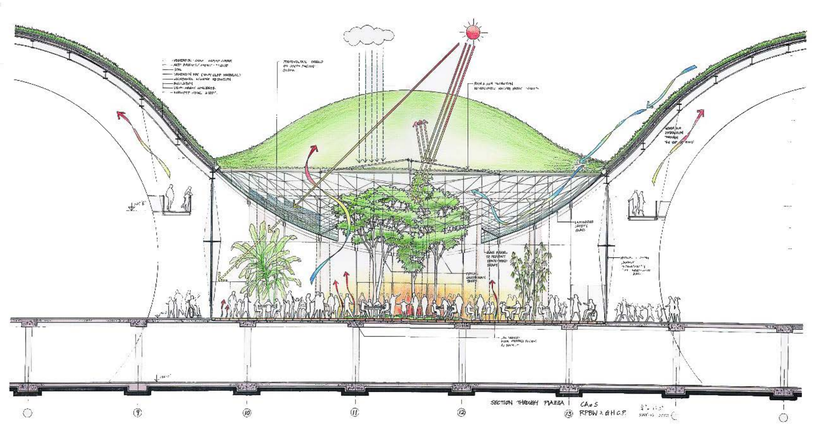
Too Cool -

Just Right +

[3.1] Form and Air

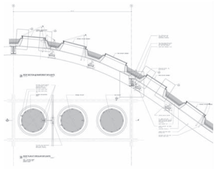
Optimization of ventilation through form

The form of the California Academy of Sciences works to create efficient air ventilation and thermal comfort. The final diagram expressing how to spheres placed to create both the rain forest and planetarium help in creating microclimates at key points of user action. Along with the combination of windows, the piazza, and the greenroof to encourage both horizontal and vertical air movement and minimizing heat loss within the building.[Figure 3.1]

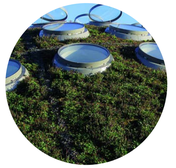


Focus on energy saving usuing natural ventilation and a living roof.

Architect Renzo Piano achieved innovative, imaginative energy savings in his design for the Living Roof. Not only does the green rooftop canopy visually connect the building to the park landscape, but it also provides significant gains in heating and cooling efficiency. The six inches of soil substrate on the roof act as natural insulation, and every year will keep approximately 3.6 million gallons of rainwater from becoming stormwater. The steep slopes of the roof also act as a natural ventilation system, funneling cool air into the open-air plaza on sunny days. The skylights perform as both ambient light sources and a cooling system, automatically opening on warm days to vent hot air from the building.



LIVING WALL SYSTEM - SKYLIGHTS

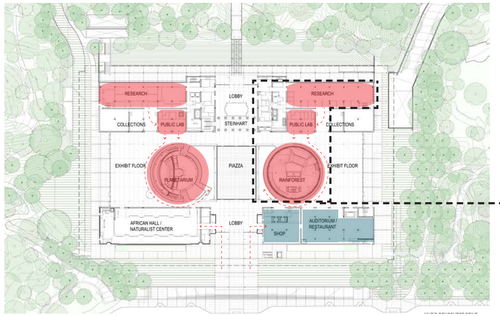


SOIL AS INSULATION

DENIM INSULATION

Attention to detail

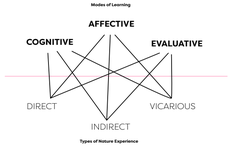
The entire 37,000 sq. m complex is like a piece of the park that has been cut away and lifted 10 m up above the ground. This "living roof" is covered with 1,700,000 selected autochthonous plants planted in speciallyconceived biodegradable coconut-fibre containers.



[3.2] Program Arrangement and Circulation

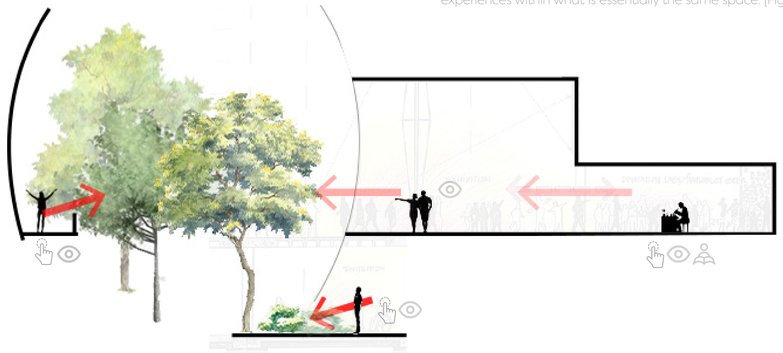
Programming to Learn : Organization

The progammatic makeup of the Academy of Sciences plays a big role in the involvement of community and want for pedogagy that focuses on nature and science. Combining exhibition space, education, conservation and research beneath one roof, the Academy also comprises natural history museum, aquarium and planetarium. Exhibit spaces that allow the user to directly, indirectly, and vacariously interact with nature within exhibit spaces is ideal. This project takes these ideas a bit further with the incorporation of public labs and research spaces that can be accesed by the public for scientific exploration

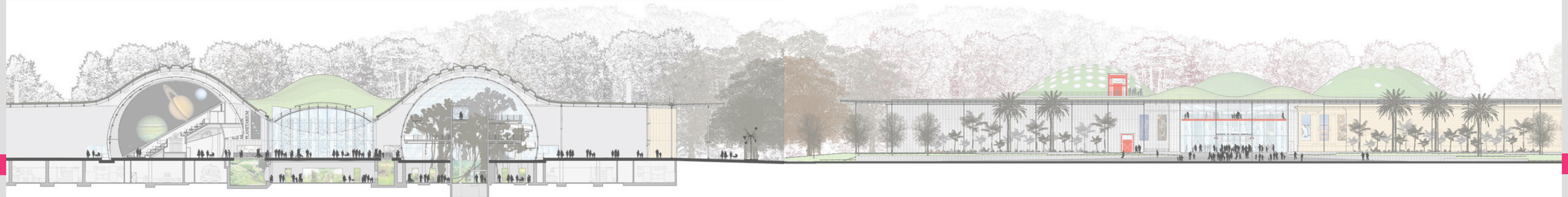


Programming to Learn : Organization cont.

We look at the relationships between the uses and spaces. Visual and physical ques are linked throughout. For example, the glass domes used for the exhibits spaces allow for visual conntections through public labs creating connections of study and nature. Also creating multiple floors that users are able to interact within nature creates two different experiences within what is essentially the same space. [Figure 3.3]



[3.3] Indoor / Learning and Nature in Academy of Sciences



3.2 SIDWELL FRIENDS MIDDLE SCHOOL

KieranTimberlake Associates LLP
Location: Washington D.C. , USA
Date of Completion: 2006
Typology: Educational (K–12)

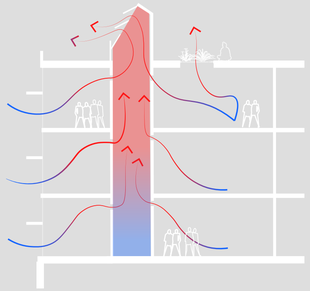
[3.4] https://www.aiatopten.org/node/140

Overview

The renovation and addition to the middle school transforms a 55-year-old facility into a school that teaches environmental responsibility by example. The 39,000 ft2 addition more than doubled the size of the existing building, providing modern spaces for music and art, science and computer labs, counseling, and a library while retaining and enhancing the value of the existing structure.

Learning about our buildings

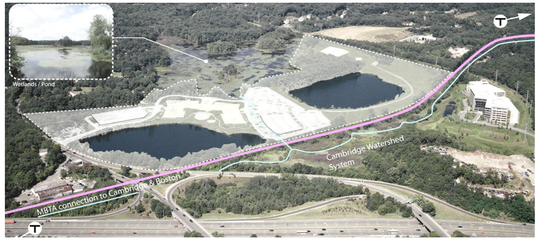
Solar chimneys—designed for passive ventilation, operating without additional energy—provide another learning opportunity about the sun as a primary, renewable source of energy. Wind chimes ring to indicate the movement of air.



[3.4] Author | Solar Chimney and Wind

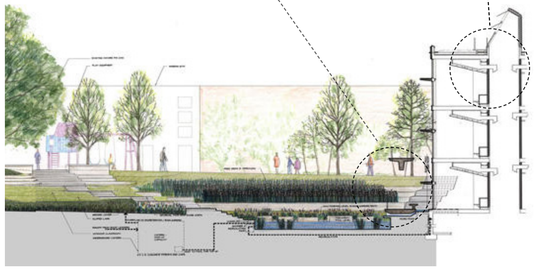
Solar Chimneys

Solar chimneys with south-facing glass provide passive ventilation. The sun heats air within the glass chimney tops, creating a convection current that draws cooler air into the building through north-facing open windows. Mechanically assisted ventilation in the renovated portion of the building utilizes the return ductwork and exhaust fan in the air-handling unit to draw air through open windows. An economizer minimizes mechanical cooling when opening the windows would provide too much outdoor air to maintain comfortable conditions. Contacts tied into the building automation system prevent mechanical heating or cooling when windows are open.



Rain Garden

Solar Chimney/Rooftop Gardens



Learning about our buildings (cont.)

The goals of the master plan were to integrate educational opportunities into the campus landscape, to create a unified campus, and to provide spaces for individual reflection and large-group assembly. The building addition, together with the constructed wetland, forms an academic quadrangle that welcomes the campus as a whole into its space.

Neighborhod Connections to ecological sources

The campus sits at the edge of the Piedmont Plateau and Southeastern Plains ecological regions. Downslope is Rock Creek Park, a scenic federal park and sanctuary for many rare and unique species. The planting design was inspired by this ecological context. Peripheral areas were converted from lawns to "micro-restoration areas" intended to showcase native ecosystems such as oak-beech woodlands and wet meadows. More than 80 regionally appropriate species were introduced into the campus landscape.

Sun & Water

The project team considered designing a living machine to process wastewater but decided that the transformation of the landscape into a constructed wetland to process wastewater would provide a better integration between the school's curriculum and mission. The naturally treated water is eventually reused in the toilets and cooling towers, substantially reducing the school's use of potable water. In addition, sensor-operated water-conserving lavatory faucets are used.

3.3 BEN FRANKLIN ELEMENTARY SCHOOL

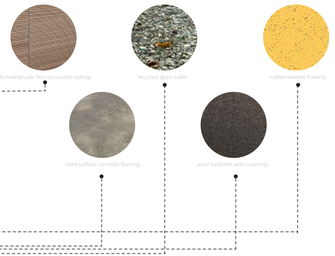
Malhum Architects
Location: Seattle, Washington, USA
Date of Completion: 2006
Typology: Educational (K–6)

Overview

The Ben Franklin Elementary School serves 450 students in kindergarten through grade six. The students are distributed within small learning communities, each including a cluster of four naturally ventilated and daylit classrooms around a multipurpose activity area. Stacked within two-story wings that extend toward the woods, these communities are integrally linked with views and access to nature beyond. The new school expands learning beyond the classroom by connecting the district's educational pedagogy with environmental sustainability at every level. This project was chosen as an AIA Committee on the Environment Top Ten Green Project for 2006.

Use of Materialilty to Decrease Emissions of VOC's

The impact of the materials on the indoor environmental quality for children is becoming an ever more significant part of the selection criteria. Durable, nontoxic, low-impact materials were used throughout the project. These include paint with low emissions of volatile organic compounds (VOCs).



