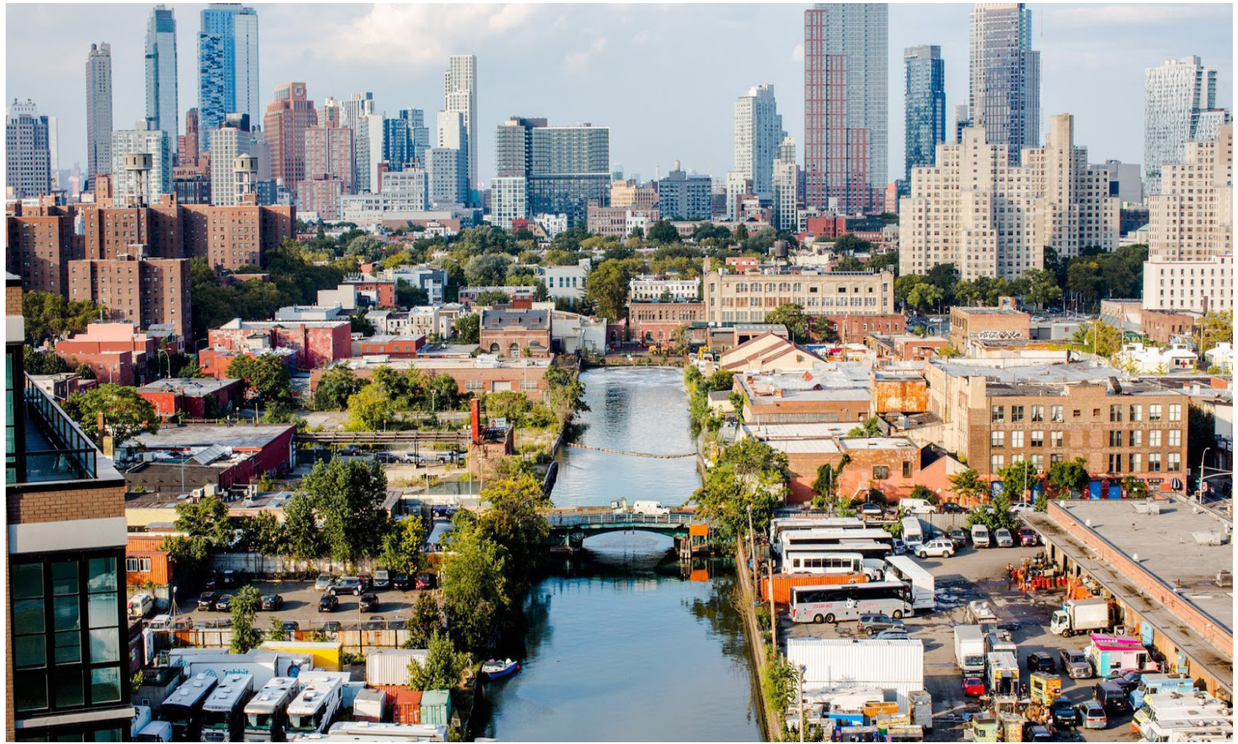
URBAN DESIGN CLIMATE WORKSHOP

FROM CLIMATE SCIENCE TO CLIMATE ACTION

G O W A N U S

B r o o k l y n

2019



Source: https://www.nytimes.com/2018/01/11/real estate/brooklyn-real-estate-prices-climb-higher.html

GOWANUS CANAL, BROOKLYN, NY

PREFACE

The Urban Land Institute's New York District Council (ULI New York) and the ULI Urban Resilience Program engaged the academic research group at the New York Institute of Technology (NYIT), together with the Urban Climate Change Research Network (UCCRN) – a global consortium of climate experts – to conduct an Urban Design Climate Workshop (UDCW) for Gowanus, a mixed-use, industrial neighborhood in Brooklyn. The UDCW is a hands-on, capacity-building exercise that engages the local community, real estate and land use professionals, and government officials as they confront 21st century climate challenges in their neighborhoods and cities. These workshops also demonstrate how rezoning or other redevelopment initiatives should incorporate climate projections to better understand likely climate impacts and opportunities for mitigation. In this instance, Gowanus is scheduled to be rezoned, which is likely to impact resident quality of life as well as urban heat stress adaptation, flood resilience, and greenhouse gas emission mitigation.

The Gowanus UDCW emerged as follow-up to a Technical Assistance Panel (TAP) conducted in the Spring of 2017 at the request of the Fifth Avenue Committee, a leading Brooklyn-based non-profit and advocacy organization. The TAP explored specific strategies for the Gowanus rezoning, with proposals for key tools and investments to address the Urban Heat Island (UHI) effect, with the goal of positively impacting the health and quality of life of Gowanus residents, particularly low-income residents and communities of color, who are most at risk from extreme heat and have been historically marginalized in planning and land use processes. In follow up conversations with the Fifth Avenue Committee and the New York City Department of City Planning, it became clear to us that there was both an opportunity and a need to develop additional, science-based UHI resources that would add support to the TAP recommendations and strengthen advocacy efforts already underway for climate and environmental justice in Gowanus as part of the rezoning.

Unlike the ULI TAP process, where a final report reflects the recommendations of multidisciplinary ULI member experts, the Gowanus UDCW was planned, designed, and executed by graduate urban design students in the Architecture, Urban & Regional Design master's degree program at NYIT's School of Architecture and Design, under the supervision of faculty and in coordination with a local ULI taskforce. The goal of the students' work was to examine the local microclimates and, based on the best available data, to propose regulatory strategies that could be implemented in a complex environment like New York City. In doing so, the students sought to demonstrate the value of evidence-based, climate driven urban design strategies.

It is our hope that the proposed mitigations and intervention strategies offered in this report, as well as the overall approach for incorporating climate modeling into a rezoning proposal, may serve as a source of new and innovative ideas for ULI member practitioners, policy makers, and community leaders in addressing climate issues and advancing public health and resilience.

We are grateful to the New York Community Trust for contributing funding to this effort. We would also like to thank our project partners and participants who made the Gowanus UDCW possible – including the NYIT faculty and graduate students, the UCCRN, the local project partners at the Fifth Avenue Committee and the Gowanus Canal Conservancy, and local ULI members. With this support, ULI New York was able to advance its mission and the goals of ULI's Urban Resilience program, which seeks to ensure that resilience efforts strengthen cities, reduce vulnerability to climate impact, and enhance environmental performance, economic opportunity, and social equity.

Felix Ciampa
Executive Director, ULI New York

Katharine Burgess
Vice President, ULI Urban Resilience

EXECUTIVE SUMMARY

In 2019, the Urban Land Institute's New York District Council and Urban Resilience Program collaborated with the New York Institute of Technology (NYIT) and the Urban Climate Change Research Network (UCCRN) to conduct an Urban Design Climate Workshop (UDCW) in Gowanus – a rapidly changing area of New York City that is currently targeted for upzoning as part of Mayor de Blasio's 2015 pledge to create and preserve 300,000 units of affordable housing by 2026. While the goal of creating and preserving affordable housing is laudable, the impacts of rezoning in communities, most often low-income communities of color, warrants significant evaluation to avoid unintended negative consequences to community members. Gowanus is one such community.

Gowanus sits at a critical nexus between the superfund-designated Gowanus Canal, the more affluent communities of Park Slope and Carroll Gardens, and the industrial, last mile freight and residential community of Red Hook. As a densely developed area with few parks or green spaces for residents, Gowanus is amenity-constrained. This lack of green space makes the urban heat island effect intense for neighborhood residents, many of whom do not have air conditioning. These conditions will only worsen given the escalating impacts of climate change.

As recognized in the New York City Department of City Planning's (DCP) Gowanus Neighborhood Planning Study, there are numerous community needs. These include:

- Support for existing and future resiliency and sustainability efforts;
- Advocacy for and expansion of neighborhood services and amenities, such as supermarkets;
- Improvement to streetscapes and pedestrian safety;
- Recreational access along the Canal for all people;
- Innovative ways to support and develop space for job creation, including industrial, arts, and cultural uses;
- Promoting opportunities for new and affordable housing;
- Protection of existing residential tenants against harassment and displacement; and
- Coordination of necessary infrastructure improvements throughout the area to support the continued cleanup of the Gowanus Canal and to accommodate existing and future needs.

DCP's study builds upon the planning study Bridging Gowanus, led by Councilmember Brad Lander, which worked with the community to identify larger priorities for the neighborhood rezoning, including supporting a mix of uses, more and better affordable housing, integration of arts and culture, an improved public realm, and greater sustainability and resilience. To the latter point, the Gowanus Neighborhood Coalition for Justice (GNCJ) and member organizations have been making the case for forwarding environmental and racial justice as a part of the Gowanus Neighborhood rezoning. Gowanus Canal Conservancy (GCC), a GNCJ member and a partner organization in this ULI-sponsored effort with NYIT students, has led a four-year effort working with community members to better understand needs and priorities for public open space and to codify and articulate investment and policy opportunities to meet these needs in the Gowanus Lowlands Master Plan.

Following the ULI New York Technical Assistance Panel (TAP) conducted for Brooklyn Community Based Organization the Fifth Avenue Committee in 2017 – A Vision for a Green, Healthier, Cooler Gowanus: Strategies to Mitigate Urban Heat Island Effect – greater exploration of community interests as related to climate exposures and adaptation alternatives was needed. While technical assessments continue with the DCP, the collaboration with NYIT faculty and students, as well as with NASA Goddard Institute for Space Studies (GISS), the Urban Climate Change Research Network (UCCRN), the American Institute of Architects New York Chapter (AIANY), the Fifth Avenue Committee (FAC), Gowanus Canal Conservancy (GCC), and ULI member experts offers a compelling next step with the next generation of professionals seeking to integrate climate change planning and visioning into current policies and practices.

The 2017 TAP characterized urban heat island impacts in Gowanus and noted the history of the area as a transportation nexus for an industrializing city, and related limited public realm improvements such as parks and street-network tree canopies. The TAP flagged the densities of New York City Housing Authority (NYCHA) public housing, the ongoing industrial waterfront inclusive of an Industrial Business Zone (IBZ), and environmental hazards including the superfund site extents, brownfields throughout the area, and manufactured gas plant locations. The TAP also noted that the population of Gowanus tends toward lower income with a range of poverty from 17-32% depending on location. Finally, the TAP identified intense zones of urban heat deserts where temperature compounds the inhospitable character of impervious surface parking lots, windowless heat-absorbing/reflecting facades, and a dearth of shade or public realm amenities.

Working with GISS, UCCRN, AIANY, FAC, GCC, and ULI, the faculty and students of the NYIT studio extended the climate assessment of the New York Panel on Climate Change and the Second Assessment Report on Climate Change and Cities, by investigating the microclimates of the Gowanus rezoning area and the public health impacts of such climates. Using Land Surface Temperature maps and conducting microclimate analyses at locations such as a local grocery, the team identified baseline conditions and modeled projected conditions by 2050 if the upzoning were to occur as planned, as compared to an identified best practice approach.

In addition, the team examined sea level rise and inland flooding scenarios given current designated floodplains and historical data from superstorm Sandy in 2012. These approaches, combined with existing land use patterns and density, along with projected density given the upzoning, yielded opportunities for supporting Gowanus in a changing climate in line with community priorities – a key outcome for the NYIT design studio. Such reimagination included a range of strategies to address the urban heat island effect, such as improving the efficiency of urban systems and mitigating the ill-effects of greenhouse gas emissions, modifying the urban form for climate-responsive passive strategies, increasing the use of efficient construction materials and surface coatings, and integrating cooling along with flood mitigation strategies to reduce urban heat and stormwater-induced flooding. The nominal best practice approach included short-term, medium-term, and long-term implementation strategies that combined policy changes with building material, vegetative cover, an interconnected public realm, and development form changes following this guidance.

The Vision 2050 Urban Design Concepts included new development planning strategies. These include:

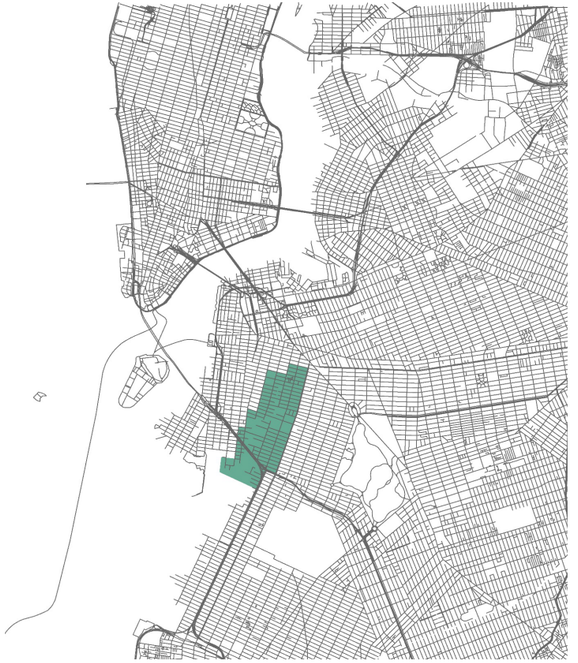
- Taking advantage of cooling summer breezes;
- Harnessing water for cooling and flood reduction;
- Optimizing micro-mobility to improve area transportation;
- Including hybrid and adaptive live-work typologies to retain good local jobs and to constructively integrate manufacturing and housing;
- Densifying residential buildings while maximizing permeable areas;
- Increasing passive strategies for cooling; and
- Piloting such ideas through small-scale district interventions to test the approaches and providing development incentives for ecologically sensitive plans.

Small-scale district interventions in Gowanus may include a number of typological opportunities. Urban farms and food hubs would increase food security and nutritional health. Expanded parkland for activities and leisure and connected green spaces would enable community members to move more easily through cool corridors between anchor sites such as schools and grocers. Overall, a more holistic approach that links community interests and priorities from Bridging Gowanus and Gowanus Lowlands to upzoning opportunities and challenges is paramount. This approach would be inclusive of equity, small business stability, climate change readiness, safe space for outdoor recreation and health, and greater community cohesion. During public health crises like the COVID-19 pandemic, the need for this holistic approach is even more urgent.

Many of the student-led ideas presented in this report, developed with support from leading professionals and community organizations, challenge the status quo well beyond Mayor de Blasio's affordable housing target and the subsequent efforts of the Department of City Planning. The contextualized, yet unrestrained approach from the students provides additional value and different perspectives than those of more seasoned professionals. The NYIT students used science-based microclimate assessments, community preference and guidance, and crowd-sourced feedback to imagine how Gowanus might tackle the twin challenges of too much water/too much heat and too little affordable housing, all the while preserving the sense of community. ULI is fortunate to have worked alongside such an enthusiastic, talented, and dedicated group of emerging professionals and recognizes the value in continuing collaborations with the next generation of civic leaders. While this work introduces challenges to implementation, such as de-densifying areas in order to capture prevailing breezes, or Industrial Business Zone (IBZ) changes and new typologies for live/work manufacturing, it remains important to raise awareness of the possibilities, to engage new thinking, and to take the conceptual underpinnings of these efforts forward in order to continually question how and why we develop as we do and how new strategies might offer greater value in the marketplace and the communities the marketplace serves.