[38] Interior Space and Interior Finishes

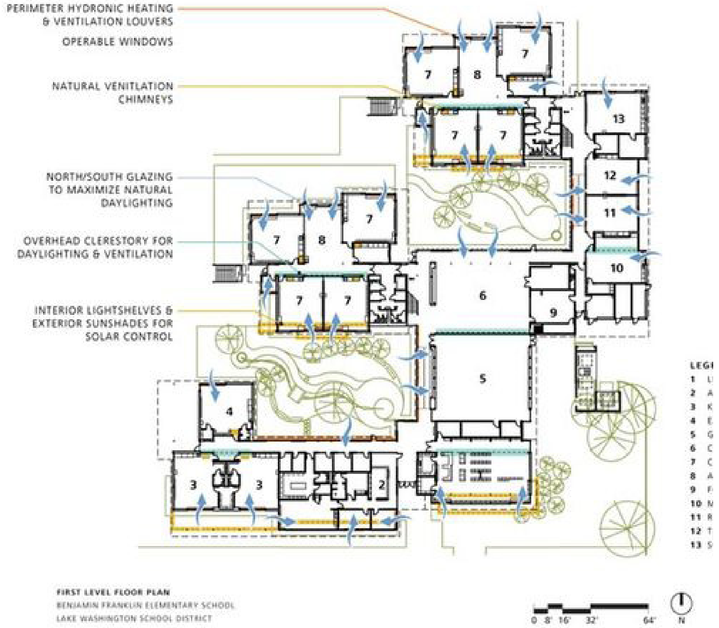
Outdoor Learning and Community Connection

The new school expands learning beyond the classroom by connecting the district's educational pedagogy with environmental sustainability at every level. With outdoor learning courtyards, visual connections to wooded spaces to learning areas. xposing students to elements of the region's unique hydrology and providing direct connections to the site's native forested ecosystem. The functional ecosystem of the southern courtyard makes natural processes visible on a day-to-day basis. This outdoor environment provides educators with a three-dimensional, "hands-in-the-dirt" laboratory that fosters understanding through observation.

[39] Nature Visuals from Classrooms

Outdoor Classrooms

Between, courtyards landscaped with native plants and enhanced by integrated artwork, serve as outdoor classrooms and feature an intermittent stream fed by roof runoff. Gathering areas for outdoor classes are located within the landscaping.



FIRST LEVEL FLOOR PLAN
BENJAMIN FRANKLIN ELEMENTARY SCHOOL
LAKE WASHINGTON SCHOOL DISTRICT

Celestory Windows and Louvers

All learning areas are naturally ventilated without the use of air handling equipment or supplemental fans. Operable windows and ventilation chimneys in the classrooms generate a natural stack effect that results in ten air changes per hour, providing an exemplary indoor air quality without energy consumption.

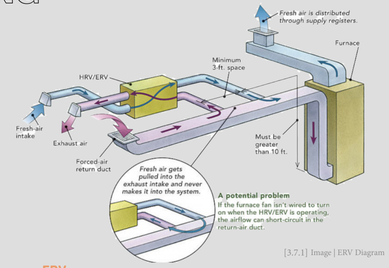
3.4 BERTSCHI SCHOOL LIVING SCIENCE BUILDING

Renzo Piano
Location: Seattle, Washington, USA
Typology: Educational (Science Wing)

[3.7] Ross, K.

Overview

The Bertschi School Living Science Building was designed by intense collaboration between Bertschi students and staff, and KMD Architects Restorative Design Collective. The site is located on the north side of an urban campus in Seattle, Washington, USA. Through a series of interviews, the team learned what the students wished for in their new learning space: "an indoor river, a bamboo fountain to relieve stress, and green house where something's always growing". Architects, landscape architects, engineers, and other consultants paired these requests with the rigorous standards of the Living Building Challenge v 2.0 (LBC) to design a 1,425 sq ft science classroom building on a 3380 sq ft site with an ethnobotanical garden. The Bertschi School is designed to meet the Equity requirements of the Living Building Challenge which asks a building to be built at a human scale with access for all in consideration to democracy and social justice. This building is perfectly sized for the campus needs and the pre-kindergarten to fifth grade users. In addition to school use, the building provides a place for community events.



[3.7.1] Image | ERV Diagram

ERV

1. Cool, fresh air is drawn in through an exterior vent in the EcoHouse wall near the green roof.

2. The cool air passes through the ERV where it exchanges heat with the classroom air exiting.

3. The now somewhat warmer fresh air then passes through an electric tempering chamber that heats the air to near room temperature. That unit is labeled HC-1 in second picture at left.

4. The fresh air then is distributed through a duct and ventilation louvers into the classroom area.

5. As fresh air enters the classroom, the used warm air is drawn out of the classroom through a return air duct and sent back through the ERV.

6. The ERV removes some of the heat from the used air and exchanges it with the cool fresh air entering in step two above.

7. Having given up much of its heat, the used air then exits into the EcoHouse. There it exits from a vent in the upper corner of the room after passing along the green wall.

Fresh air using ERV Technology

The Science classroom and EcoHouse have an airflow relationship that benefits both rooms in terms of air quality and temperature. The Energy Recovery Ventilator (ERV) shown in picture at left, circulates air into both spaces while recovering heat from the air. Above are the steps for air travel through the system:

1 North, insulated glazing and operable windows provide daylighting and natural ventilation
2 2x12 wood framed, cellulose insulated walls
3 SIPS panel roof
4 Hydronic radiant floor heating
5 Ventilation system with energy recovery
6 Operable skylight provides stack-effect ventilation and toplighting
7 Rain leaders to cisterns, exposed for education
8 Glass-covered interior runnel transports rain water to potable cistern
9 Exterior runnel transports excess rain water for potable use to irrigation cistern and rain garden for infiltration
10 Irrigation cistern
11 Rain garden
12 Stormwater control valves divert water from other campus property to irrigation cistern and rain garden

[1] image

1 North, insulated curtain wall glazing provides daylighting.
2 Skylights provide additional toplighting for the Green Wall
3 Grey water filter tanks remove large particulate matter before sending to Green Wall
4 Green Wall treats all grey water on-site through closed-loop evapotranspiration
5 Vacuum flush toilet
6 Composting units (2) treat all black water on-site
7 Potable water treatment system (wall mounted) including micron filters and UV light for disinfection
8 Radiant floor hybrid hot water heater
9 Moss mat green roof
10 2x12 wood framed, cellulose insulated walls
11 SIPS panel roof
12 Porous concrete outdoor classroom

Biodiversity and Greenwalls

The Bertschi School Science Wing demonstrates how successful biophilic design engages all of the senses. In this hands-on educational setting, children are encouraged to touch the plants. Native plants have also been planted in the ethnobotanical garden and are used for lessons on biodiversity, urban agriculture and craft.

Visible and Fun Naturous Learning

The most important aspect of the project is that all the sustainable features are visible and functional for students to learn ecological concepts that can become intrinsic values for future generations. The design phase involved the students throughout the process. Their ideas of a "river in the classroom" and a place where "something was always growing" inspired the functional features in the building. Using the fifth graders' inspired dreams for their classroom helped to make a space that was unique, functional, and meaningful to the students who use it.

Fresh air using ERV Technology

The Bertschi School Living Building meets the very definition of sustainable by functioning as a building that is completely dependent on and connected to its site. The Living Building Challenge looks for restorative buildings that act as a flower, only using what is available on site and affecting it in a positive way. The Bertschi School harnesses the solar energy that reaches it, gathers the rain that falls upon it, grows food to sustain its occupants, and treats all of its waste within its footprint.

3.5 TOBEME EARLY CHILDHOOD CENTRE

Scott and Ryland Architects

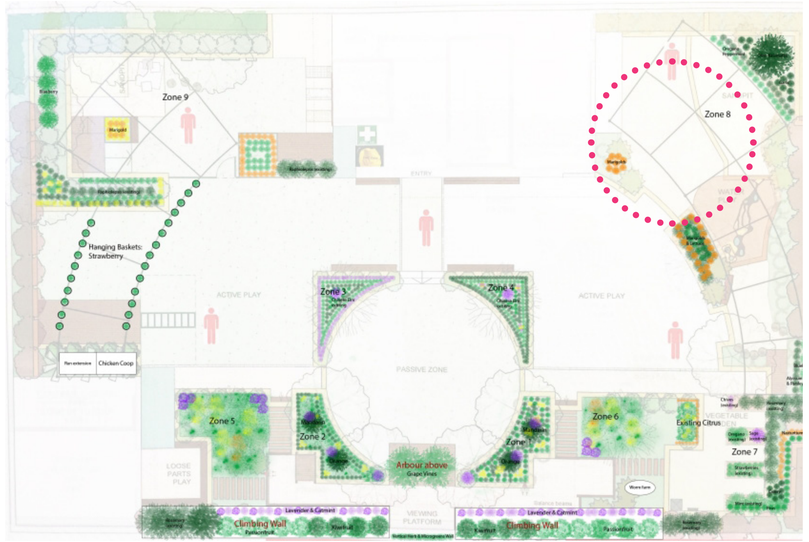
Renzo Piano
Location: San Francisco, United States
Typology: University (Cultural/Science Institution)

Overview

Built within a repurposed warehouse this project serves as an example of natural engagement of the child and its environment. Created with the focus of using biophilic design as a learning tool. In this case the project is planned around a series of edible growing zones for different companion plants. It started with orange trees and herbs but has evolved into a comprehensive list of fruit and vegetables.(Scott) This organization allows the children to be involved in the life cycle of the plant while also using the space as play areas encouraging motion through the creation of active spaces.

Paying Homage to Open-Air Classrooms

The open air context of this space is an interesting take on the former open-air classrooms that were created in efforts to mitigate disease transmission. Using the outside space for learning oppurtunity does not become limited to teaching about plant and naturous topics but can be modified to fit the program of different topics. The scope for this sort of program within primary and high schools is full of possibilities; the study of biology, geography, history, maths and English can all be enriched by on-site explorations and parallels in nature.(Scott) This open structure allows for an abundance of horizontal wind ventilation.



Growing Zones to Learn

The rooftop play area and garden has been planned around a series of edible growing zones for different companion plants. Permaculture strongly emphasises building mutually beneficial and symbiotic relationships (Holmgren, 2015). The garden is not generated in isolation, but through continuous and reciprocal interaction with the children, between the different plant species and with other organisms such as insects and animals. So the children are allowed to play in and around the gardens and the gardens are continually evolving and changing. The children are involved daily in planting and nurturing the plants, weeding and harvesting. Then in the kids' kitchen, they are involved in the preparation, cooking and eating of their yield. As Indira Naidoo (2011) puts it, they may not be able to grow everything they eat but they can eat everything they grow.

Sustainable in Every Way

The space maximizes natural light and ventilation; With views of the sky and trees that also allow the external natural soundscape to be heard. We also see a use natural materials and textures in the internal and external fitout for increased sensory experience; and, providing access to landscaped settings, as both retreat spaces and communal areas.

Design Layout using Growing Spaces

This project 's entire design is focused on the growth and experience of the natural environement. Though located on the roof of an building it has allowed for nature to vegetation to be prosperously embraced throught each space by the students.

4

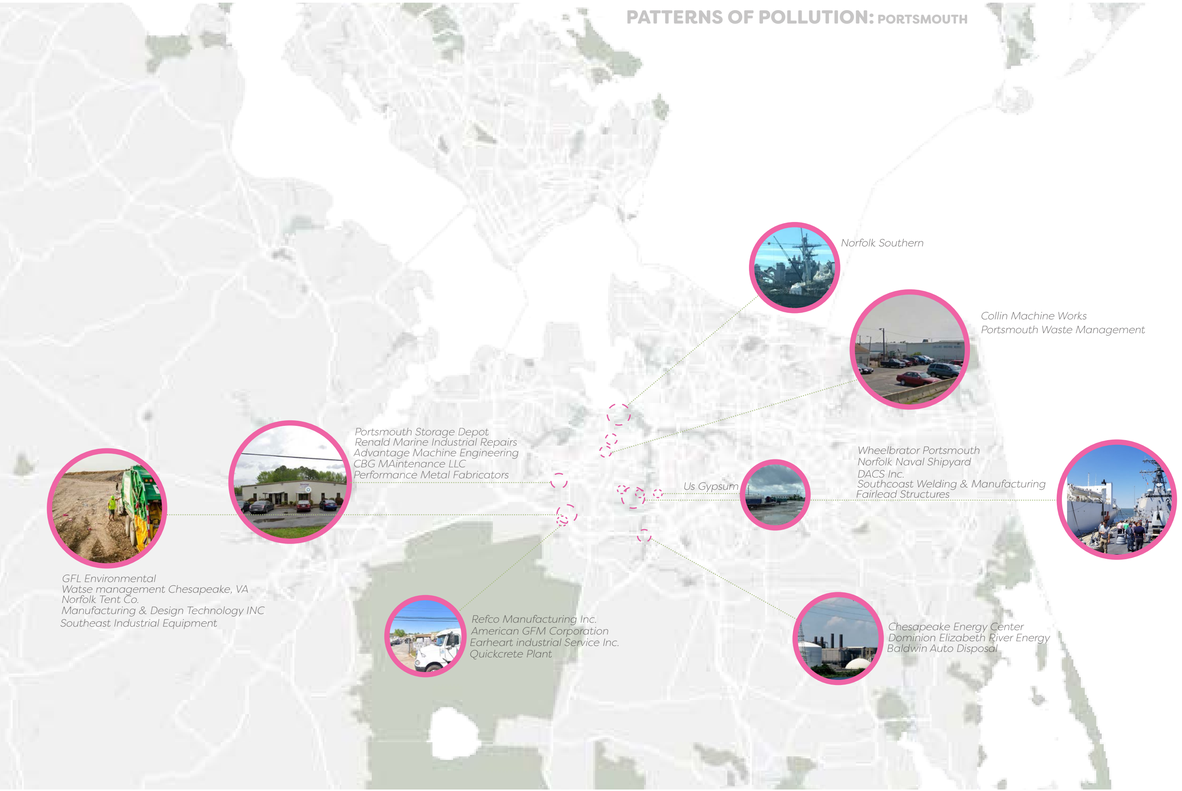
THE CASE OF:
LAKEVIEW ELEMENTARY SCHOOL

This section will focus on the site in a macro to micro scale. Paying close attention to environmental factors such as light and wind and their impact on the existing institution. This analysis will help in gaining a well-rounded understanding about the natural and man-made systems, and how they may effect the design of the space.

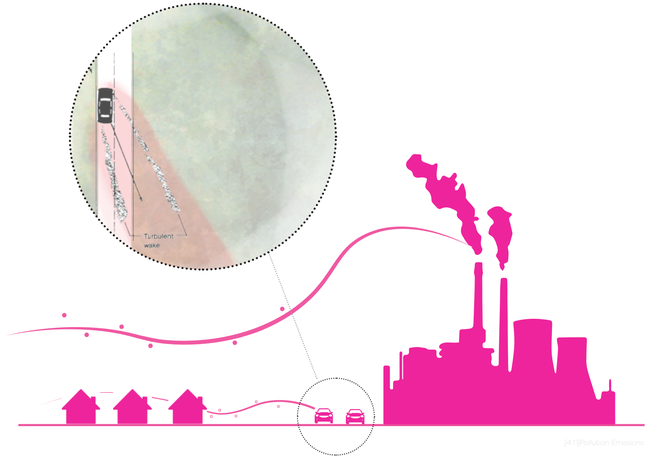
04.1 Portsmouth, Virginia : Urban Renewal and the Dislocation of African Americans

Life in **Portsmouth** has historically revolved around the Norfolk Naval Shipyard, or the Yard, which has grown from its inception as the Gosport Shipyard in 1767, making it the oldest industrial facility owned by the United States Navy. Segregation was the status quo in Portsmouth. While **segregation** was the reality for the African American community in this area, they were able to create spaces for themselves to enjoy and thrive in. **Portsmouth urban Renewal projects** taking down many strong **African American communities**. Early neighborhoods like Lincolnsville,Weaver, and Mount Hermon were all subjected to an urban development project which drastically changed the community fabric. Our site is located in **manor**, a predominantly African American Neighborhood located further west of the urban Portsmouth area transpiring into a more suburban residential neighborhood. We can see this consistency in demographic being a **result of Urban Renewal** during the early 1900s. The neighborhood offered many families - couples working as city employees, Navy officers, shipyard workers, nurses and schoolteachers - their first opportunity for homeownership. In the beginning, it was one of the few neighborhoods where blacks were allowed to own houses, as deed restrictions closed off other neighborhoods. Even as segregation ended, according to the Virginia Pilot, "real estate agents continued to steer black buyers to **Cavalier Manor**. Cavalier Manor played a major part in bringing those changes, said Marlene Randall, a City Councilwoman and retired school administrator who moved to the community in the first wave of residents in the late 1950s." (Virginia Pilot,2008)

PATTERNS OF POLLUTION: PORTSMOUTH



[4.1] Author | Mapping Sources of Pollution



[4.1]Pollution Emissions

POLLUTION EMMISIONS

Some pollutants are more heavily concentrated in different areas depending upon emission sources. For example, areas where solid fuel is heavily used for domestic heating are likely to have higher emissions of sulphur dioxide pollution. If the wind is blowing towards an urban area from an industrial area then pollution levels are likely to be higher in the town or city than if the air 100ft - 200ft away they are halved again. Motor vehicle pollution can generate high levels of nitrogen dioxide, carbon monoxide and hydrocarbons in cities and towns. Particulate pollution may be high as a result of vehicle pollution, fuel burning, building work, industrial emissions, soil and road dust and quarrying. Pollution emissions in other countries can also be transported across international borders to create high levels of pollutants such as ozone." Air quality: Clean air: Air pollution. (n.d.).

EXPOSURE TO POLLUTION

There are many sources of pollution, both indoor and outdoor which can have affect health. Research has shown that air pollution inside moving cars in heavy traffic is around twice as high as that outside the car. However, air pollution decreases rapidly as you move away from busy roads. Air pollution is also often concentrated in underground car parks, tunnels and near petrol stations. Levels of air pollution are also likely to be higher in the vicinity of industrial processing works, power stations and waste incineration plants.

Pollution vs Pollen in Portsmouth and its effects on Asthma

Portmouth, Virginia has one of the highest mortality rate within the state of Virginia due to asthma. Identifying two factors that act as environmental irritants towards respiritory health: Pollution and Pollen. Using the Breezometer to collect real time street level air quality information. According to the maps, though Lakeview does not sit directly in areas of lower air quality but is bordered by high acounts of ar pollution from various pollution emmissions and high amounts of pollen that dispurse from urban lands that reside south of the city borders.

PM2.5

DOMINANT POLLUTANT

13
µg/m3

PM10

43
µg/m3

O3

33
ppb

NO2

14
ppb

CO

384
ppb

SO2

0
ppb

NO

0
ppb

NOX

1
ppb

Ground - Level Ozone

SOURCES

Ground-level Ozone isn't emitted directly, it's formed in the atmosphere from other primary pollutants when the sun is out

EFFECTS

Ozone exposure has been linked to breathing problems, asthma, reduced lung function & respiratory diseases

Sulfur Dioxide

SOURCES

Sulfur Dioxide is produced from the burning of certain fossil fuels and from certain methods of metal extraction. SO2 can also contribute to the phenomena of acid rain.

EFFECTS

SO2 exposure has been found to harm the respiratory system and cause eye irritation. According to the World Health Organization, it can increase the risk of infection.

Particulate Matter

SOURCES

Particulate Matter is a broad family of inhalable and respirable particles, categorized by their size. Sources of PM can be natural or man-made, like dust, fire smoke, sea-salt, soot or they may come from industrial activities.

EFFECTS

PM10 is inhalable, meaning it can get into the lungs & cause inflammation in the respiratory system & heart. PM2.5 gets even further into our bodies, passing into the bloodstream where it can get transported to multiple organs, including the skin

Carbon Monoxide

SOURCES

The main sources of Carbon Monoxide include the toxic fumes emitted by our vehicles and industrial activity which relies on fossil fuels (e.g. coal, oil, natural gas).

EFFECTS

At high levels, CO exposure can impact the level of oxygen transported in the bloodstream to critical organs. There's also evidence that long-term exposure (even at low levels) affects the body more widely.

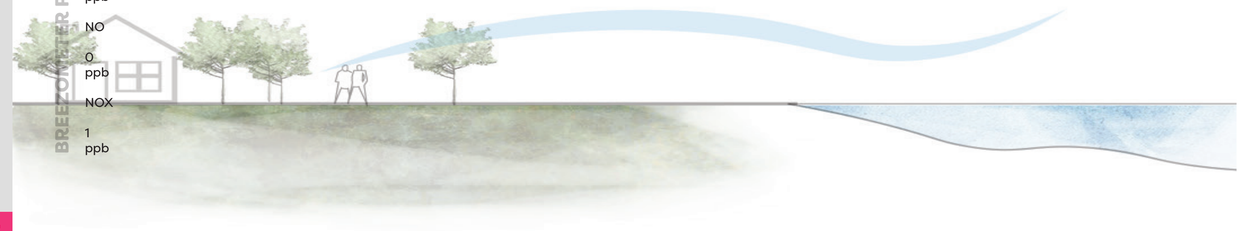
Nitrogen Dioxide

SOURCES

NO2 plays a role in the creation of Ozone and Particulate Matter and like SO2, mainly gets emitted by industrial and traffic sources.

EFFECTS

On its own, N02 increases symptoms of bronchitis, asthma & contributes to reduced lung function as well as growth. Scientists are now also linking NO2 to premature mortality and heart/respiratory disease.

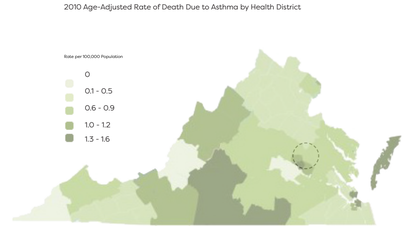


BREEZOMETER POLLUTIONS

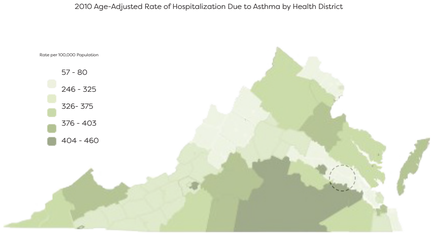
Asthma in Portsmouth

The Virginia Department of Health has created the Virginia 2018 Asthma Burden Report, In addition to adults, a significant number of children also live with asthma. Across the U.S., anestimated 20.4 million adults aged 18 and over are known to have asthma, including 6.1 millionchildren.1 Although asthma is the leading chronic disease in children, according to the CDC, asthmaepisodes have declined in children from all races and ethnicities from 2001 through 2016. Overall,roughly 129,316 children living in Virginia currently have asthma. (VDH 2018)

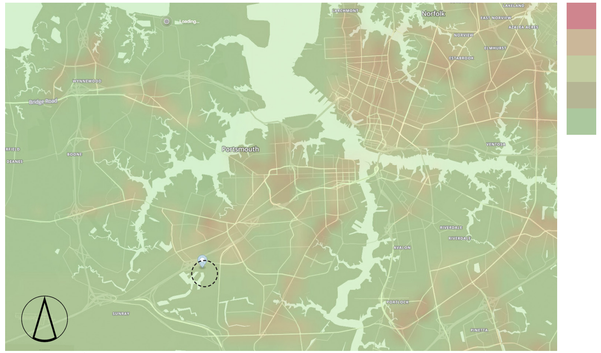
Death Rate: South-central and far eastern Virginia show the highest mortality rate in serveral cityies, including Newport news, **Portsmouth**, Hampton, and Richmond.



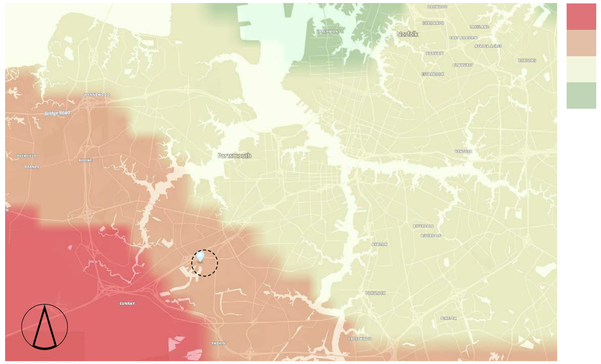
Hospitalization Rate: South -Central Virginia has the highest inpatient hospitalization rates in Virginia. Cities such as **Portsmouth**,Roanoke,Newport, and richmond show high hospitalization rates



[4.2] Image | Virginia Burden Report Asthma



Pollution Map - Air Contaminents



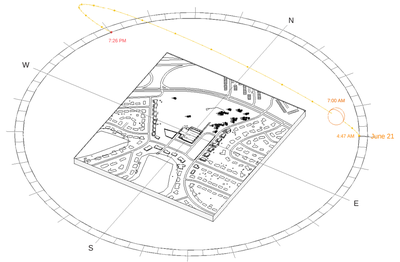
Pollen Map - Pollen

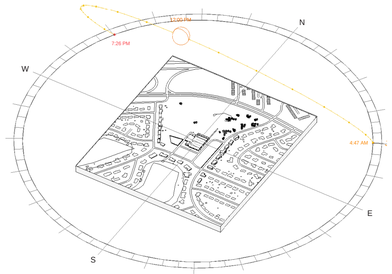
[4.3] Images Air Quality Index Breezometer

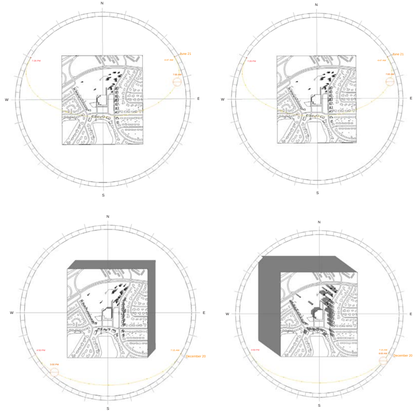
WEATHER CONDITIONS

The weather has an important effect on air pollution levels. Generally, windy weather causes pollution to be dispersed whilst still weather allows pollution to build up. The wind direction also affects air pollution. Coastal locations and open areas often experience more windy weather and are therefore likely to experience better air quality.