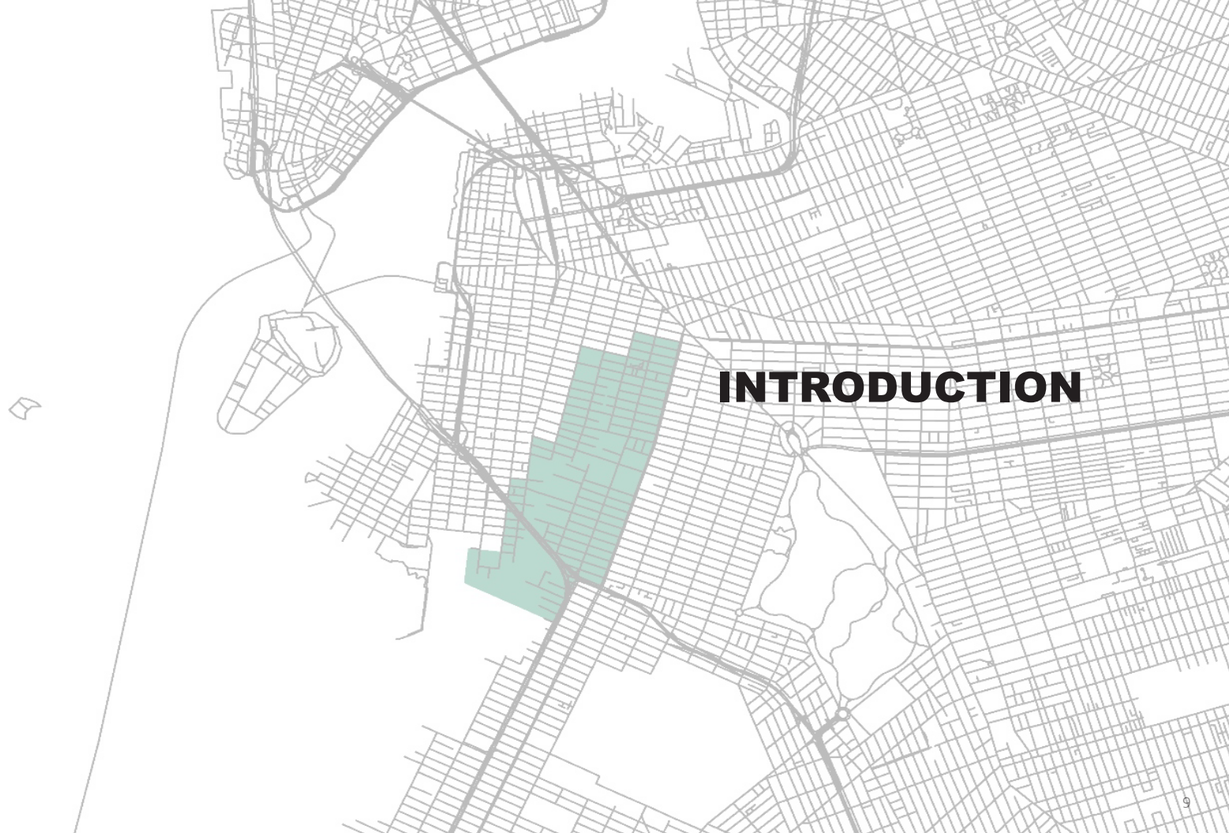
Given its focus on 2050, the next steps for 22nd century planning for this nearly 400-year old city must include climate projections at least through the end of the century and must integrate near-term implementable strategies inclusive of market motivations and policy platforms. However, this glimpse of what could be, if a group of innovative next-generation thinkers were invited to lead, might set imaginations moving in a new direction so that the formative actions of the rest of us lean a bit more into these bright futures.

NYIT team presenting to the Gowanus Neighborhood Coalition for Justice (GNCJ) at the June 2019 workshop.



Map of Gowanus, Brooklyn, that highlights the UDCW study area (in green).

CONTENTS



INTRODUCTION

GOWANUS URBAN DESIGN CLIMATE WORKSHOP (UDCW)

Developing the New York metropolitan area in a denser, more compact manner, mixing land uses and supporting mass transit, will result in a reduction of the metropolitan area's carbon footprint. As such, dense urban districts can be configured to enhance quality of life and reduce the impact of urban heat and storms, which are made worse by the changing climate.

The **Urban Land Institute's** (ULI) New York District Council and Urban Resilience Program partnered with the research taskforce at the **New York Institute of Technology** (NYIT), and the **Urban Climate Change Research Network** (UCCRN), a global consortium of climate experts, to explore this topic. The team, led by Jeffrey Raven (NYIT), conducted an Urban Design Climate Workshop (UDCW) for the Gowanus neighborhood in Brooklyn, New York, focused on urban heat stress adaptation integrated with flood resiliency and greenhouse gas emission mitigation.

UCCRN and NYIT **Urban Design Climate Workshops** are hands-on, capacity-building exercises that engage the local community, industry professionals, and city officials as they confront climate challenges in 21st century neighborhoods. The approach, which derives its value proposition from positive public health and economic growth outcomes, envisions that urban design can help shape transformative climate action in evolving districts like Gowanus. It also shows how rezoning or other redevelopment initiatives can incorporate climate projections to better understand likely climate impacts and opportunities for mitigation.

The Gowanus UDCW gave further voice to the important conversation around mitigating the impacts of urban heat islands and addressed the alignment of urban climate impact with the Gowanus rezoning proposal. The primary goals of the Gowanus UDCW were to create locally-specific climate models and, based on the best available data, to propose "actionable" regulatory strategies for a complex city like New York.

In its study process, the UDCW taskforce drew on expertise from various professionals to configure prototype interventions for strategic sites in Gowanus. These interventions used baseline (business-as-usual) and best practices (climate-driven urban design) scenario forecasts. The work included a technical modeling process to calculate the projected population influx and the urban heat island effect in 2050, keeping in mind projected development as outlined in the Gowanus rezoning proposal. This approach provides compelling actionable evidence to a wide audience, including NYC policymakers, of the value proposition of evidence-based, climate-driven urban design strategies.

The Gowanus UDCW was divided into multiple phases, including:

Phase 0 (February-March 2019): The graduate urban design students from the NYIT Urban Design Climate Lab undertook a comprehensive climate-driven urban design process for a future district based upon "best practice" climate strategies. On a parallel pedagogical track and at key milestones during the UDCW process, the draft urban design outcomes were reviewed by a design jury. At the conclusion of Phase 0, the taskforce presented its findings to an advocacy organization, the Municipal Art Society of New York.

Phase 1 (April 2019): ULI convened a taskforce including real estate, design, and planning professionals who participated in a 2017 Gowanus Technical Assistance Panel (TAP), members of ULI New York's TAPs Steering Committee, and the Gowanus TAP Sponsor, the Fifth Avenue Committee (FAC). This ULI taskforce identified the GDCW project scope, study zone, and preliminary urban design interventions. Using the resulting scope, the NYIT-UCCRN team refined its approach and began its technical modeling process.

Phase 2 (May 2019): The Gowanus UDCW taskforce and invited representatives from the Gowanus Canal Conservancy reviewed and discussed the draft technical modeling and suggested revisions to the neighborhood population projections and proposed urban design intervention prototypes.

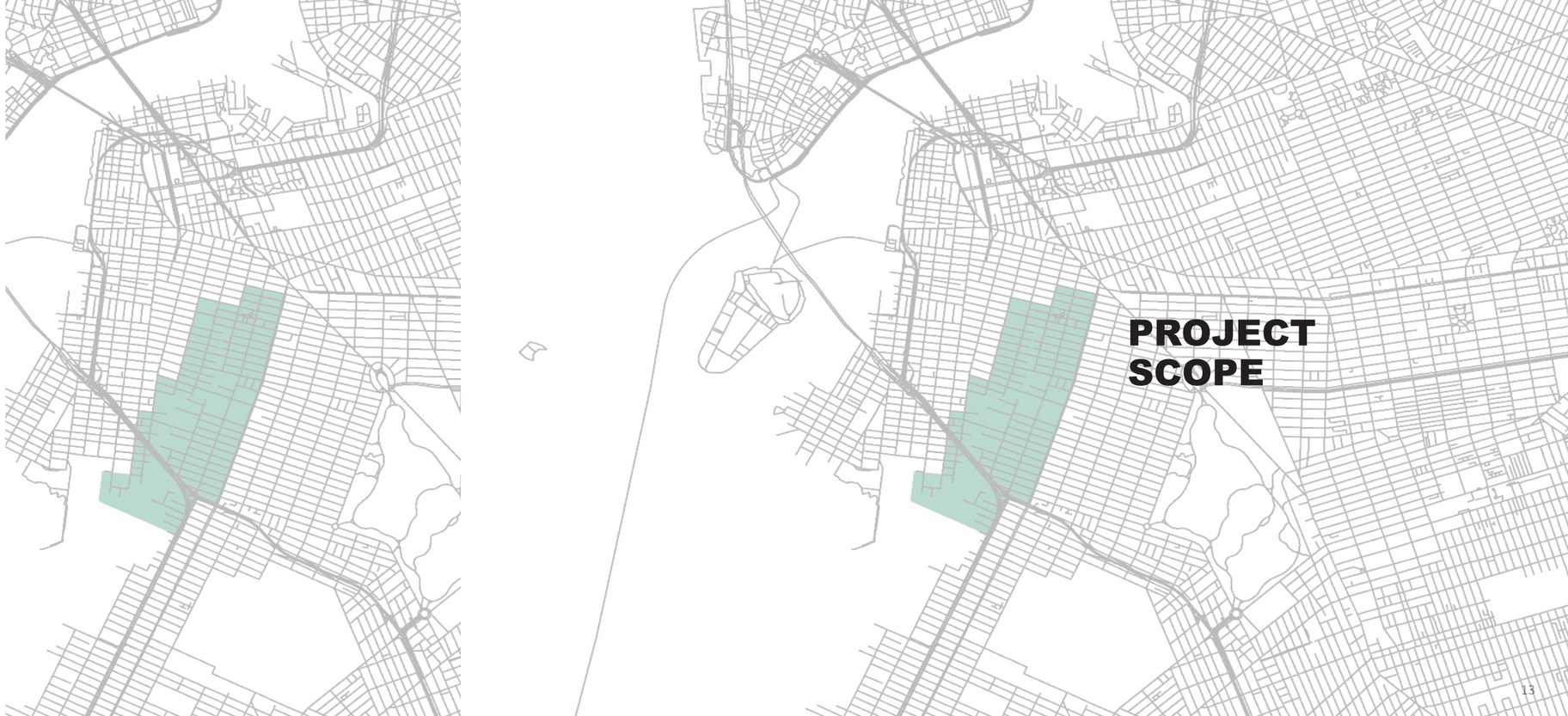
Phase 3 (June 2019): In partnership with the Gowanus Neighborhood Coalition for Justice, ULI hosted a two-day workshop in Gowanus to present the research, technical modeling,

and recommendations that stemmed from the first two phases. These sessions facilitated an open dialogue between the local community, city officials, and ULI members around issues related to land use, urban heat, public health, and climate adaptation and mitigation.

This report showcases the proposed practices, key findings, and recommendations that emerged from the UDCW process; demonstrates how design and development can address climate issues, including the urban heat island effect; and highlights best practices for enhancing resilience in a previously industrial neighborhood undergoing a large-scale rezoning.

ACKNOWLEDGMENTS

The Gowanus Urban Design Climate Workshop was made possible through generous funding from the New York Community Trust (NYCT). The Urban Land Institute's New York District Council and Urban Resilience program are grateful for the support and the opportunity to explore this important topic and produce recommendations that may inform more sustainable development in NYC.



PROJECT SCOPE

The Gowanus canal area is the subject of New York City's planning and rezoning process that proposes an evolution from its current condition as a scattered industrial zone with low-rise residential buildings to a higher density mixed-use district.

The definition of the study area is based on the rezoning plan boundaries combined with the canal's portion of the Southwest Brooklyn Industrial Business Zone (IBZ), including the southern part of Gowanus.

This Urban Design Climate Workshop modeled three climate/ development scenarios, refining the proposed site interventions through micro-climate modeling with qualitative flood mitigation co-benefits at a district scale.

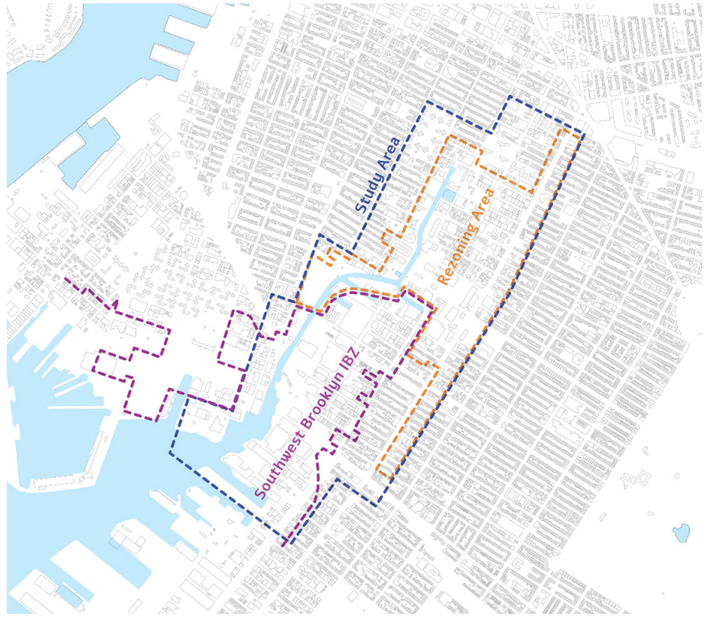
The three scenarios are as follows:

Existing, 2019: Scenario reflecting current climate and development patterns.

Baseline Business as Usual (BAU), 2050: Hypothetical scenario based on the NYC Department of City Planning Rezoning Plan and "market driven" full build-out assumptions.

Best Practices, 2050: Based on climate adaptive development and considering evidence-based "best practice" urban climate factors.

These criteria are described in the Study Area Analysis section (page 39).

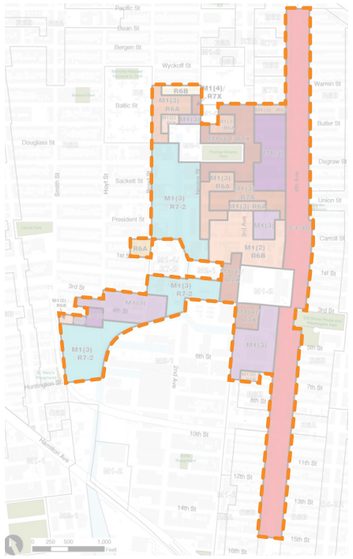


Study Area Boundary

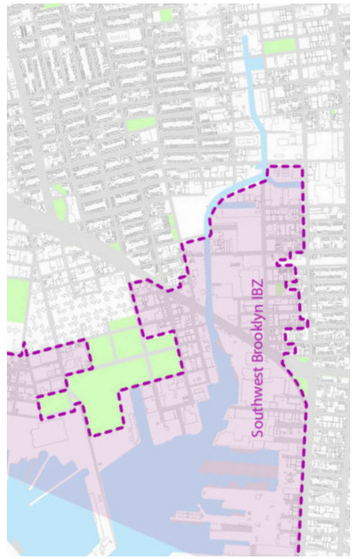
STUDY AREA

The Northern part of the canal (marked with an orange dashed line) is designated to become a high density mixed-use district in the NYC Department of City Planning (NYCDCP) Rezoning Plan, which was at an advanced draft stage at the time of the UDCW and included various studies and a public engagement process.

The Southern part of the canal (marked with a purple dashed line) is the Brooklyn Industrial Business Zone (IBZ), a designated manufacturing district at the southern part of the canal.



Rezoning Plan by NYC Department of City Planning



Brooklyn Industrial Business Zone (IBZ)

1. https://www.1.nyc.gov/site/planning/plans/gowanus/gowanus-framework.page
2. http://www.aecom.com/swbrooklyn/wp-content/uploads/2016/09/SW-Brooklyn-Study.pdf

PROJECT PARTNERS

Integrated Climate Adaptation & Climate Mitigation

This Gowanus Urban Design Climate Workshop integrates climate mitigation and climate adaptation by prioritizing actions that reduce greenhouse gas emissions (low carbon) while strengthening climate adaptation (UHI and flood mitigation).

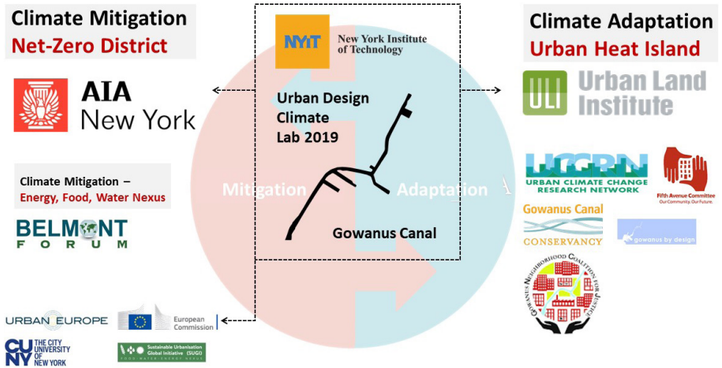
Two adaptation-mitigation initiatives are occurring in parallel as separate but scientifically-related projects.

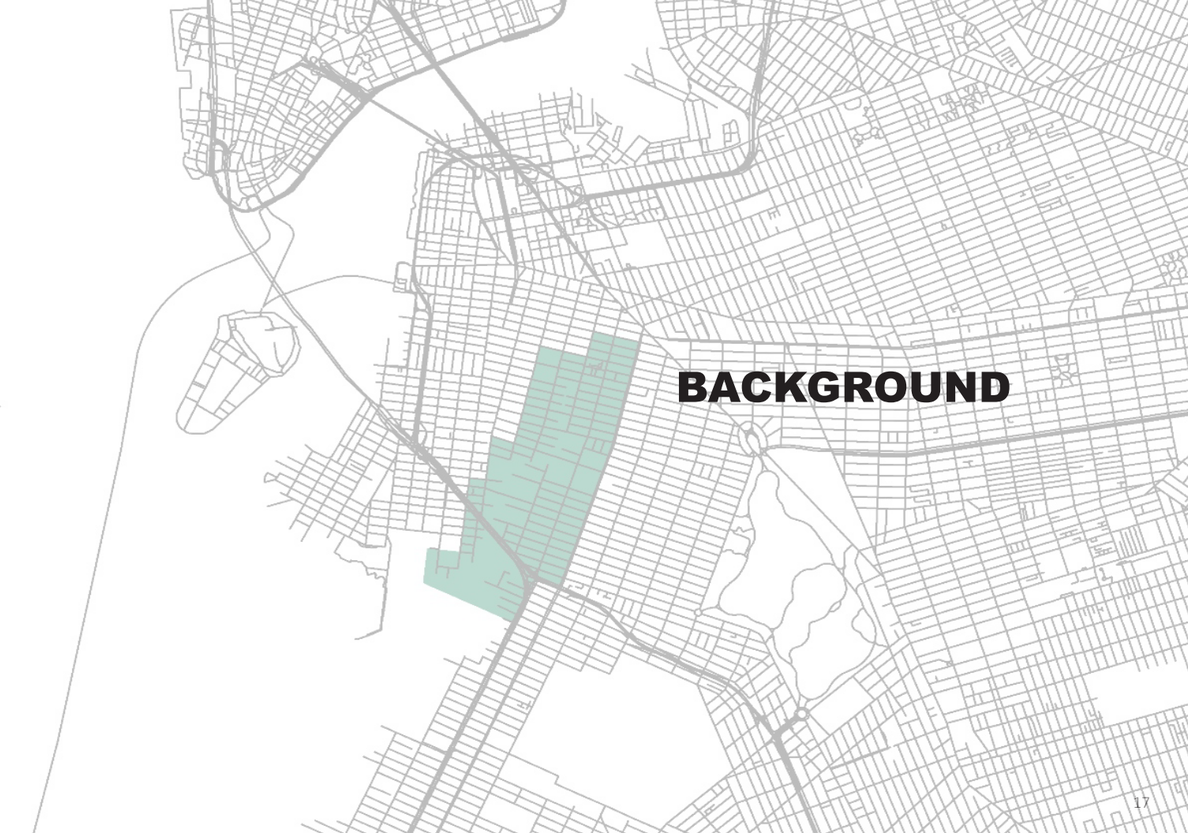
Climate Adaptation: Urban Heat Island. The ULI-NYIT/ UCCRN publication is in collaboration with climate experts and stakeholders through the lens of urban heat island.

Climate Mitigation: Net-Zero District. This effort is led by the American Institute of Architects (NYC Chapter) in collaboration with the Insource – Belmont European-American research consortium.

These two Gowanus efforts overlap: integrated climate adaptation (UHI) to reduce cooling loads overlaps with climate mitigation (net-zero) to achieve net-zero carbon emissions by balancing a measured amount of carbon (or C02 equivalency) released with an equivalent amount of CO2 generated on-site or offset. Peer-reviewed scientific research shows that this integration is the most effective approach to confronting climate change in cities.

Stakeholders & Participants

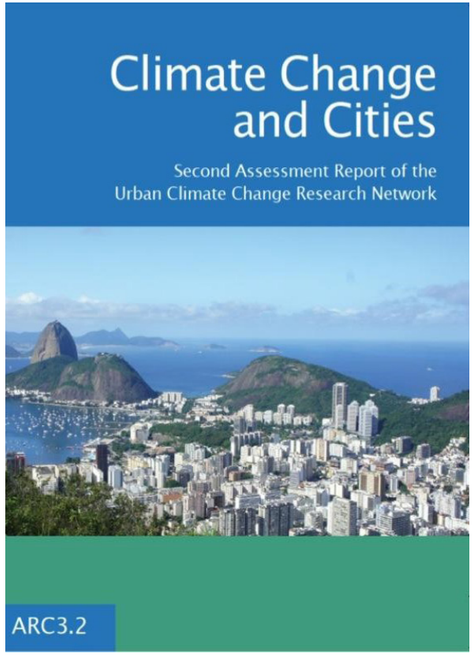




CLIMATE SCIENCE, URBAN DESIGN & POLICY

Peer Reviewed Research

The Urban Design Climate Workshop is based on the **Second Assessment Report on Climate Change and Cities** (ARC3.2), published by Cambridge University Press. The Urban Planning and Urban Design chapter contends that confronting the challenges of a rapidly urbanizing world threatened by climate change requires expanding on the traditional influence and capabilities of urban planning and urban design. Evidence-based ARC3.2 strategies demonstrate how integrating climate science, natural systems, and compact urban form will configure dynamic, desirable, and healthy communities.



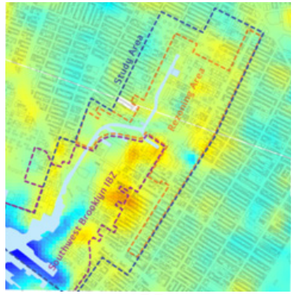
*Raven, J., Stone, B., Mills, G., Towers, J., Katzschner, L., Leone, M., Gaborit, P., Georgescu, M., … Rudd, A. (2018). Urban Planning and Urban Design. In Climate Change and Cities: Second Assessment Report of the Urban Climate Change Research Network (pp. 139-172). Cambridge: Cambridge University Press. doi:10.1017/9781316563878.012

By Cynthia Rosenzweig, William Solecki, Patricia Romero-Lankao, Shagun Mehrotra, Shobhakar Dhakal, Tom Bowman, Somayya Ali Ibrahim. Edited by Cynthia Rosenzweig, William D. Solecki, Hunter College, City University of New York, Patricia Romero-Lankao, National Center for Atmospheric Research, Boulder, Colorado, Shagun Mehrotra, New School University, New York, Shobhakar Dhakal, Somayya Ali Ibrahim

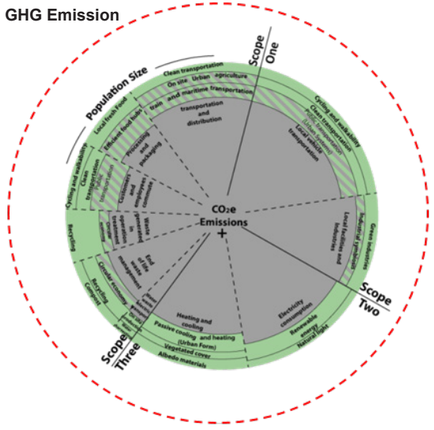
Publisher: Cambridge University Press

Download publication: http://uccrn.org/files/2019/09/ARC3.2-PDF-Chapter-5-Urban-Planning-and-Design-wecompress.com_.pdf

2019 Urban Heat Island (LST)



GHG Emission



Yuval Eynath, NYIT Urban Design Climate Lab, 2019

CLIMATE SCIENCE, URBAN DESIGN & POLICY

Integrated Climate Adaptation (UHI) & Climate Mitigation (GHG)

The NYIT Urban Design Climate Lab regularly engages New York City as a climate laboratory. Students research the intersection of urban form, low-carbon cities, and climate to propose 21st century urban design practices, applying synergies between climate mitigation strategies (reducing greenhouse gas emissions) and adaptation strategies (enhancing resilience through UHI reduction).

Greenhouse Gases (GHG) are emissions due to human activities, which are the most significant driver of observed climate change since the mid-20th century.

According to the **2015 NYC Citywide GHG Emissions by Sector and Source**, primary GHG emitters are:

- STATIONARY ENERGY: 66.7%
- TRANSPORTATION: 29.7%
- WASTE: 3.5%

GHG and UHI are two different phenomenon representing different effects on climate. The goal of this Urban Design Climate Workshop is to connect the two phenomenon by modeling how compact, low carbon settlement patterns can help manage local climate effects.

2015 NYC Citywide GHG Emissions by Sector and Source
https://www.dec.ny.gov/docs/administration_pdf/nycghg.pdf

CLIMATE SCIENCE, URBAN DESIGN & POLICY

Land Surface Temperature Maps

The urban heat island effect refers to the higher temperatures that can be found in city centers, which makes them hotter than surrounding rural areas due to the human-made surfaces, lack of vegetation, and lack of natural land cover. Heat islands are created principally by the use of asphalt or concrete roofs, parking lots, and roads, which absorb sunlight and re-radiate the energy as heat. The images on the previous page and on the left show how the 2019 current scenario could develop by 2050. The colors on the three UHI maps represent the temperature of surfaces – red being the hottest, blue being the coolest.

The maximum temperature represented in the maps (June - August):

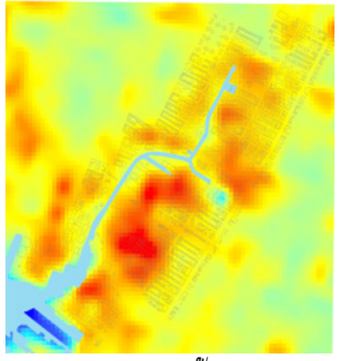
LST Maps

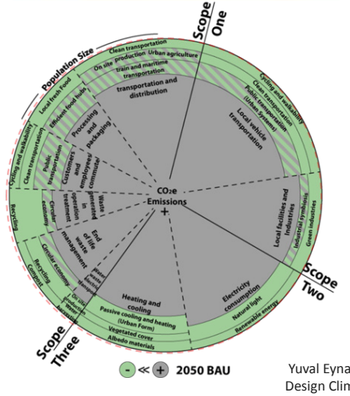
- 2019 UHI: 32°C/ 89.6°F
- 2050 BAU UHI:36°C/ 96.8°F
- 2050 BP UHI: 34°C/ 93.2°F

GHG Diagrams

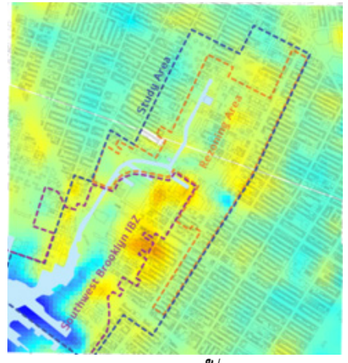
- Circle: Population size
- Green: Activities and strategies
- Grey: Carbon (or C02 equivalency) emissions
- Dashed: Efficient use of carbon (or C02 equivalency)

2050 Business as Usual





2050 Best Practice



Yuval Eynath, NYIT Urban Design Climate Lab, 2019

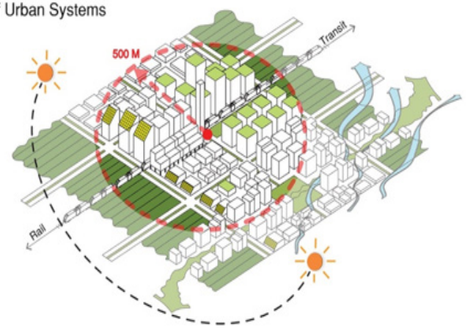
CLIMATE SCIENCE, URBAN DESIGN & POLICY

Urban Climate Factors: Integrated Climate Mitigation and Adaptation

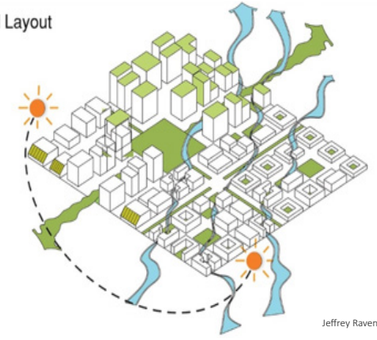
The following strategies facilitate integrated climate mitigation and adaptation in cities:

1. Reducing waste heat and greenhouse gas emissions through energy efficiency, transit access, and walk-ability.
2. Modifying form and layout of buildings and urban districts.