SUN PATTERNS:PORTSMOUTH,VA

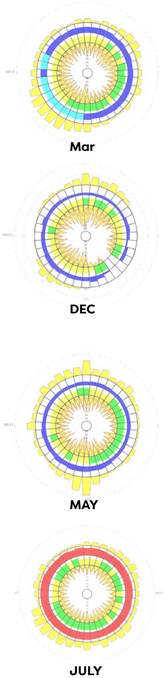






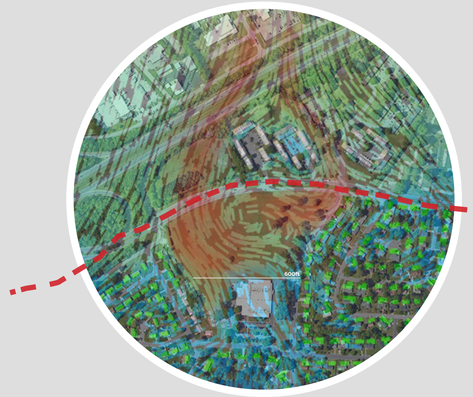
[4.4] Author | Sun Patterns, Lakeview Elementary

WIND PATTERNS:PORTSMOUTH,VA



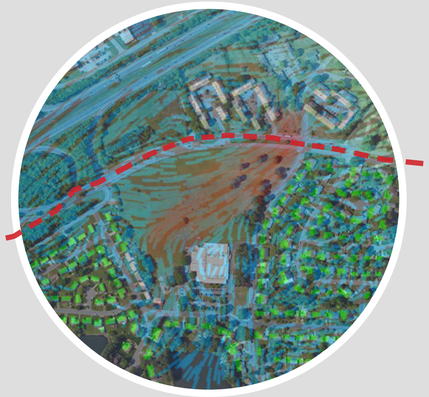
[4.5] Author | Wind Patterns, Lakeview Elementary

Exposure to Pollution Due to Wind



North winds on site

Levels of air pollution 30-50 feet away from busy roads are generally half of the roadside concentration and a further 100-120 m away they are halved again. In accordance to our site strong northern winds direct roadside pollution from Greenwood Dr. into the site weakening as it draws near the school. These northern winds also push polluted air from construction management and industrial facilities only 2,000ft away such as: Watse management Chesapeake, VA and GFL Environmental.



Northwest winds on site

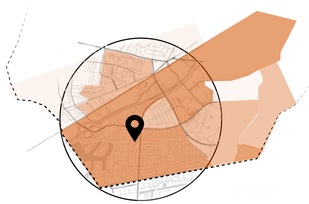
Levels of air pollution 30-50 feet away from busy roads are generally half of the roadside concentration and a further 100-120 m away they are halved again. Strong Northwest winds direct roadside pollution from a high traffic area.

[4.2] Author Wind and Pollution , Lakeview Elementary

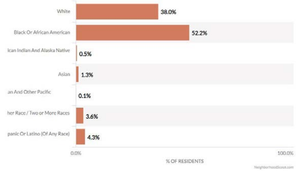
NEIGHBORHOODS

Cavalier Manor is a suburban neighborhood (based on population density) located in Portsmouth, Virginia. Cavalier Manor real estate is primarily made up of medium sized (three or four bedroom) to large (four, five or more bedroom) single-family homes and townhomes. An interesting characteristic about the Cavalier Manor neighborhood is that there are more incarcerated people living here than 99.0% of neighborhoods in the U.S. The United States has the highest rate of incarceration in the world, currently with 1 out of every 100 adults in the country are incarcerated as a punishment for crimes committed. The extremely high incarceration rate of this neighborhood could mean that a prison, juvenile detention facility or other correctional facility occupies a large proportion of the neighborhood, or contains a large portion of the neighborhood's population.

Portsmouth's age structure and the age groups it attracts suggest it has the natural advantages and disadvantages of a central city. Its location, commuting numbers, and redevelopment issues also suggest it functions more as a central city. However, most of the city has the density, urban form, and housing stock of a suburb. For Portsmouth, gaining residents and businesses may mean embracing its role within the metro area. It has the potential to be a vibrant urban core for areas west of the Elizabeth River at a time when demand for urban residential options is higher than it has been in the past. The type of neighborhoods it could offer are sparse in the Hampton Roads area.



demographics



DEMOGRAPHIC

Portsmouth, Virginia is mostly populated with African Americans. However, white residents follow not so far behind making up almost 40% of the city's population. Our site specifically has a higher concentration of African Americans, concetration in the Cavelier Manor neighborhood. This could be a result of the urban renewal practices that forced African Americans into more suburban/urban areas pushing them away from the existing ports. With a 52.2% black population we can assume that a large majority of the students living within these areas are

zoning

- D2 FBC
- GMU
- GR
- HLB(HIST.LTD.BUS)
- HLO(HIST.LTD.OFF.)
- HR(HISTORIC RESD)
- IL
- IN
- MX/EMP
- NMU
- NR
- P1
- PRESERVATION/GOVT
- RAC
- SD
- T3
- T4
- T5
- T6
- UR
- UR-MPO
- URH
- WF

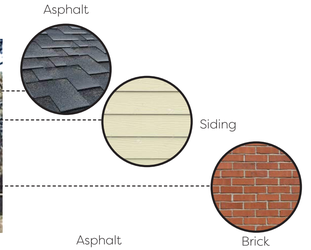
ZONING

Our site is located under UR/URH zoning regulations. This stands for urban residential/ urban residential housing. The High Density Urban Residential (UR-H) district is established to accommodate a diverse range of residential development as a principal use, along with mixed-use and neighborhood-serving commercial development. Accommodating most forms of residential development, including single-family attached dwellings, two-to-four-family dwellings, townhomes, live/work units, multi-family dwellings, and residential dwellings above the first floor of commercial development. Also allowed are complimentary uses such as parks, open space, libraries, religious institutions, community centers, **schools (elementary, middle, and high)**, child care centers, and minor utilities. Neighborhood-serving commercial and service uses are allowed to encourage diverse, functioning neighborhoods.

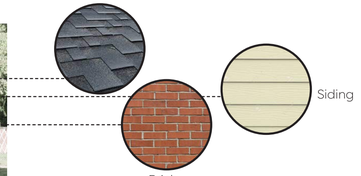
[4.2] Author | Demographics and Zoning

Located in Portsmouth, VA, Lakeview Elementary School serves as the site where the development of new air infiltration techniques be applied. Taking into account the unique circumstances of the school itself. Being constructed in the year 1967 much progress has been made to improve air quality. The school has been chosen due to its association in the ECO-DISTRICT Initiative. Problems that will be addressed include:

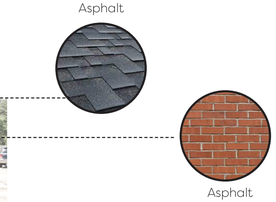
Neighboorhood Stats



Type: Townhomes
Year Built: 1977
Estimated Selling Price: $192,612 Estimated Rental Price: $1,100/mo
Walk Score: 23 (Car Dependent)
Transit Score: (Minimal Transit)
Not in district for Lakeview Elementary School



Type: Single-Family
Year Built: 1968
Estimated Selling Price: $246,699 Estimated Rental Price: $1,400/mo
Walk Score: 25 (Car Dependent)
Transit Score:22 (Minimal Transit)
In district for Lakeview Elementary School



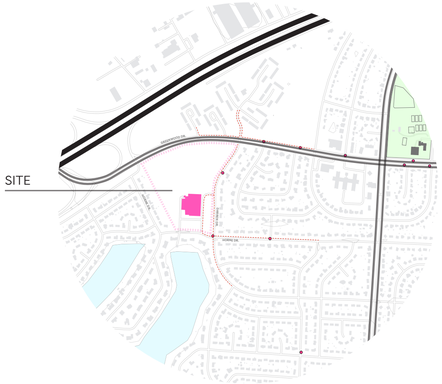
Type: Single-Family
Year Built: 1972
Estimated Selling Price: $420,631 Estimated Rental Price: $1,795/mo
Walk Score: 12 (Car Dependent)
Transit Score:20 (Minimal Transit)
In district for Lakeview Elementary School

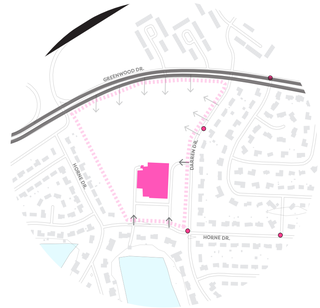
BUILDING TYPOLOGIES/ COMMUNITY FEATURES

CAVELIER MANOR MAP

- HEALTH
- RETAIL
- RELIGIOUS WORSHIP
- SINGLE - FAMILY RESIDENTIAL
- EDUCATION
- COMMUNITY CENTER
- TRANSPORTATION SERVICE
- INFRASTRUCTURE
- WAREHOUSE/DISTRIBUTION
- MANUFACTURING

PEDESTRIAN/VEHICULAR PATTERNS



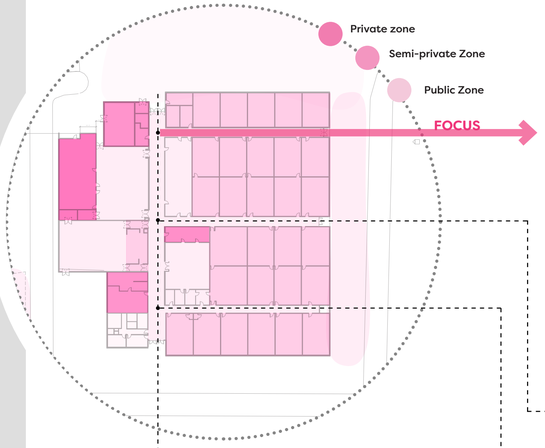


Vehicular Access

Pedestrian Access

Looking at road cirulation and poitns of entry to the site would be important when considering community access. Focusing pedestrian entryway oppurtunity to exisiting sidewalks and focusing vehicular entry oppurtunity from major and minor roadways.

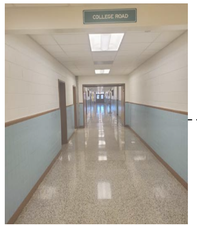
- 11 BUS STOPS
- SIDEWALKS
- PEDESTRIAN ENTRY TO SITE
- POSSIBLE ENTRY TO SITE
- MAIN ROADS
- SECONDARY ROADS
- TERITARY ROADS
- VEHICULAR ENTRY TO SITE
- POSSIBLE ENTRY TO SITE



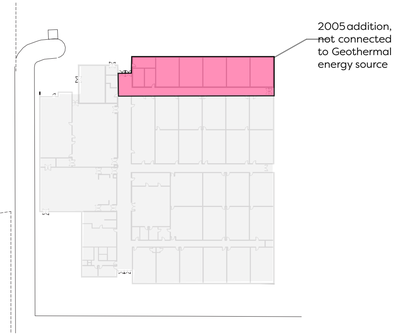
Presidents Way - Secondary Hallway

Extracirricular Classrooms

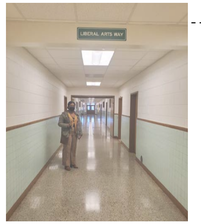
The school can be sectioned into 4 hallways: main hallways



College Road - Secondary Hallway



Entryway - Main hallway



Liberal Arts Way - Secondary Hallway

Lakeview Elemetary School has undergone a system upgrade in 2005 that makes use of the preexsiting landfill in the creation of a geothermal system. This area becomes of focus due to its unique

04.4 Municipal Solid Waste Landfills

Surface Waters on site after rainfall

In almost all cases, properly designed and monitored caps on landfills can allow the site to be reused safely. Since 1988, landfills in the US have been regulated under the Resource Conservation and Recovery Act (RCRA).