1. Efficiency of Urban Systems



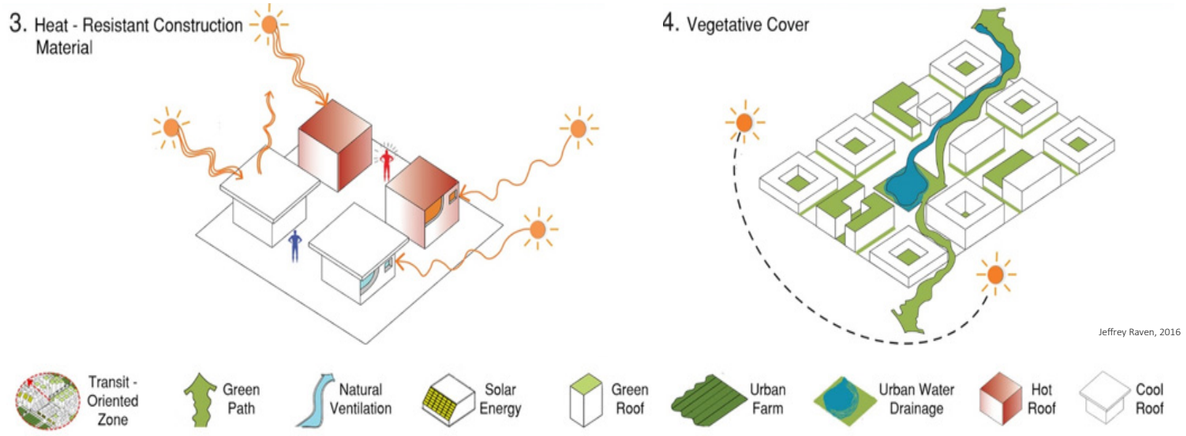
2. Form and Layout

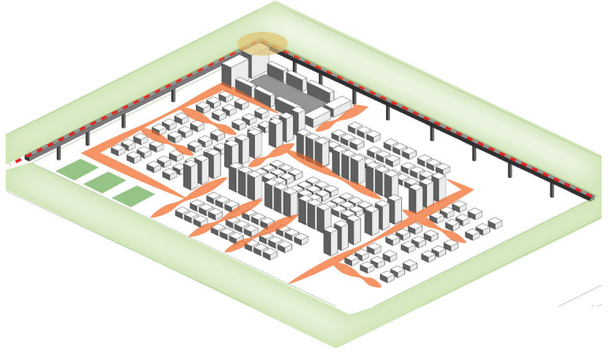


Jeffrey Raven, 2016

Urban Climate Factors: Integrated Climate Mitigation and Adaptation

3. Use of heat-resistant construction materials and reflective surface coatings.
4. Increasing vegetative cover.





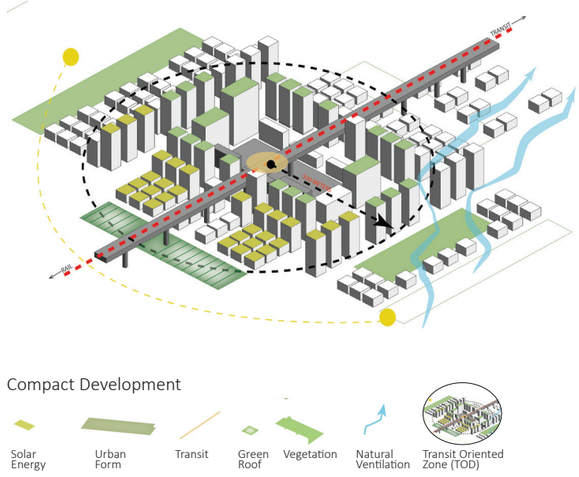
Scattered Development with low efficiency transportation.

NYIT Urban Design Climate Lab, 2019

CLIMATE SCIENCE,
URBAN DESIGN & POLICY

Urban Climate Factors: Efficiency of Urban Systems

Reducing urban waste heat and greenhouse gas emissions from infrastructure – including buildings, transportation, and industry – can be accomplished through improvements in the efficiency of urban systems.

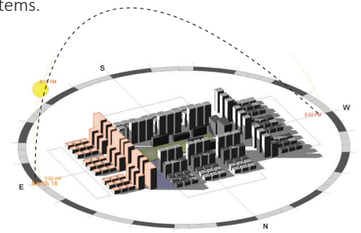


Compact Development

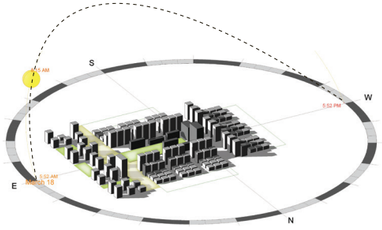
Urban Climate Factors: Form and Layout

Modifying the form and layout of buildings and urban districts can provide cooling and ventilation that reduces energy use and allow citizens to cope with higher temperatures. Varying building heights and adding breaks in the building line to reduce shadowing and increase solar access during cold months as well as maximizing use of cool surfaces and reflective roofs in hot climates improves the efficiency of urban systems.

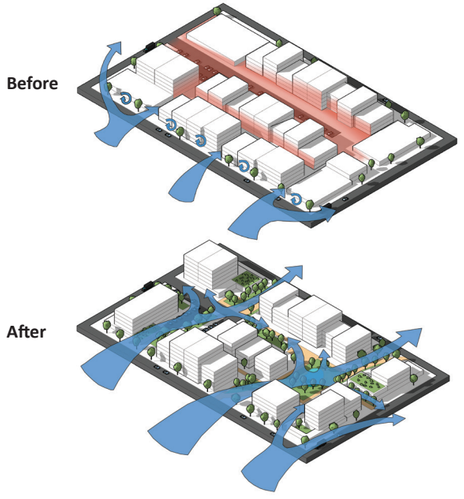
Building form blocks the entry of sunlight to open space.



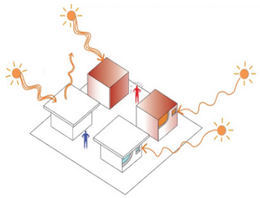
Building form allows the entry of sunlight to open space.

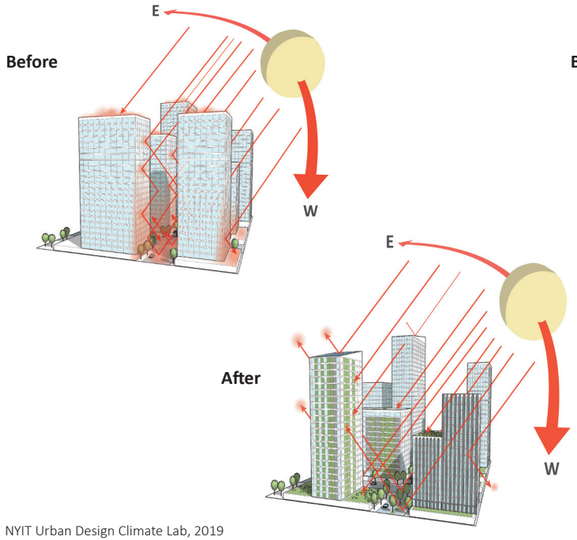


Jeffrey Raven, 2016



NYIT Urban Design Climate Lab, 2019



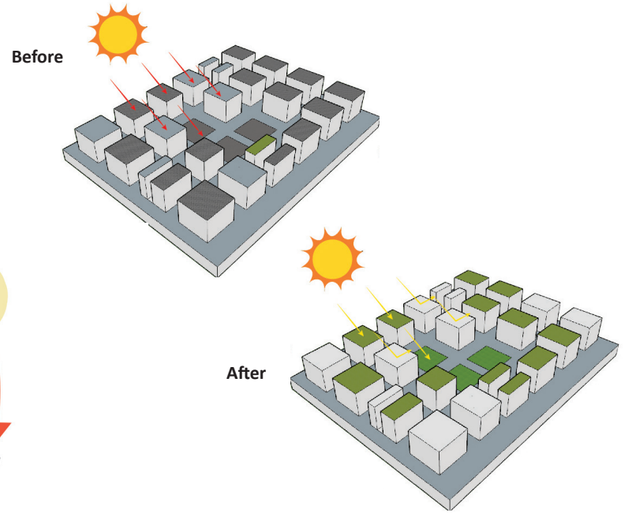


NYIT Urban Design Climate Lab, 2019

CLIMATE SCIENCE,
URBAN DESIGN & POLICY

Urban Climate Factors: Heat Resistant Construction

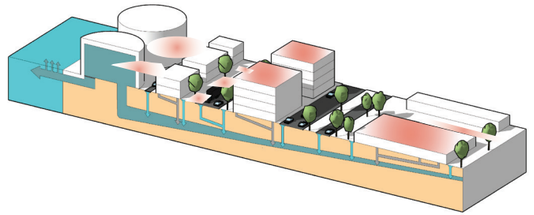
Selecting low-heat capacity construction materials and reflective coatings can improve building performance by regulating heat exchange at the surface to reduce summer heating within the building.



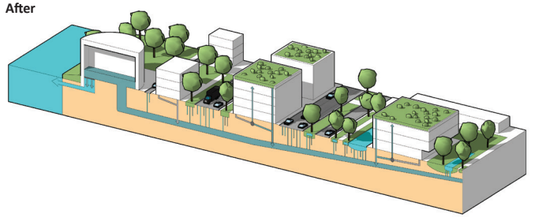
CLIMATE SCIENCE, URBAN DESIGN & POLICY

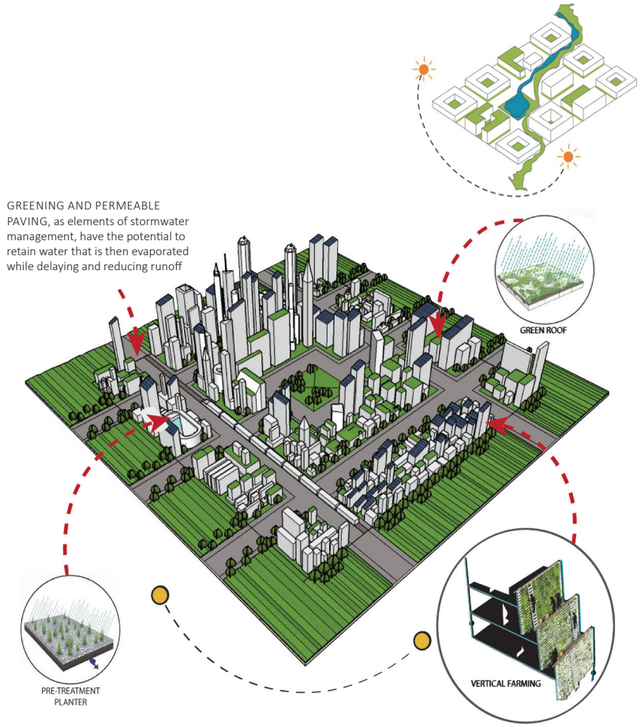
Urban Climate Factors: Vegetative Cover

Before



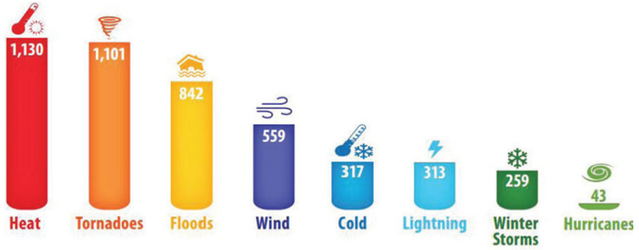
After





NYIT Urban Design Climate Lab, 2019

UHI Public Health Crisis



U.S. Fatalities by Hazard, 2006-2015

NOAA I USEPA I U.S. Global Change Research Program, 2018 https://www.globalchange.gov/

PUBLIC HEALTH

Key Observations and Findings

Gowanus is among the most at-risk communities in New York City to the urban heat island (UHI) effect. As New York City's built environment becomes more dense and the climate continues to change, Gowanus can convert the many challenges it faces into opportunities. How can Gowanus leverage investment in the neighborhood to address UHI at the building level and district scale? How can Gowanus identify funding sources and delivery structures, particularly for UHI vulnerable populations? The Urban Design Climate Workshop taskforce envisioned urban design shaping transformative climate action in the Gowanus district through a value proposition based on positive public health and economic outcomes.

Extreme heat has been the leading weather-related cause of death in the United States for the past few decades. When people are exposed to extreme heat, they can suffer from potentially deadly illnesses such as heat exhaustion and heat stroke. Extreme temperatures can also contribute to deaths from heart attacks, strokes, and other forms of cardiovascular disease.

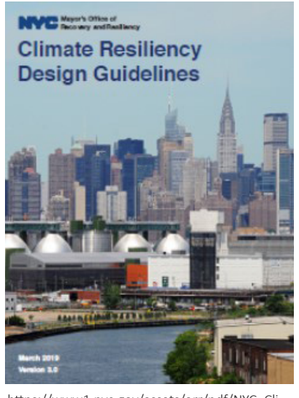
Large urban areas already face challenges related to heat. Surface air temperatures are often higher in urban areas than in surrounding rural areas for a number of reasons, including the concentrated release of heat from buildings, vehicles, and industry. This urban heat island effect is expected to strengthen in the future as the structure, spatial extent, and population density of urban areas continues to change and grow. Deaths associated with extreme heat can be mitigated as communities strengthen their heat response plans and take other steps to further adapt to climate change.

PUBLIC HEALTH

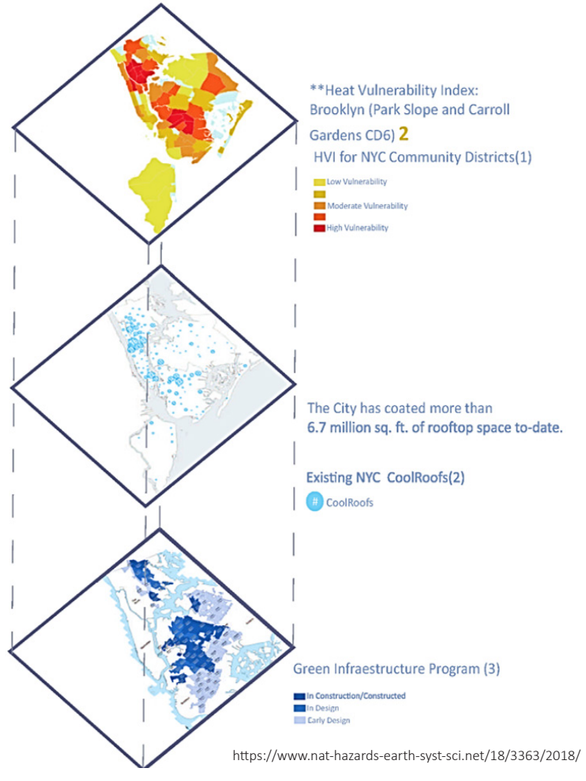
Cool Neighborhoods NYC

As a part of multiple heat adaptation strategies, NYC is collecting "baseline neighborhood-level temperature information … to provide baseline data to accurately measure the impact of interventions … to identify operational and policy strategies that address and adapt NYC to the increasing effects of UHI effect and extreme heat." Projects sited in moderate to high vulnerable areas should implement multiple strategies to reduce UHI.

https://www1.nyc.gov/assets/orr/pdf/Cool_Neighborhoods_NYC_Report.pdf

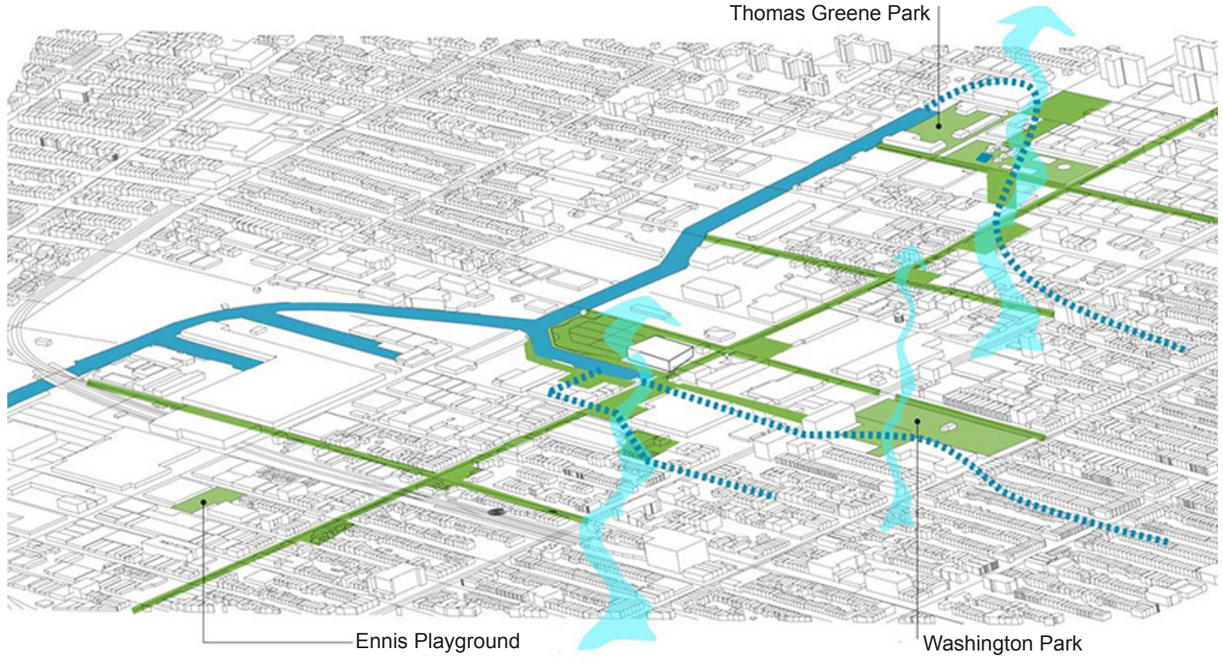


https://www1.nyc.gov/assets/orr/pdf/NYC_Climate_Resiliency_Design_Guidelines_v3-0.pdf



https://www.nat-hazards-earth-syst-sci.net/18/3363/2018/

ULI TECHNICAL ASSISTANCE PANEL (APRIL 2017)



Concept Plan, 2017 ULI Gowanus TAP, Anna (Shenger) Dai, NYIT Urban Design Climate Lab, 2017

ULI TECHNICAL ASSISTANCE PANEL (APRIL 2017)

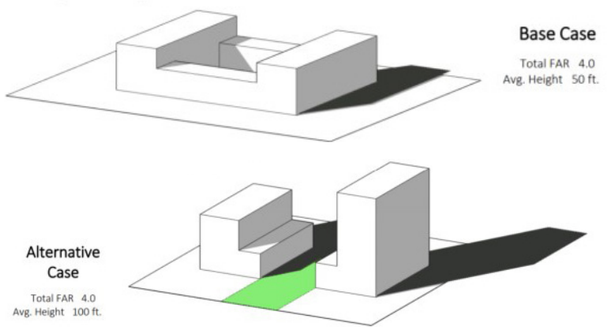
ULI Technical Assistance Panels (TAPs) are intensive, on-site engagements conducted by career professionals who serve as volunteer panelists. The panelists deliver expert, multi-disciplinary advice to local governments, public agencies, and non-profit organizations facing complex land use and real estate issues throughout New York State. The 2017 ULI Gowanus TAP partnered with the Brooklyn-based non-profit and advocacy organization, Fifth Avenue Committee (FAC). As the sponsor, FAC asked ULI New York to answer a series of questions related to urban heat island mitigation strategies in the context of the anticipated rezoning of Gowanus as well as the anticipated partial closure of Thomas Greene Park due to the CSO retention tank siting and Gowanus Canal Super-fund site cleanup.

The 2017 TAP acknowledged that the anticipated Gowanus rezoning will likely create greater density in the neighborhood, particularly for residential uses. The panel identified urban heat deserts throughout the study area – all of which lack vegetative cover. As a mitigation strategy, the panel recommended strategies that increase vegetative coverage wherever possible and leverage the network of hidden creeks in Gowanus and the prevailing summer winds to create 'paths of respite' throughout the study area.

The paths of respite are created by enhancing Thomas Greene Park and connecting the park to the canal, opening up the area to prevailing winds for cooling, creating a vegetated connection from Washington Park to the canal and adding vegetative covering to walls, and enhancing green infrastructure along the 3rd Avenue Corridor (see concept plan on page 23).

Many of the TAP recommendations for UHI mitigation would require site-specific incentives, policies, or bonuses. The TAP recommended climate zoning overlays to respond to site-specific needs with incentives or requirements related to building massing. As an illustration, the diagram to the right demonstrates how two buildings with identical building bulk floor-area-ratio (FAR) can address UHI mitigation strategies by creating on-site strategic open spaces in concert with greater building heights.

Site Specific Bonus and Building Massing



Urban Design Climate Lab, 2019

Read the full Gowanus TAP Report https://newyork.uli.org/get-involved/taps/

NYIT Urban Design Climate Lab presentation to The Municipal Art Society of New York (Spring 2019)

PLANNING & DESIGN PROCESS

Urban Design Climate Lab
NYIT Graduate Urban Design Program

The NYIT Urban Design Climate Lab is part of the NYIT Graduate Program in Urban + Regional Design (MSAURD); School of Architecture & Design. This Lab envisions urban design shaping transformative climate action in cities. It focuses on the role of urban design in greenhouse gas emission mitigation, urban heat stress adaptation, and resiliency. The NYIT Lab was taught by Jeffrey Raven and Michael Esposito (Elementa Engineering).

From February through March 2019, the graduate urban design students undertook a comprehensive climate-driven urban design process for a future district base upon "best practice" climate strategies. On a parallel pedagogical track and at key milestones during the UDCW process, draft urban design outcomes were reviewed by an invited design jury and included a presentation to the advocacy organization The Municipal Art Society of New York.

The graduate students developed quantitative and qualitative design interventions at a district scale with building massing, urban ventilation, solar impacts, green infrastructure, and anthropogenic factors shaping their urban design outcomes.

The Gowanus Urban Design Climate Workshop team was led by Jeffrey Raven and Michael Esposito with additional assistance from Dr. Christian Braneon (Goddard Institute for Space Studies at Columbia University) and Luciana Barreto Nogueira Godinho, a recent graduate of the MSAURD Urban Design program.

PLANNING & DESIGN PROCESS

Urban Design Climate Lab

Phase 1 (April 2019): ULI convened a taskforce including certain real estate, design, and planning professionals who participated in a 2017 Gowanus Technical Assistance Panel (TAP), members of ULI New York's TAP Steering Committee, and the Gowanus TAP Sponsor, the Fifth Avenue Committee (FAC). This ULI taskforce identified the GDCW project scope, study zone, and preliminary urban design interventions. Using the resulting scope, the NYIT-UCCRN team refined its approach and began its technical modeling process.

Phase 2 (May 2019): The Gowanus UDCW taskforce and invited representatives from the Gowanus Canal Conservancy reviewed and discussed the draft technical modeling and suggested revisions to the neighborhood population projections and proposed urban design intervention prototypes.

Phase 3 (June 2019): In partnership with the Gowanus Neighborhood Coalition for Justice, ULI hosted a two-day workshop in Gowanus to present the research, technical modeling, and recommendations that stemmed from the first two phases. These sessions facilitated an open dialogue between the local community, city officials, and ULI members around issues related to land use, urban heat, public health, and climate adaptation and mitigation.

ULI Task Force Session 1 (April 2019)

ULI Task Force Session 2 (May 2019)

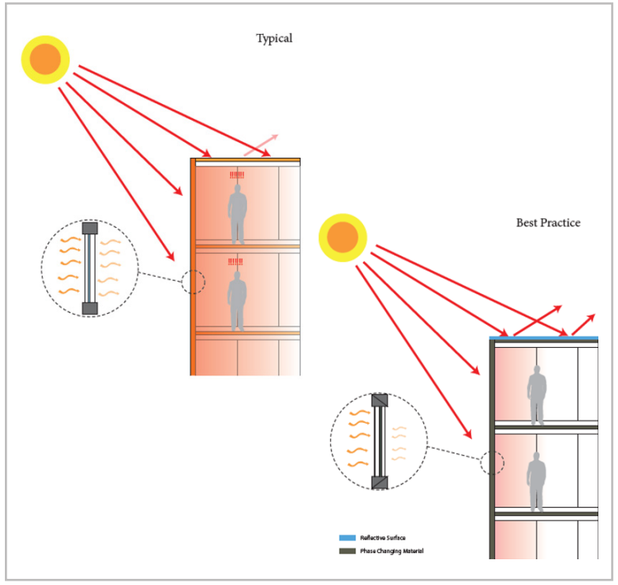
Workshop, Day 1 with Local Community Members (June 2019)

Workshop, Day 2 with Policy Makers (June 2019)

IMPLEMENTATION PROCESS

Phasing: Short Term

Heat Resistant Construction



NYIT Urban Design Climate Lab, 2019

The UDCW developed a recommended pathway to achieve the best practice climate mitigation and adaptation strategies through short, medium, and long term phasing. The recommended strategies in their respective phases are as follows:

Short Term

- Cool roofing
- Heat-resistant construction materials

Medium Term

- Decreased vehicle emissions and traffic
- Increased non-motorized bike and pedestrian accessibility
- Smart drainage system
- Green roofs or green facades
- Include urban heat island consideration in environmental impact statements (EIS)

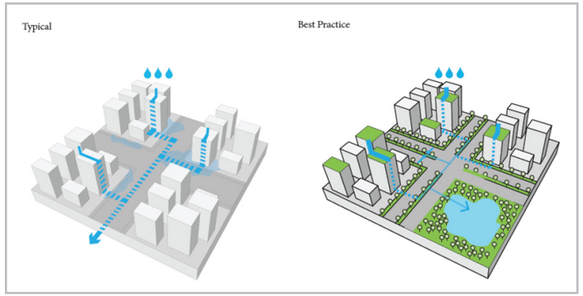
Long Term

- District energy
- Increased sky-view factor through transfer of development rights (TDR)
- Smart orientation of buildings considering sun path and wind direction
- Diversity of building forms
- Linear parks