Other chemicals which may be emitted in small concentrations by decomposing waste, such as VOCs or benzene, can directly harm people who come into contact with them.

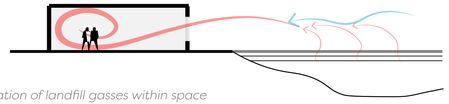
Municipal solid waste is a combination of non-hazardous wastes from house holds, commercial properties, and industries. In this case we will specifically be looking at the construction tactics of solid waste landfills to determine the best techniques to developed on site. Lakeview Elementary School resides on a preexisting solid waste landfill and with this construction can be dangerous but not impossible as technology advances.

Methane Safety Hazards

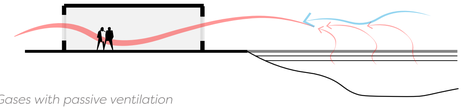
Methane is the major component of natural gas. It is highly flammable and can form explosive mixtures with air if it concentrates in an enclosed space with poor ventilation.

Odors from Landfill Gas

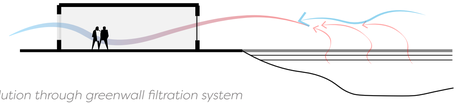
Odors in landfill gas are caused primarily by hydrogen sulfide and ammonia, which are produced during breakdown of waste material.



Accumulation of landfill gasses within space

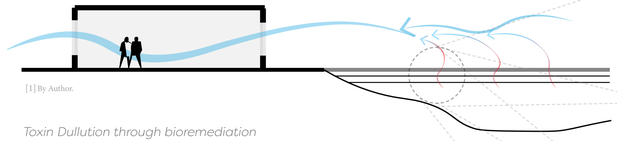


Landfill Gases with passive ventilation



Toxin Dullution through greenwall filtration system

[4.5] Author | Ventilation to Filtration



[1] By Author.

Toxin Dullution through bioremediation

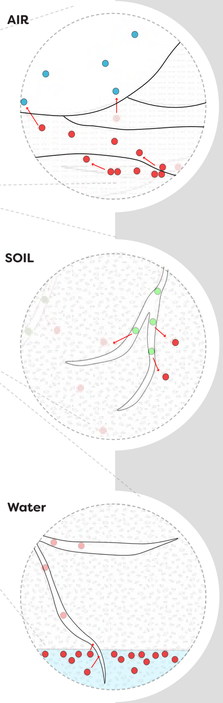
Filtration through plants is a heavily researchecd topic and has been used in multiple architcetural projects to remove toxic contaminants from a space. Typically observed for air purification but research has allowed for the decontamination of groundwater and soil. These process are called Rhizofiltration and Phytoremediation. Rhizofiltration being a result of phytoremediation. This process is helpful when looking to address landfill gases such as methane. This process becomea a system that works to detoxify our air, soil, and water within brownfield areas in a sustainable way. Even with many existing technologies, phytoremediation stands out for its self-maintaining, soil stabilizing, cost-effective processes, and for meeting greater ethical and public approval (Doty et al., 2007).

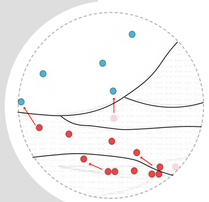
BIOPHILIA → **TOXIN DILUTION**

↓

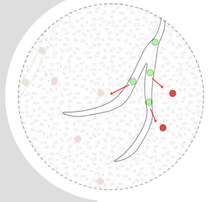
BIOREMEDIATION

Phytoremediation
Aids to augment bioremediation as it uses broad range plants to remediate soil, sediment, surface water and ground water that have been contaminated with toxic metals, organic, pesticides and radionuclide.

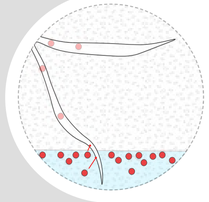




Contaminants are taken up into the plant tissues where they are metabolized, or biotransformed. Where the transformation takes place depends on the type of plant and can occur in roots, stems, or leaves.

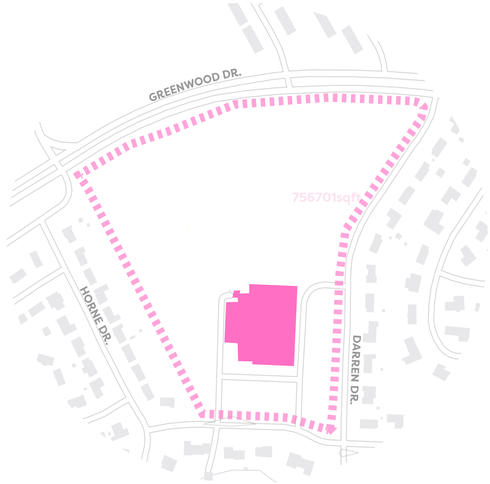


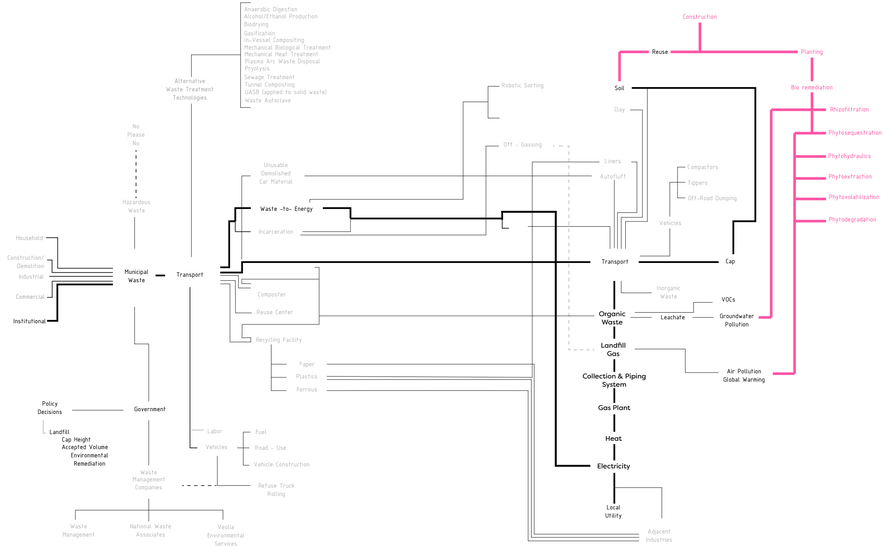
Absorption by roots, adsorption to the surface of roots, or the production of biochemicals by a plant that is released into the soil or groundwater in the immediate vicinity of the roots and can sequester, precipitate, or otherwise, immobilize nearby contamnants.



This process takes place in the soil or groundwater immediately surrounding the plant roots. Exudates (excretions) from plants stimulate rhizosphere bacteria to enhance biodegradation of soil contaminants.

Sr
U
Pb
Hg
Cd
Cr
Zn
Cu
As
Cd
Ba





[4-6] Author | Landfill Lifecycle of Sickness

Monoicous plants are those species that bear both sperm and eggs on the same gametophyte. one that has male and female flowers on the same plant, or that has flowers on every plant that contain both male and female reproductive components. Also known as “one house” or Bisexual.

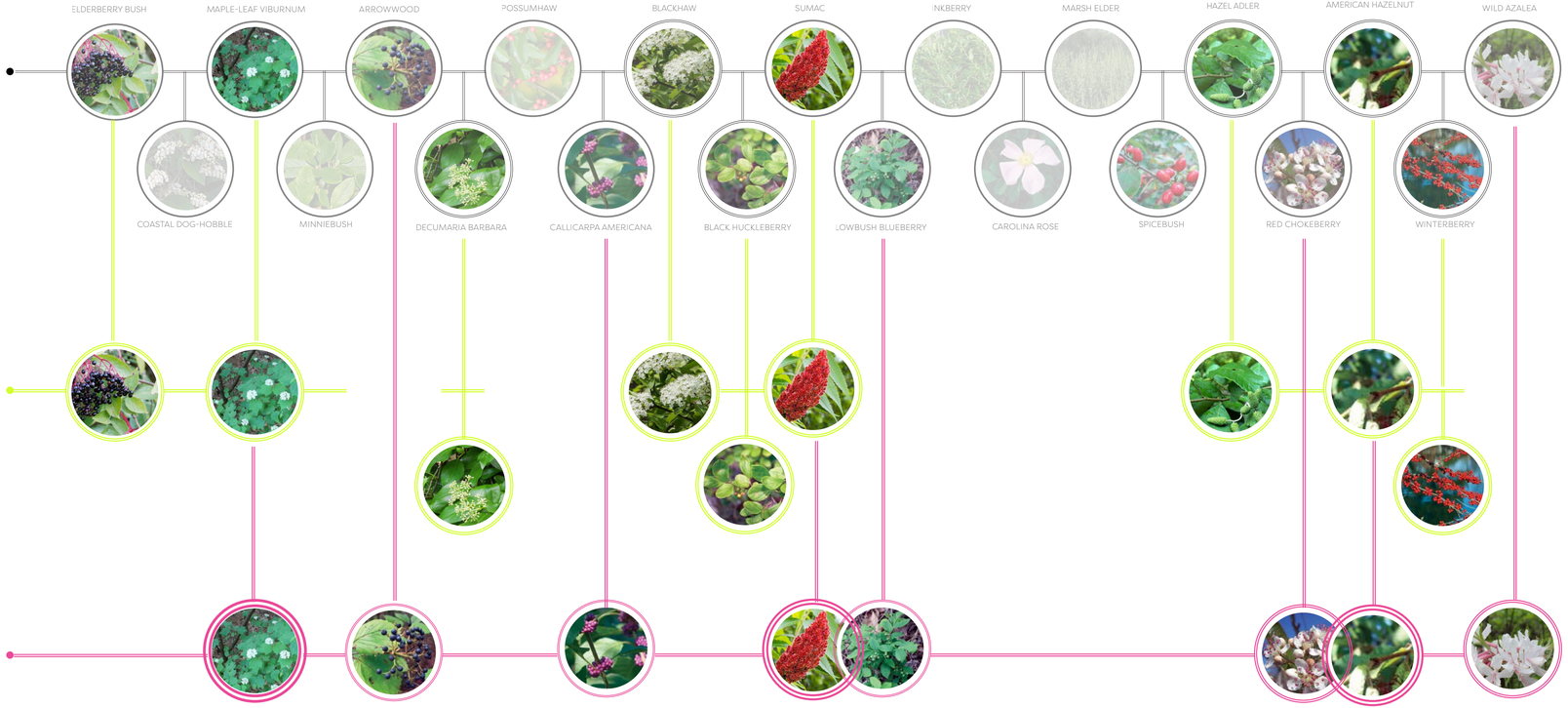
MONOECIOUS (BISEXUAL)

NATIVE SPECIES

HYPOALLERGENIC

TOXIN DILLUTION

Low -Level Vegetation



5

DESIGN

This section will focus on design in a macro to micro scale. Using architectural strategies that respond to the human-scale and biophilic environments.

Breathe refers to strategies being implemented to help in terms of respiritory health. These should be implemented throughout the entirety of the project where we see fit.