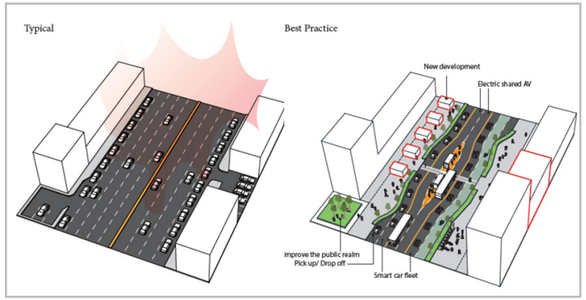
IMPLEMENTATION PROCESS

Phasing: Medium Term

Vegetative Cover

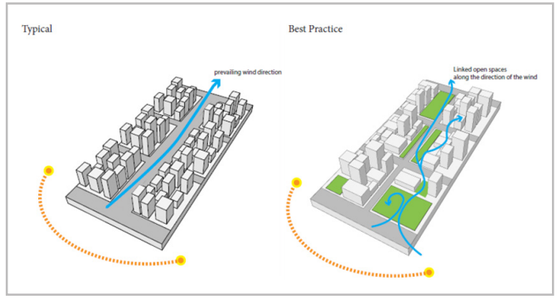


Efficiency of Urban System

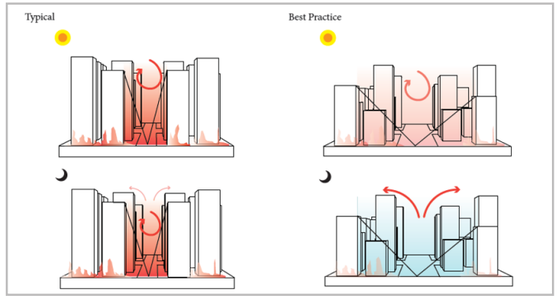


Phasing: Long Term

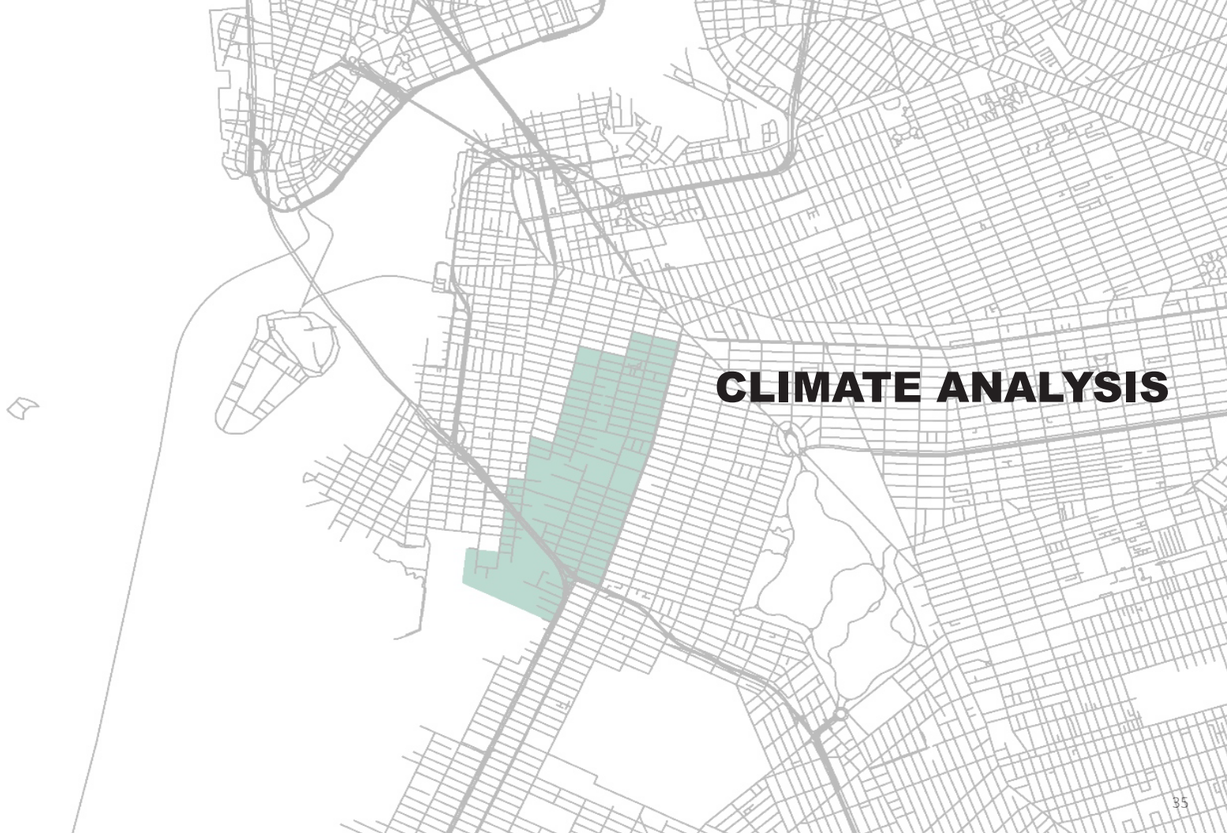
Form and Layout



Form and Layout



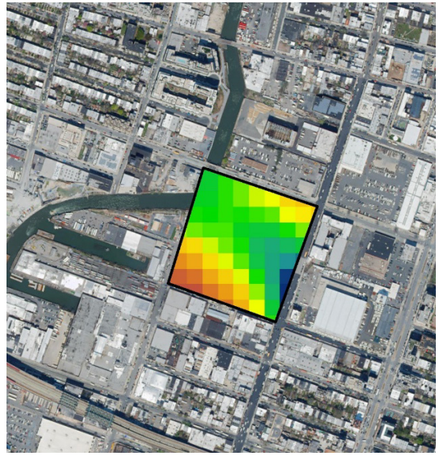
NYIT Urban Design Climate Lab, 2019



CLIMATE ANALYSIS

Mapping Urban "Hot Spots" in Gowanus

Remote sensing allows for satellites to collect information from a distance using electromagnetic energy. Passive remote sensors can detect and record an external energy source, such as the energy that is radiated from the Earth. Landsat satellite imagery provides the longest continuous space-based record of Earth's land in existence. Landsat 8 was launched in 2013 as part of the Landsat program run by NASA and the U.S. Geological Survey (USGS). The satellite has a 16-day revisit cycle and global coverage. Through thermal mapping, Landsat allows for estimates of relative land surface temperature that can be utilized to identify the hottest parts of the city and target site interventions that support extreme heat mitigation.



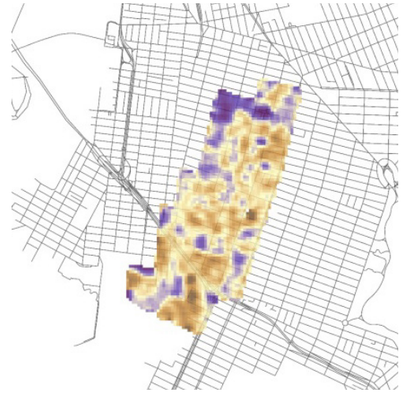
Whole Foods Market site at 3rd Avenue and 3rd Street (Gowanus, Brooklyn)

NOAA l USEPA l U.S. Global Change Research Program, 2018 Climate Science Special Report, Chapter 10

LANDSAT SATELLITE IMAGERY

Climate Analysis Mapping

Normalized Difference Vegetation Index (NDVI) quantifies vegetation land cover



Normalized Difference Built-up Index (NDBI) is a measure of the intensity of built environment (i.e. human-made materials, impervious surface, etc)

Land Surface Temperature (LST) is the radiative skin temperature of the land surface, as measured in the direction of the remote sensor

http://landsat.gsfc.nasa.gov l "Measuring Vegetation (NDVI & EVI)," NASA, https://earthobservatory.nasa.gov/features/Measuring Vegetation/measuring_vegetation_2.php l Dwyer, J.L., Roy, D.P., Sauer, B., Jenkerson, C.B., Zhang, H., and Lymburner, L., 2018, Analysis ready data—Enabling analysis of the Landsat archive: Remote Sensing, v. 10, no. 9, art. no. 1363. doi.org/10.3390/rs10091363

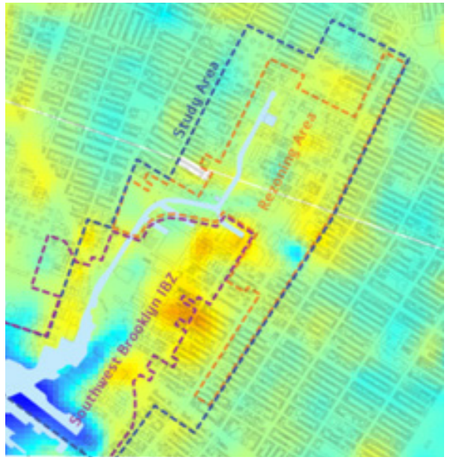
LAND SURFACE TEMPERATURE (LST)

Data Sources
For the Gowanus UDCW, data from NASA's Landsat 5, 7, and 8 satellites containing passive sensors were used. In addition, data from the European Union's Copernicus Sentinel-2 mission and NASA's Landsat Analysis Ready dataset were utilized. The USGS Earth Explorer tool was used to identify and download summertime (June, July, August) imagery for New York City from 1984 to present.

Interpreting Data
The normalized difference built-up index (NDBI) is a measure of the intensity of built environment, i.e. human-made materials, impervious surface, etc., correlated with land surface temperature (LST) in urban environments. For the Gowanus UDCW, Landsat 5 imagery was analyzed to derive historic relationships between NDBI and LST to project future LST distributions.

Mapping Results
The 2019 distribution of summer land surface temperature for Gowanus is shown at right with boundaries for the study area as well as the rezoning and Brooklyn IBZ areas noted. Hot spots exhibiting elevated land surface temperature can also be seen on this map. NASA satellite imagery from Landsat 8 was used to characterize the current distribution of urban heat in Gowanus and establish a baseline for the development of potential 2050 development scenarios, i.e. 2050 Business-as-Usual and 2050 Best Practices. Historic relationships between NDBI and LST were used to project future extreme heat conditions and growth of existing hot spots. New hot spots are also projected to emerge under the 2050 Business-as-Usual development scenario. The projected 2050 distribution of summer land surface temperature for Gowanus is shown on the following page.

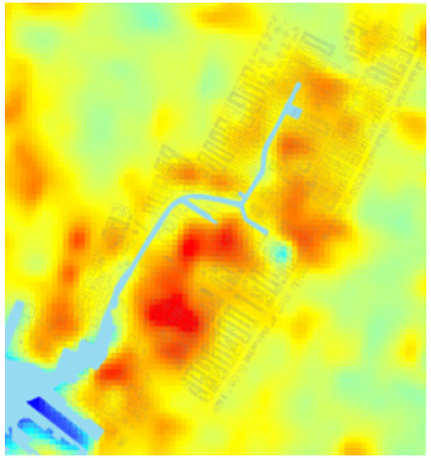
2019 Urban Heat Imagery



Land Surface Temperature (LST) 2019

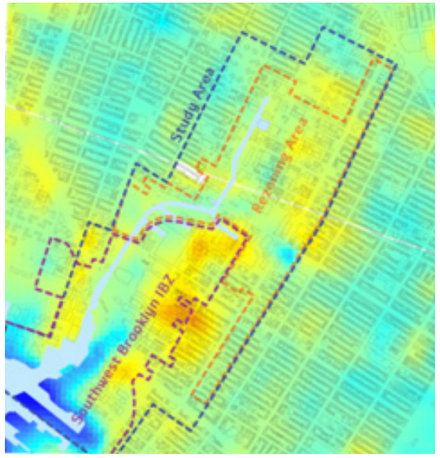
LAND SURFACE TEMPERATURE (LST)

2050 Business as Usual (BAU)



Worst Case Scenario LST 2050
Scenario based on typical "market-driven" development patterns

2050 Best Practice (BP)



Best Practice Scenario LST 2050
Scenario based on climate adaptive development, considering the four climate factors

Remote Sensing

Land surface temperatures (LST) estimates are valuable for identifying hot spots and evaluating urban design interventions because air temperature observation stations are often sparsely distributed and typically do not provide sufficient coverage for thorough analysis across an urban area. LST trends and parameters such as normalized difference vegetation index (NDVI) and normalized difference built-up index (NDBI) are used to project future extreme heat scenarios.

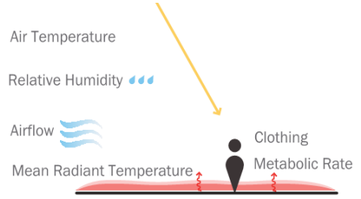
"Using the USGS Landsat Level-1 Data Product," USGS, https://landsat.usgs.gov/using-usgs-landsat-8-product. https://doi.org/10.3390/rs8110952

UNIVERSAL THERMAL CLIMATE INDEX (UTCI)

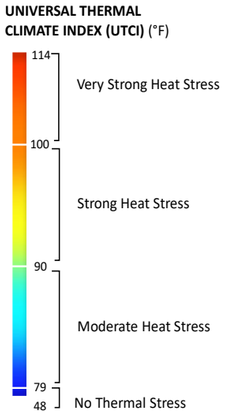
Universal Thermal Climate Index (UTCI) is a comprehensive measure of outdoor thermal comfort that accounts for a broad range of environmental factors including air temperature, mean radiant temperature (including land surface temperatures), relative humidity, and wind speed. UTCI uses these variables as inputs in a human heat balance model to determine the level of thermal stress a person may experience with extended exposure. Weather forecasters describe the UTCI as the "feels like" temperature or the "perceived temperature."

The scenarios on this and the following page illustrate the importance of looking at thermal comfort within the urban environment using a comprehensive index such as UTCI. Even though the air temperature in both cases is 90°F, a person standing on a dark surface in the sun may experience strong heat stress while a person in the shade experiences only moderate heat stress.

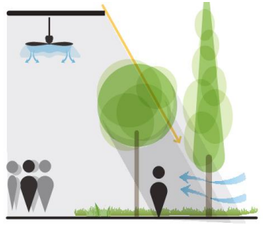
UTCI of a Person in the Sun



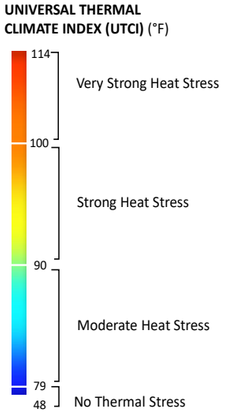
UTCI: 37.7 ° Celsius (99 ° F) "Feels Like" Temperature



UTCI of a Person in the Shade



UTCI: 31.2 ° Celsius (88 ° F) "Feels Like" Temperature



Michael Esposito, NYIT Graduate Faculty Senior Building Analyst, Elementa Engineering, 2019

UNIVERSAL THERMAL CLIMATE INDEX (UTCI)

Through best practice urban design and planning choices, designers have the ability to impact the mean radiant temperature, air temperature, and wind speed experienced by city dwellers. By using off-the-shelf (and free) analysis tools such as Energy Plus, Open FOAM CFD, and Radiance it is possible to simulate the potential impact of design strategies on urban micro-climates and UTCI well before a project is built. In doing so, simulation of UTCI can be used to help inform the selection of outdoor comfort design strategies, some of which are listed below, and assess the relative risk of heat stress under current and future climate scenarios.

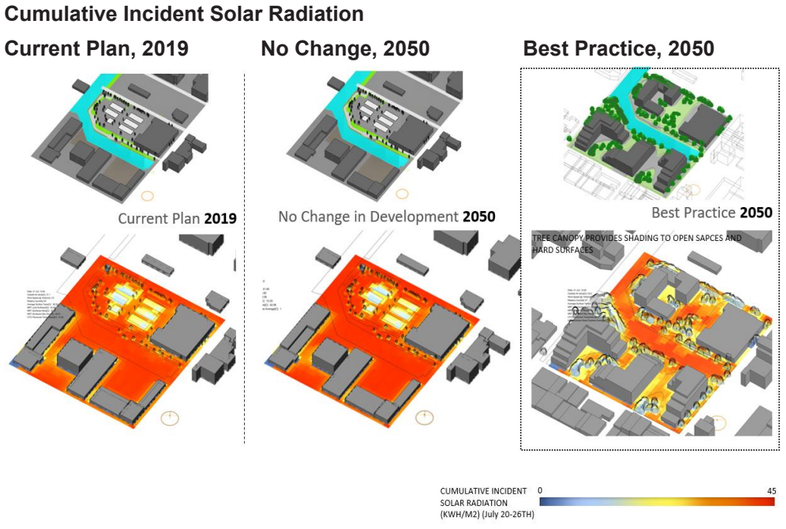
Potential Outdoor Comfort Design Strategies:

- Preserve access to wind (ventilation corridors)
- Provide shaded public spaces, streets, and sidewalks (tree canopy, reflective umbrellas, PV canopies, etc.)
- Minimize hard scape and maximize dense vegetative coverage
- Use light-colored, reflective roofs
- Consider evaporative cooling and night-sky radiant cooling in public spaces
- Use heat-resistant building constructions and shaded thermal mass

As part of the UDCW research into climate-resilient planning for Gowanus, an analysis of an urban micro-climate was conducted for a representative site within the study area. The purpose of this analysis was to demonstrate the potential impact of design strategies and a warming future climate on UTCI within Gowanus. Simulated environmental parameters included solar radiation, surface temperatures, and spatial mean radiant temperatures. Air temperatures and wind speed measurements were taken directly from a typical meteorological year (TMY) dataset for both the present day and future 2050 climate scenarios. This simplified, yet sophisticated approach to urban UTCI modeling allows for simulation of multiple design iterations or future climate scenarios in a relatively short amount of time.

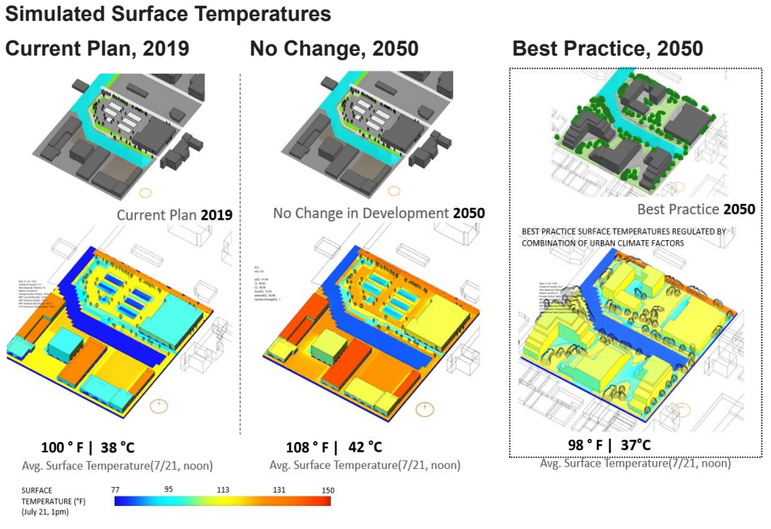
The following comparative analysis evaluates UTCI and the environmental factors contributing to it for three different cases: current neighborhood with present day weather trends; current neighborhood with future weather projections; and a "best practice" neighborhood design with future weather projections. The analysis was run over an extremely hot week, and images at right show incident solar radiation from July 20-26, 2019.

Cumulative Incident Solar Radiation



Michael Esposito, NYIT Graduate Faculty Senior Building Analyst, Elementa Engineering, 2019

Simulated Surface Temperatures



Michael Esposito, NYIT Graduate Faculty Senior Building Analyst, Elementa Engineering, 2019

Urban surface temperatures can vary significantly across a neighborhood block depending on the absence or presence of solar radiation, shading, vegetation, and large water features, as well as the solar and thermal properties of roof, wall, and paving materials. The images at left show simulated surface temperatures on July 21st at noon for the three cases described previously. Note that the outside air temperature is 90°F for the 2019 scenario and 95°F in the 2050 scenario.

- **Current Plan (2019 climate)**: Surface temperatures vary between approximately 70-130°F. The relatively high average surface temperature across the site can be attributed to a large amount of dark paved surfaces, which absorb solar radiation.
- **No Change (2050)**: If the neighborhood remains unchanged but air temperatures increase in magnitude and frequency, the average surface temperature could increase by approximately 8°F.
- **Best Practice (2050)**: Use of light, reflective roofing materials and placement of mature vegetation and trees in areas of the site receiving the greatest solar radiation during the summer has the potential to keep surface temperatures cooler than the current plan at present, despite increased density of buildings and warmer air temperatures.


STUDY AREA
ANALYSIS

FLOOD MAP

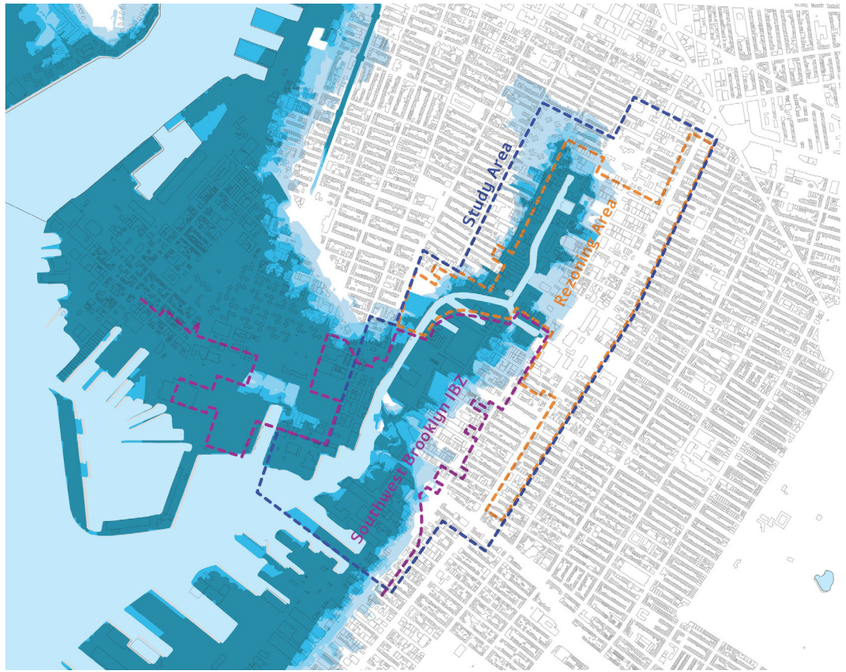
Predicted Scenarios

The analysis of flood lines comes from the mixing of the projections provided by FEMA.

The FEMA Flood Map Service Center (MSC) is the official public source for flood hazard information produced in support of the National Flood Insurance Program (NFIP).

The overlapping flood zones illustrate future flood projections for Gowanus based on recent events and climate models. The natural floodplain, which includes all of FEMA's projections and Hurricane Sandy's inundation zone, was included as part of the research base and analysis to develop the 2050 BAU and 2050 BP scenarios.

Flood Map Depicting the Range of Flood Plains

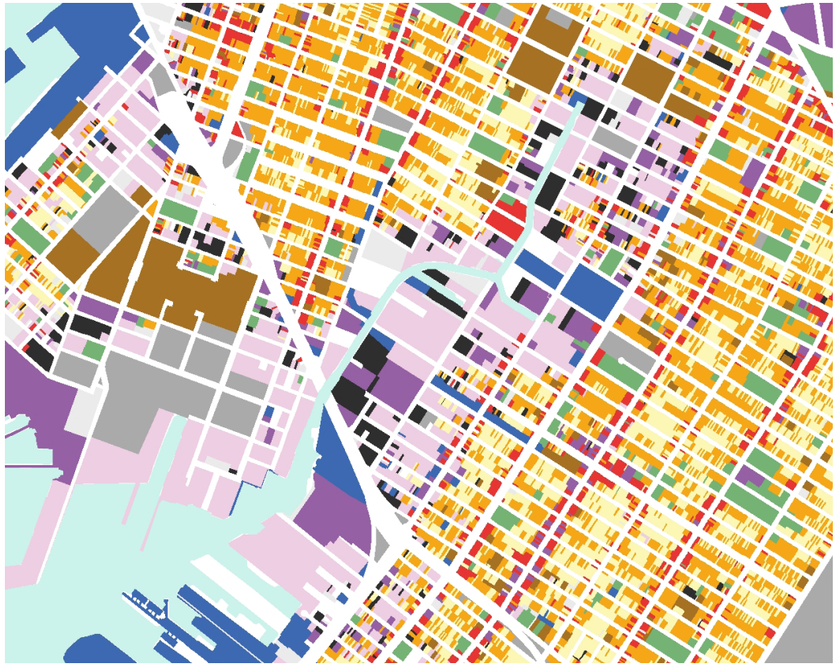


- Sandy Inundation Zone
- FEMA's 2020's 100-year Floodplain
- FEMA's 2050's 100-year Floodplain
- FEMA's 2050's 500-year Floodplain

National Flood Insurance Program (NFIP)

LAND USE

Land Use Map



Existing 2019

- One & Two Family Buildings
- MultiFamily Walkup Buildings
- MultiFamily Elevator Buildings
- Mixed Commercial/Residential Buildings
- Commercial/Office Buildings
- Industrial/Manufacturing
- Transportation/Utility
- Public Facilities & Institutions
- Open Space
- Parking Facilities
- Vacant Land
- All others or No Data

NYC Department of City Planning

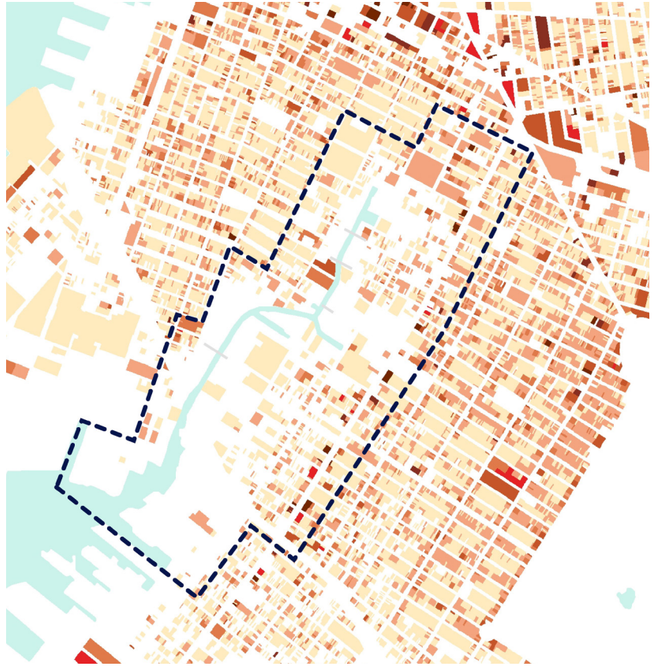
DENSITY

Allowed Floor Area Ratio (FAR)

The floor area ratio (FAR) is the relationship between the total amount of usable floor area that a building has or has been permitted to have and the total area of the lot on which the building stands. The ratio is determined by dividing the total or gross floor area of the building by the gross area of the lot. A higher ratio is more likely to indicate a dense or urban construction.

The current FAR throughout Gowanus shows most building heights below five floors.

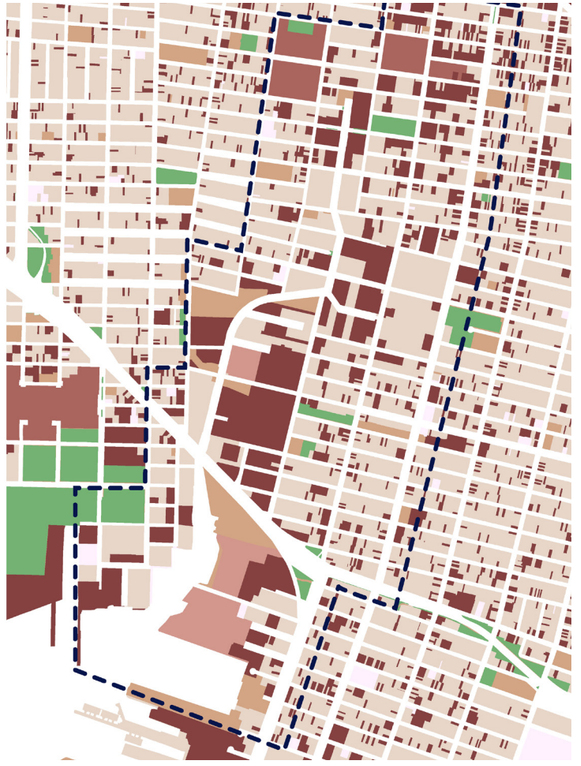
Allowable Floor Area Ratio Map



NYC Department of City Planning

OWNERSHIP

Building Ownership Map



NYC Department of City Planning

OWNERSHIP

Notable Buildings

Gowanus is home to a number of notable historic buildings and structures of historical significance.

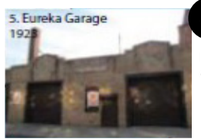
1 R.G. Dun and Company, 1914

4 Brooklyn News, 1919

7 Carrol Street Bridge, 1889

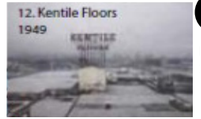
11 American Can Factory, 1886

2 ASPCA Building, 1913



5 Eureka Garage, 1923

8 BRT Central Power Station Engine House, 1901-04



12 Kentile Floors, 1949

3 Flushing Tunnel Pump Station, 1911

6 National Packing Box Factory, 1922

9 New York Vitrified Tile Workshop, 1934

13 Roulston Grocery Complex, 1904

10 Coignet Stone Building, 1872

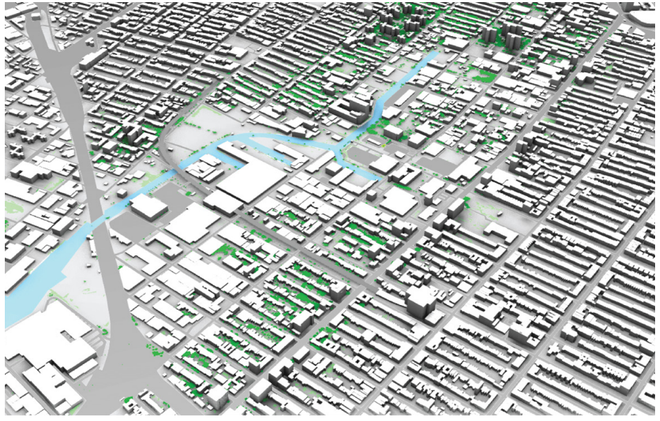
14 The S.W. Browne Grain Storage, 1886

POPULATION DENSITY: 2019

The 617-acre Gowanus UDCW study area is comprised of mostly low-rise industrial and commercial buildings.

- The few residential areas can be found in the site's northern and western edges and are comprised of 23,320 units (the rezoning area, excluding those edges, only contains 5,858 residences).
- The New York City Housing Authority (NYCHA) complex is in the northern section of the study area.
- The study area site has a density of as low as 33.9 people per acre while the New York City average is 42.2 people per acre.
- The underdeveloped sites are comprised of parking lots and empty and/or underdeveloped lots, particularly along the Canal's edges.

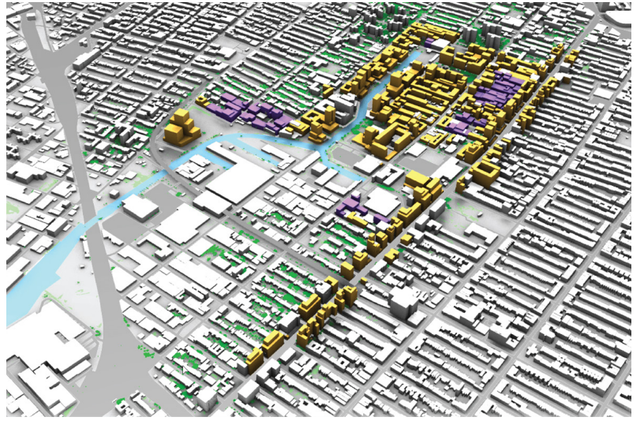
All calculations were taken from the Gowanus Neighborhood Rezoning and Related Actions Draft Scope of Work.



	Total Area		Current 2019			Addition		Total 2050		
	km2	acre	Res. Floor Sqm	ppl	Dens. ppl/acre	Res. Floor Sqm	ppl	ppl	Res. Floor Sqm	dens
Rezoning area	0.7	171	229,620	5858	20.1	1256601	33,590	39,448	1,297,648	
Active Permits			-	-		90,281	2295	2295	90281	
Study area	1.8	446	-	17,462	39.15	1758402	6599	24061		
Total	**2.5**	**617**		23,320	**33.9**	**1690760**	**42484**	65,804		

NYC Department of City Planning https://popfactfinder.planning.nyc.gov

POPULATION DENSITY: 2050 SCENARIO



The 2050 "business-as-usual" population scenario is a hypothetical scenario based on the proposed NYC Department of City Planning (NYCDCP) Rezoning Plan and "market driven" full build-out assumptions. For this scenario, each building lot was built-out to its fully allowed maximum FAR per the Rezoning Plan.

Based on this maximum allowable buildout, the residential square footage was calculated to achieve a total population projection. Based upon this scenario, the NYCDCP Rezoning Plan could allow an additional population of 33,590 people by 2050.

For areas within the UDCW study area, yet outside of the NYCDCP Rezoning Area, a digital mapping analysis identified lots with unused FAR that have development potential. In addition, the proposed local plan to infill development around the NYCHA complex was added to the scenario.