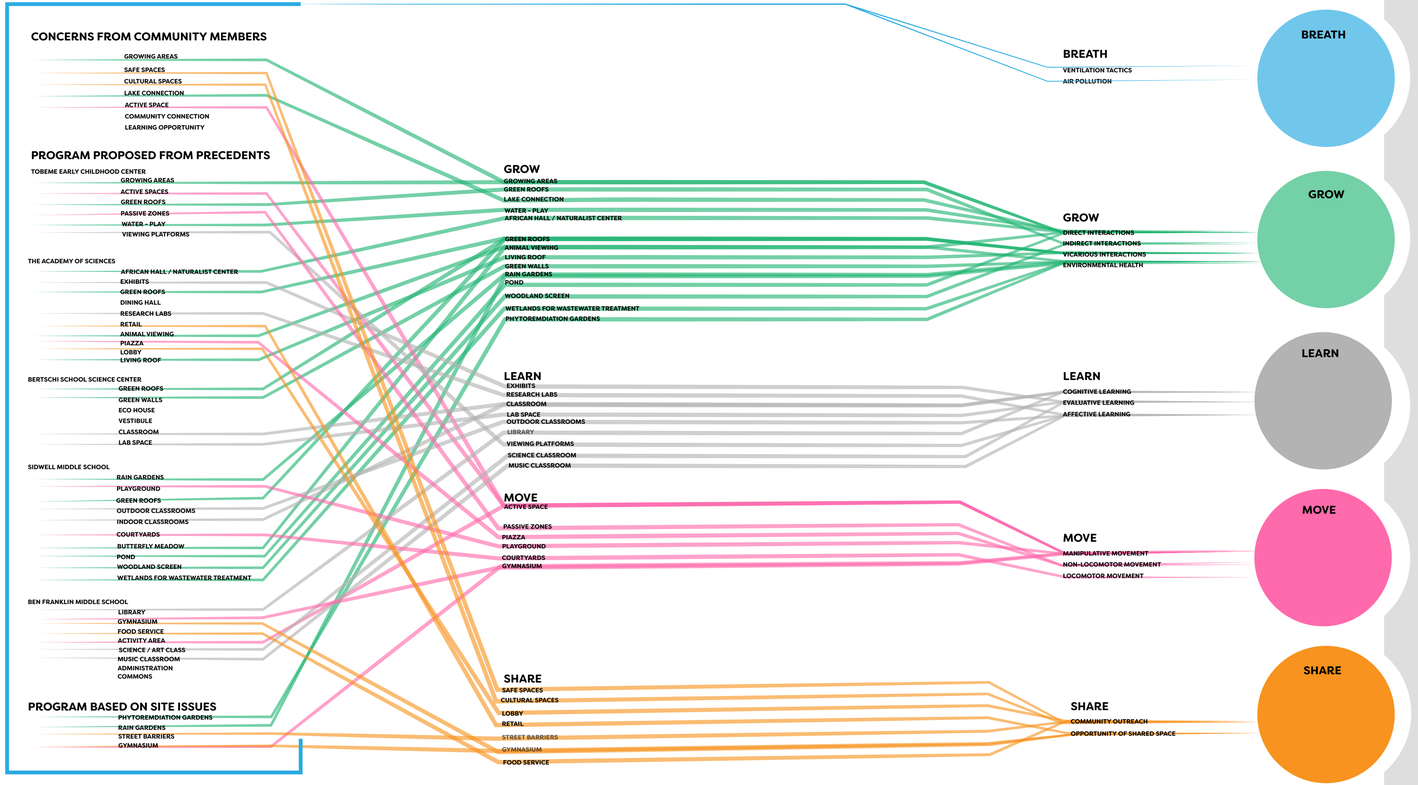
Program that encourages activity and movement within a space. Identifying with the three types of movement mentioned: Manipulative, non-locomotor, and locomotor. These spaces will typically have larger amounts of open space.

Growing is nature. These programs focus on indoor and outdoor vegetative qualities. This also includes any instances of biophilic design qualities.

Learning program is exemplified by spaces that are used to teach using cognitive, evaluative, and affective tatics.

Share refers to the sharing of spaces between students and community members. The immediate community is able to benefit the programmatic type.

PROGRAM DEVELOPMENT



Located in Portsmouth, Virginia Lakeview Elementary school serves as the site where the development of new air infiltration techniques be applied. Taking into account the unique circumstances of the school itself. Being constructed in the year 1967 much progress has been made to improve air quality. The school has been chosen due to its association in the ECO-DISTRICT Initiative. Problems that will be addressed include:

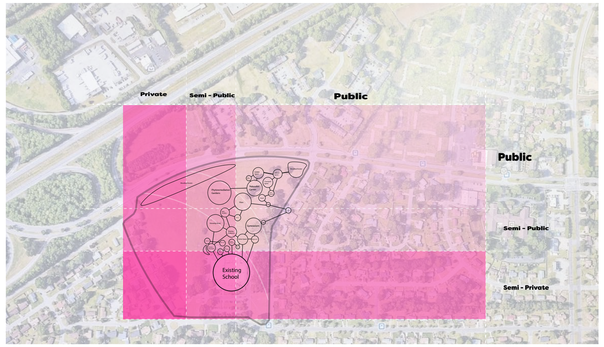
Severe Spatial Needs

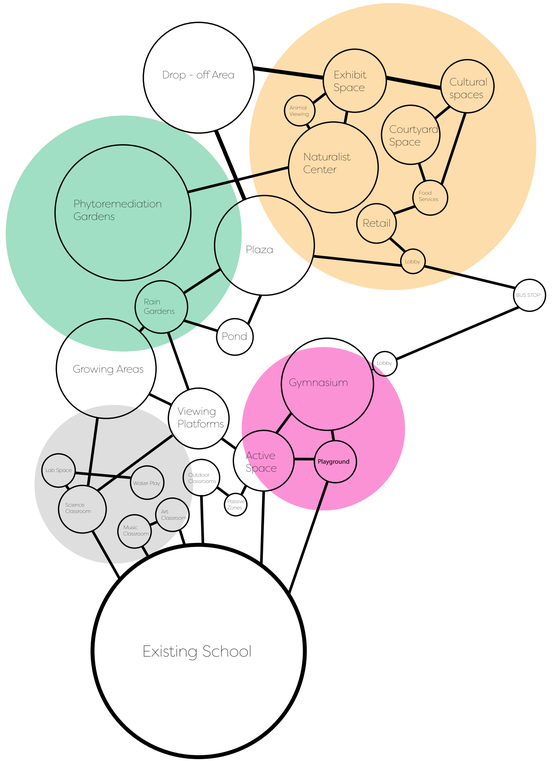
High Accounts of Students with Respiratory Needs

Preexisting Landfill, Unsuitable Building

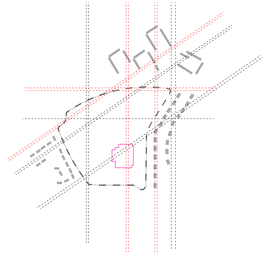
Program configuration becomes based on conerns from the community. These ideas were collected from conversations with the school's principal, Dr. Smith, and portsmouth Virginia native and president of the Center for Sustainable communities. Program will also be taken from precedents used to define the values of the project, consisting of qualities

Public



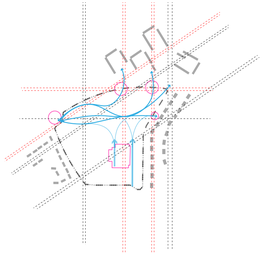


SITE DEVELOPMENT



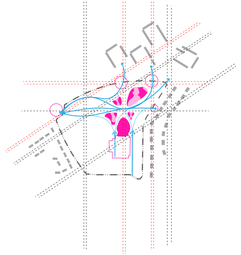
CONNECT

Creating grid lines based on the street infrastructure of the immediate neighborhoods. Red signifying more prominent paths, black representing more secondary paths.



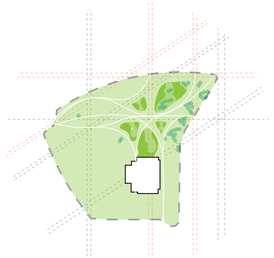
ACCESS

Focusing on accessability and creating interconnecting pathways throughout the site connecting on end to the other.



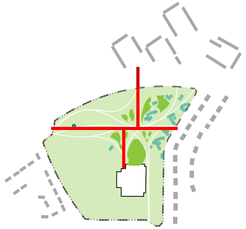
PLACEMENT

Signifying areas that will be used for building and or intentional landscaping based on existing grids and developed access pathways.



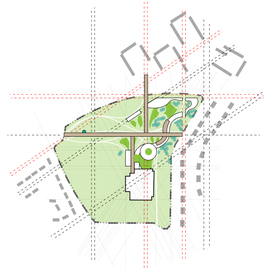
GREEN

Existing vegetaion becomes a factor of considerationwhen designing for such spaces . Choosing to design around the areas in order to preserve current natural conditions.



PATHS

Creating more prominent pathways throughout the site that connect poorer communities, public transit, student access, and vehicular entry .



FORM

Forn finding through use of geometric grids. These forms respond to wind and sun while still considering major pathways and vegetation.

1 RENOVATE

Re-creation of systematic connectivity - from isolation to network in a flexible framework that structures a multi – layered urban infrastructure.

2 REMEDIATE

Visible transformation of toxics and contaminants as a sensual experience through the dynamic media of the landscape. Staging of phytoremediation as landscape typologies.

3 CONSTRUCT

Remediation as a tool to build new districts and neighborhoods on former brownfields and a source for economic growth and revitalization. Integration of micro scale with urban and regional scale as a multi-scale approach.

4 CONNECT

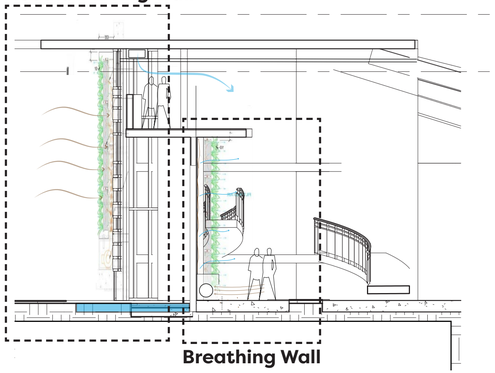
Decentralized, local, on-site strategies. Interdisciplinary collaboration between scientists, designers, and planners.

Legend

1. exhibit
2. library
3. naturalist hall
4. retail
5. community gallery
6. phytoremediation gardens
7. gymnasium
8. active space
9. classroom
10. outdoor classroom
11. science wing
12. geothermal system
13. Drop off

VOC removal from air

Needlaw Living Wall

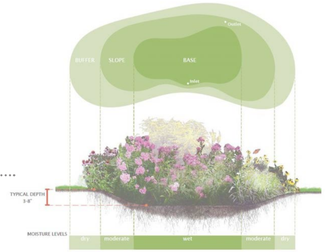


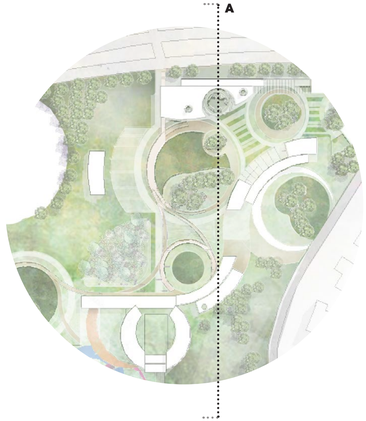
Breathing Wall

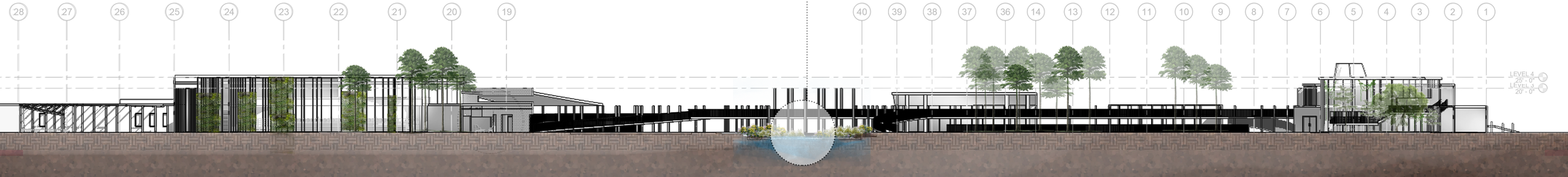
CO2 reduction from air

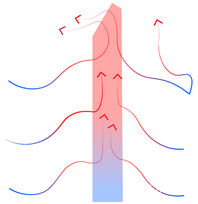
Active Living Wall Systems

An architectural review on "The Affects of Active Living Wall System on the Indoor Environment" has showed the great potential of the ALWS. A 'passive' LWS has no effect on the indoor environment. This is because too little air is coming in contact with the root zone of the plants, where the phytoremediation is taking place. Air needs to be ventilated through the LWS to increase the efficiency of the phytoremediation process. This way the ALWS can provide significant amounts of 'fresh air' for occupants that is purified, humidified and cooled within one system. The active ALWS' ability to remove VOCs, CO2 and PM, humidify and cool the air, makes the device superior to most non-biological systems used as general air quality maintenance devices. On top of the physical effects, the aesthetic value can also have a positive mental effect. In conclusion, a correctly designed ALWS can have a significant improvement on the indoor environment and the overall human health and well-being.







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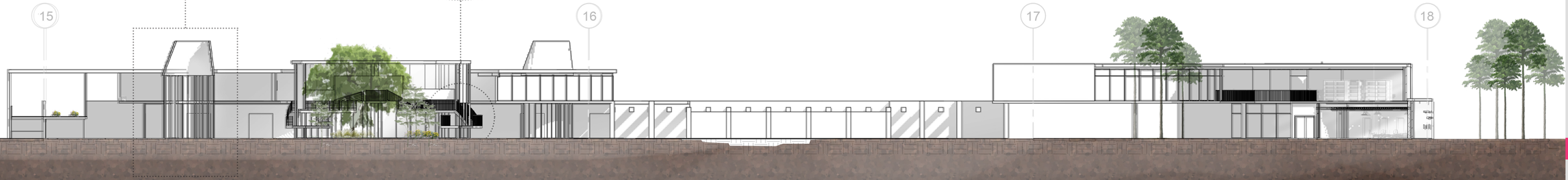
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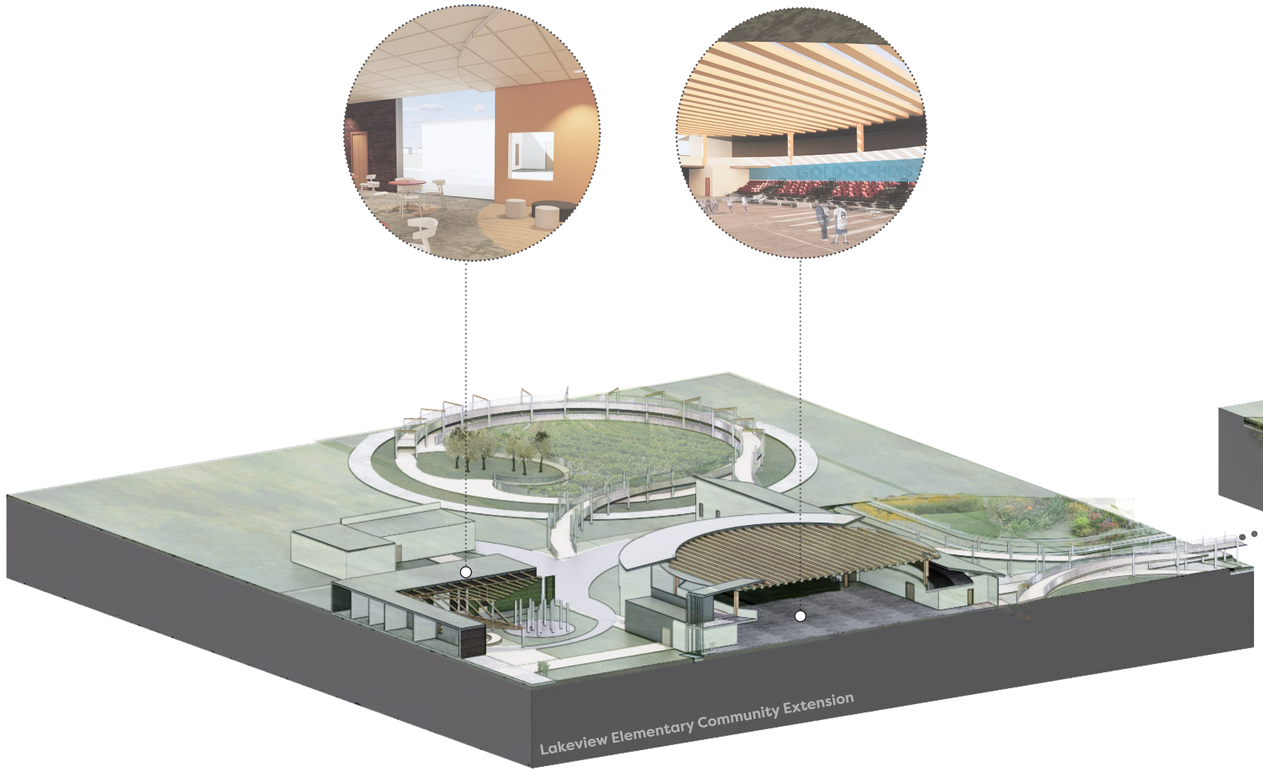
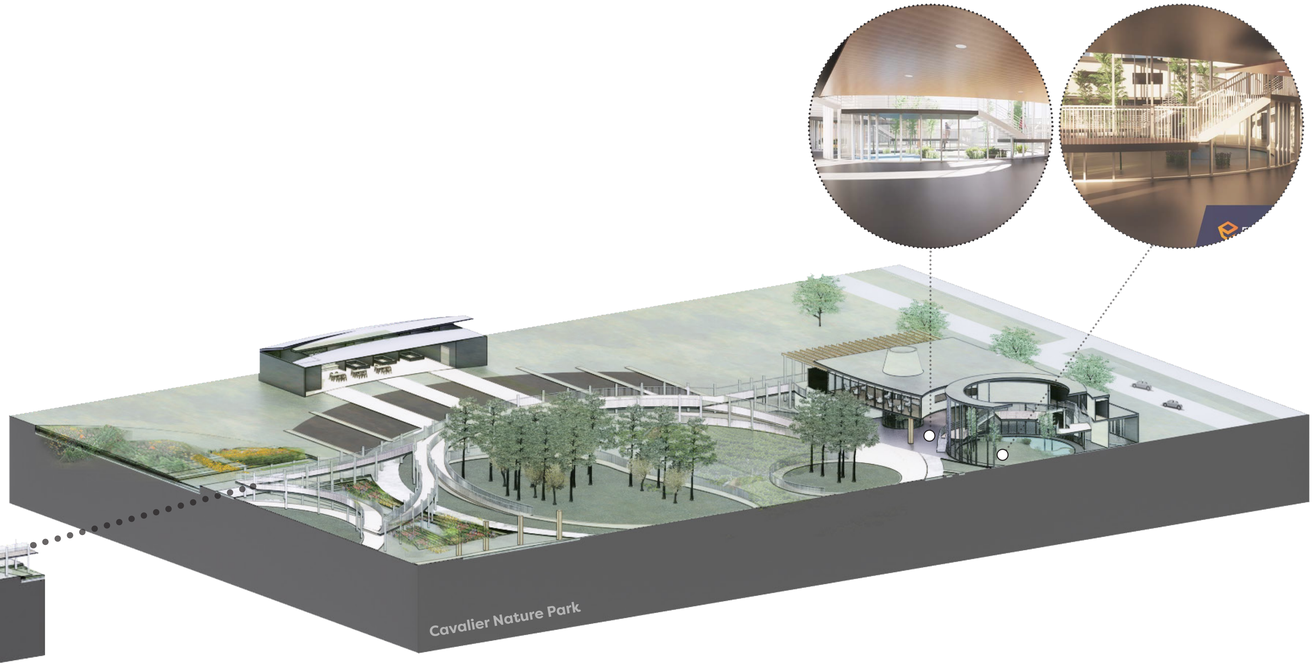

Lakeview Elementary Community Extension


Cavalier Nature Park

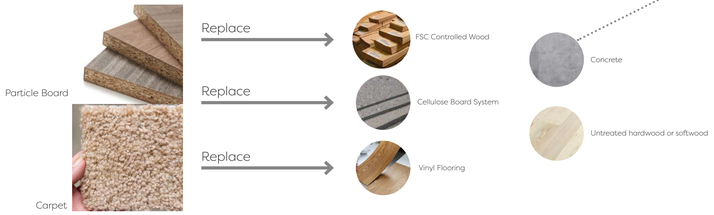
Materials to Reduce VOC's (interiors)

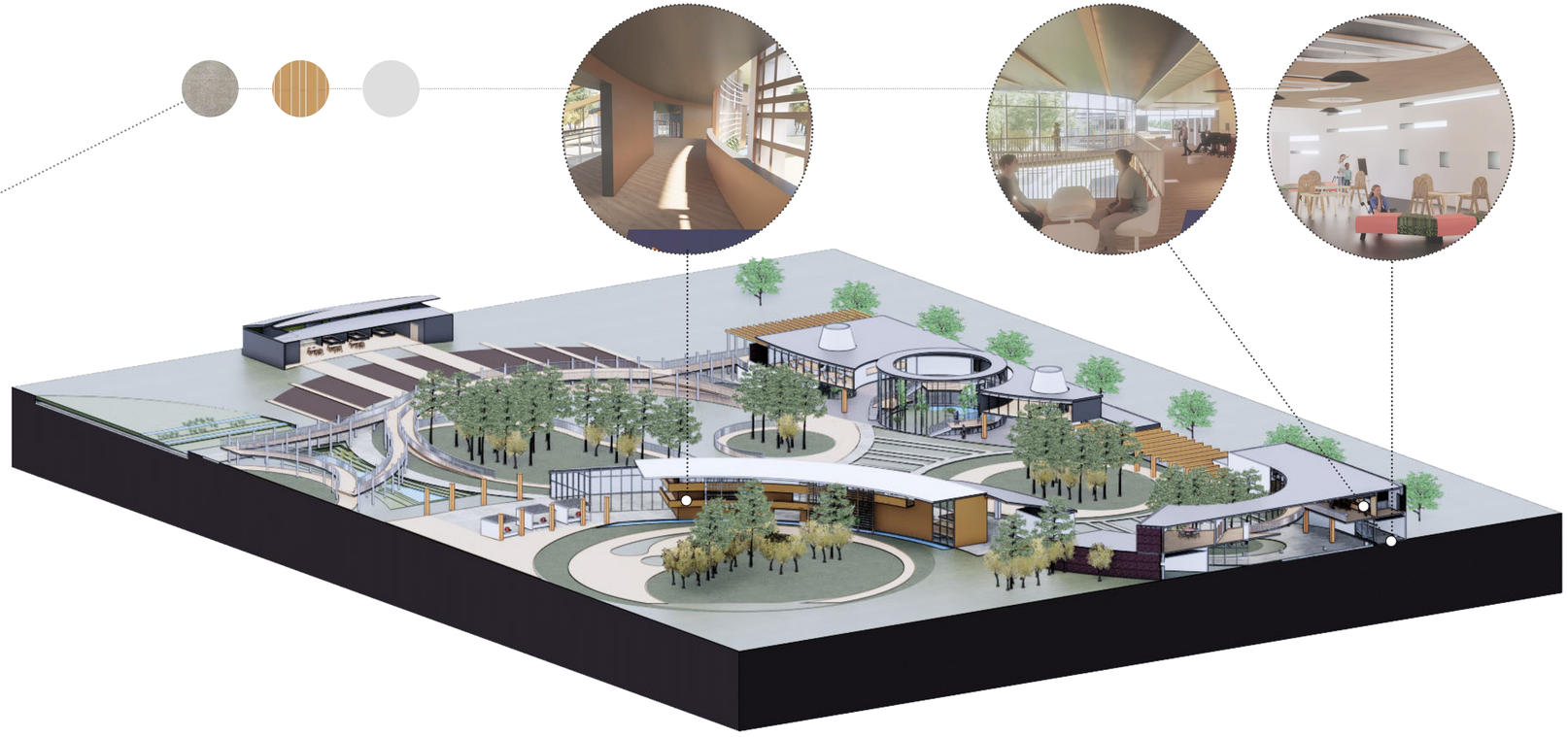
Formaldehyde is Bad

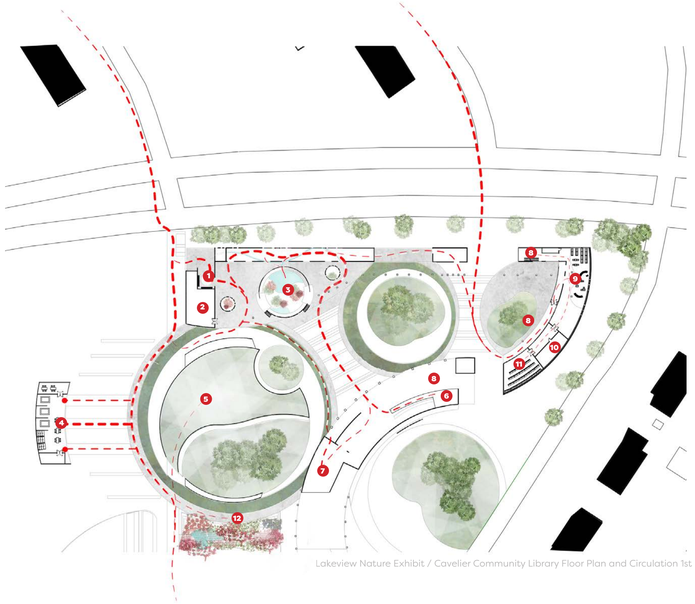
Formaldehyde is present in significant quantities in a wide range of house furniture, insulation and floor and wall fittings. It is used in hundreds of industrial processes including the manufacture of particle boards, MDF, chipboard and plywood, thermal insulation foams, adhesives, glues and resins. A study into the domestic exposure of young children to formaldehyde in Australia suggested that it increases the risk of childhood asthma.52 An Austrian report distinguishes between the levels perceived as safe for occupational exposure and the levels that should be present in the home – infants spend a large portion of their time indoors. Risks Exposure to high levels or long-term low levels of formaldehyde may cause cancer (emissions still occur after installation).Formaldehyde is recognised as an asthma trigger.

Particle Board

Select formaldehyde free floor panels and finishes. Particle board contains formaldehydes which are carcinogenic. Chipboard/ particleboard is one of main culprits in toxifying indoor air. Also some floor panels are laminates requiring more glue and formaldehyde content (5). Consideration should be given to using a cellulose board system.







Lakeview Nature Exhibit / Cavelier Community Library Floor Plan and Circulation 1st Level

PROGRAM

1. LOBBY/ENTRY
2.ANIMAL VIEWING SPACE
3. NATURE EXHIBIT SPACE
4. MAKE SPACES/ COMMUNITY GARDEN
5. PHYTO GARDENS
6. NATURE HALL / PHYTOFILTERS BIOWALLS
7. RETAIL
8. STAIRS
9. KIDS LIBRARY SPACE
10. COMPUTER LAB
11. COMMUNITY MEETING SPACE
12. RAIN GARDEN / BIOSWALE VIEWING

CAVELIER COMMUNITY LIBRARY

plants for bioremediation (soil)


Warneckei


English Ivy

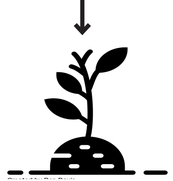

Janet Craig


Spider Plant


Peace Lily

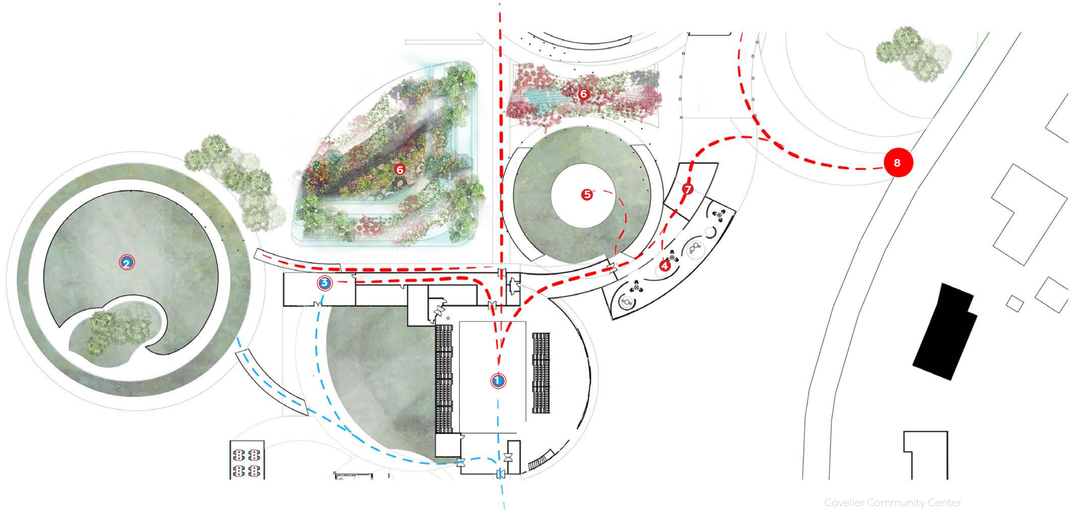
VOC removal rate	CO_2 removal	PM removal
10.4% - Formaldehyde	5.49 g/h Air flow: 3.5 m/s	53.35 ± 15.99% Air flow: 11.25 L s^{-1}
73.2% - Benzene 9.2% - Trichloroethylene	1.36 g/h Air flow: 3.5 m/s	
89.8% - Benzene 10.9% - Trichloroethylene		
77.6% - Benzene 17.5% - Trichloroethylene		
79.5% - Benzene 23.0% - Trichloroethylene		
79.0% - Benzene 13.2% - Trichloroethylene		
52.6% - Benzene 13.4% - Trichloroethylene		
70.0% - Benzene 20.2% - Trichloroethylene		

BIOPHILIA → **TOXIN DILUTION**



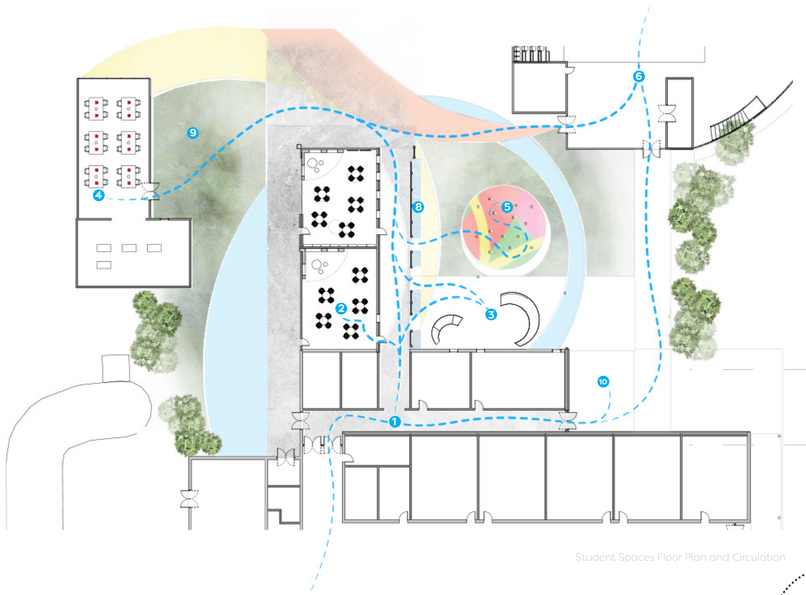
Active Living Wall Systems

An architectural review on "The Affects of Active Living Wall System on the Indoor Environment," has showed the great potential of the ALWS. A 'passive' LWS has no effect on the indoor environment. This is because too little air is coming in contact with the root zone of the plants, where the phytoremediation is taking place. Air needs to be ventilated through the LWS to increase the efficiency of the phytoremediation process. This way the ALWS can provide significant amounts of 'fresh air' for occupants that is purified, humidified and cooled within one system. The active ALWS' ability to remove VOCs, CO2 and PM, humidify and cool the air, makes the device superior to most non-biological systems used as general air quality maintenance devices. On top of the physical effects, the aesthetic value can also have a positive mental effect. In conclusion, a correctly designed ALWS can have a significant improvement on the indoor environment and the overall human health and well-being.



1. COMMUNITY GYMNASIUM
2. PHYTO GARDENS
3. SHARED MULTIPURPOSE ROOMS
4. COMMUNITY ART GALLERY
5. COMMUNITY PLAYGROUND
6. RAIN GARDENS
7. RETAIL
8. BUS STOP

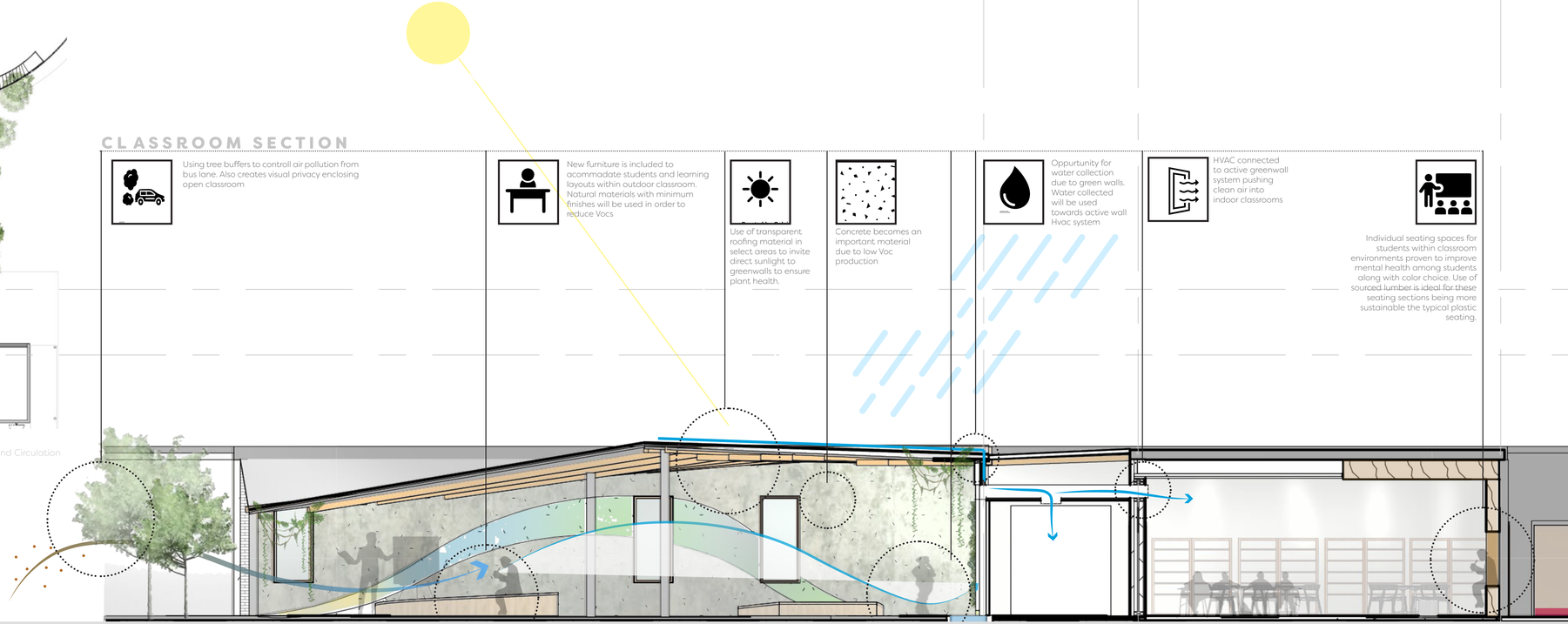
OUTDOOR CLASSROOM/ACTIVE SPACE

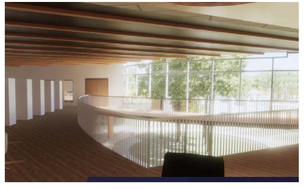


Student Spaces Floor Plan and Circulation

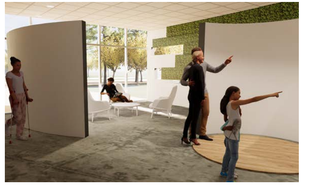
1. EXISTING CORRIDOR
2. CLASSROOM EXTENSION (ART)
3. OUTDOOR CLASSROOM
4. SCIENCE WING
5. NATURE- BASED PLAY SPACE
6. GYMNASIUM
7. STUDENT GARDENS
8. PHYTOFILTERS/BIOWALLS/ WATER-PLAY

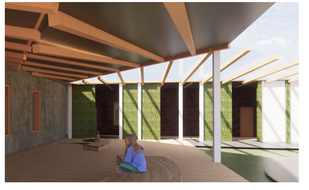
CLASSROOM SECTION





THANK YOU





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