To summarize the scenario, a population increase of 42,484 people could be allowed via the rezoning by 2050 for a total population of 65,804. This growth would represent a density of 106 people per acre.

	Total Area		Current 2019			Addition		Total 2050		
	km2	acre	Res. Floor Sqm	ppl	Dens. ppl/acre	Res. Floor Sqm	ppl	ppl	Res. Floor Sqm	dens
Rezoning area	0.7	171	229,620	5858	20.1	1256601	33,590	39,448	1,297,648	
Active Permits			-	-		90,281	2295	2295	90281	
Study area	1.8	446	-	17,462	39.15	1758402	6599	24061		
Total	**2.5**	**617**		**23320**	**33.9**	**1690760**	**42484**	**65,804**		

https://www1.nyc.gov/assets/planning/download/pdf/applicants/env-review/gowanus/gowanus-draft-scope-work.pdf?r=1

LAND USE INVENTORY: 2050 SCENARIO

The land use inventory diagram on the opposity page provides a summary of the land use capacity within the district boundary area.

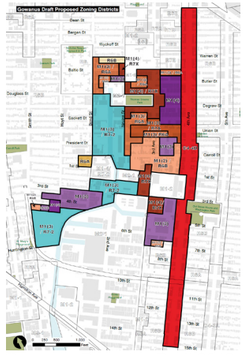
Based on the 2050 population projections, the land use demands were analyzed to quantify the amount of land that will be needed for each of the land uses:

- Residential – according to the population assumptions.
- Industrial – keeping the industrial land use quantity in order to achieve a live-work mixed-use district.
- Green spaces – using the NYC Open Space Index with an additional assumed 10% (to both public and private open spaces) to allow effective climate mitigation.
- Commercial – as recommended in the NYC "Planning for Retail Diversity" corresponding to the 2050 population.
- Civic – according to principle building activity averages in the US and with calculated school seats demand translated into school floor area.
- Initial result: the land use inventory shows that a minimum of 4 residential (3 full residential and 1 partial ground floor) floors are required in order to populate the site with the 2050 projections.

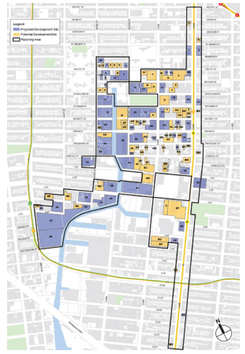
	Total Area		Current Population 2019 [1]			Addition		Total 2050		
Rezoning area	km2	acre	Res. Floor Sqm	ppl	Dens. ppl/acre	Res. Floor Sqm	ppl	ppl	Res. Floor Sqm	dens
Projected 2035			66392	1788		648750	17,985	19,773	715,143	
Rezoning area	0.7	171	229,620 [2]	5858	34.2	1256601 [3]	34,339 [4]	40,197	1,297,648	200.1
Active Permits [5]			-	-		90,281	2295	2295	90281	
Study area [6]	1.8	446	-	11,604	26	-	1358 [7]	12961		29.1
SW Brooklyn [8]										
Total	2.5	617		17462	33.9	1346882	37992	55,453		89.8 [9]

https://popfactfinder.planning.nyc.gov

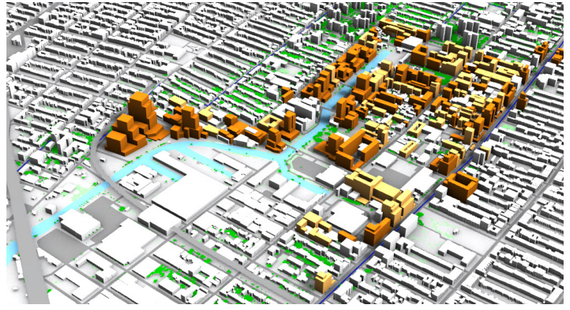
Methodology, 2050 Prediction



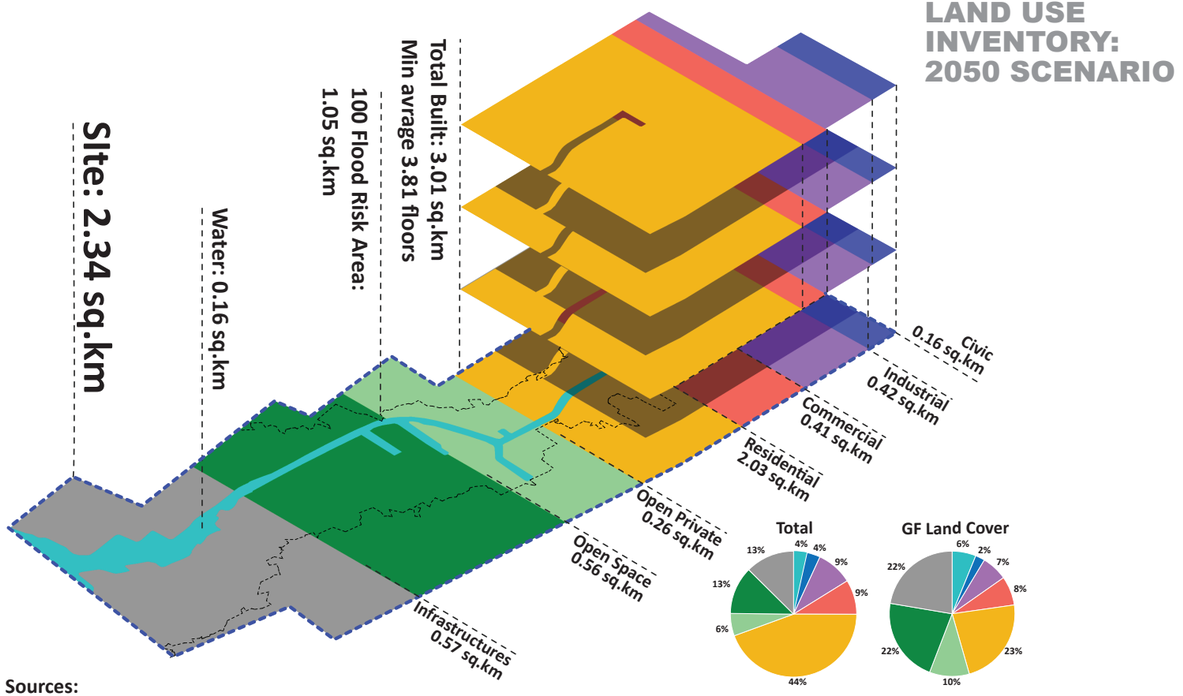
Gowanus Rezoning Draft 2019



Projected Development 2035



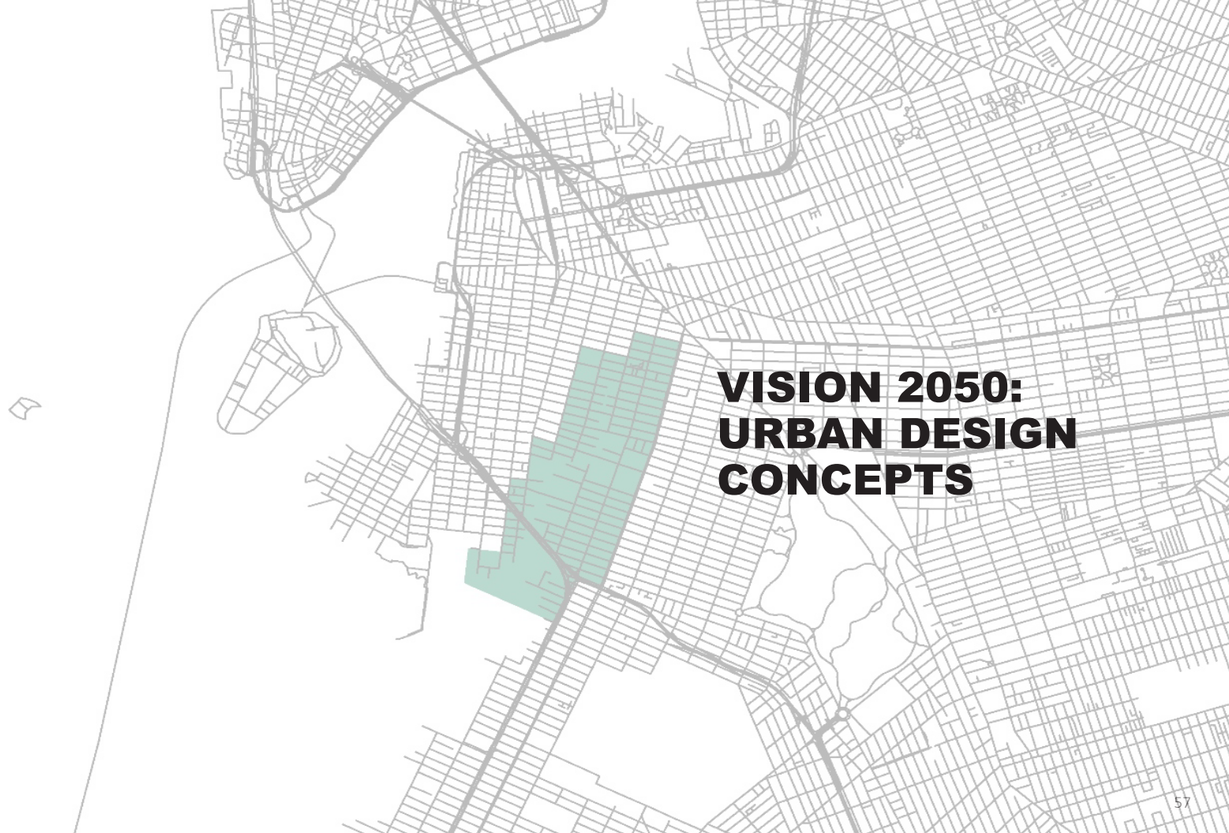
2050 Baseline (Business as Usual): Hypothetical scenario based on NYC DCP Rezoning Plan and "market driven" full build-out assumptions



Sources:

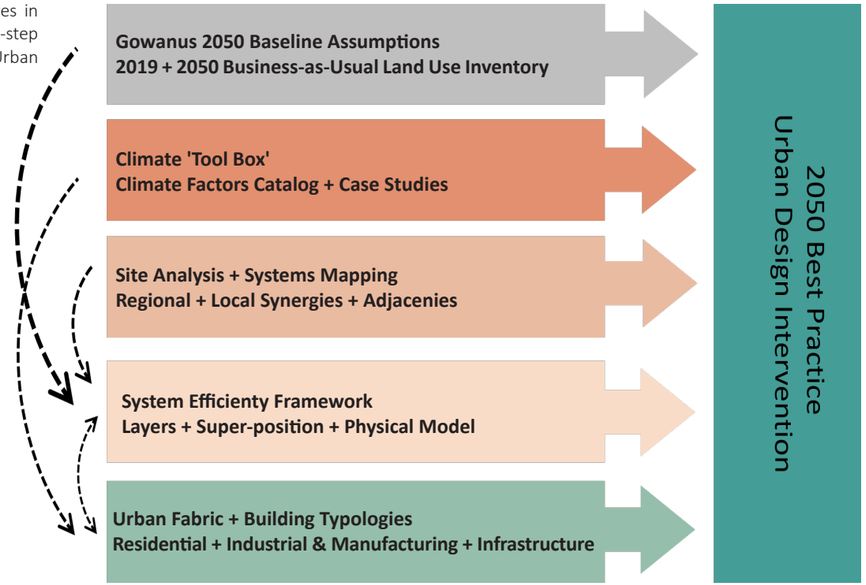
NYC Planning for Retail Diversity http://council.nyc.gov/land-use/wp-content/uploads/sites/53/2017/12/NYC-Council-Planning-For-Retail-Diversity.pdf
US EIA total and means of floorspace https://www.eia.gov/consumption/commercial/data/2012/bc/cfm/b1.php
NYC Open Space Index http://www.ny4p.org/client-uploads/pdf/OSI/NY4P_Open_Space_Index.pdf
https://www1.nyc.gov/assets/planning/download/pdf/applicants/env-review/gowanus/gowanus-draft-scope-work.pdf?r=1

VISION 2050: URBAN DESIGN CONCEPTS



URBAN DESIGN PROCESS

The urban design process and concept images in this section were conceived through a multi-step process by the graduate students of the NYIT Urban Design Program.



NYIT Urban Design Climate Lab, 2019

PROTOTYPIC CONCEPT PLAN

District Connection

The following concept diagrams and plans were created by NYIT graduate urban design students. Their approach, and the strategies listed below, are based upon the foundational four Urban Climate Factors described earlier in this report.

(1) Efficiency of urban systems: reducing greenhouse gas emissions and capturing waste heat through clean grid powering mixed-use residential/commercial/manufacturing zone; on-site energy generation, energy storage, waste to energy, energy transfer between sub-districts; and inter-modal transit node linked to multi-modal electric freight and passenger mobility within district, city, and region.

(2) Modifying form and layout of district: buildings and blocks to exploit prevailing summer breezes; orient buildings and pedestrian pathways according to the sun path; and varied building forms encourage surfaces roughness for summer wind flow.

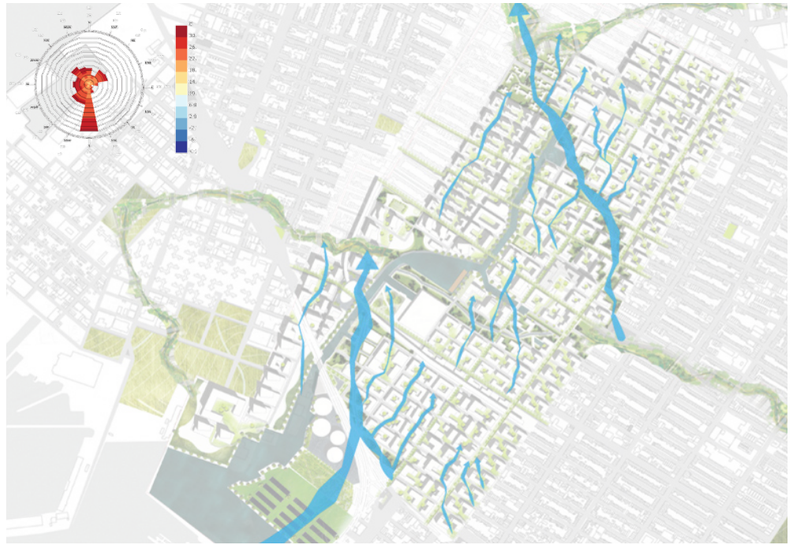
(3) Efficient construction materials and reflective surface coatings: high-albedo materials and minimizing paving to reduce heat.

(4) Green "Sponge City" strategies to integrate UHI and flood mitigation: connected green infrastructure corridors aligned with summer breezes and increased vegetative and tree canopy cover to 30% of district to maximize shading and evaporative cooling.

PROTOTYPIC CONCEPT PLAN

Wind Alignment

By modifying the form and layout of buildings in the district, the area can begin to more fully benefit from prevailing summer breezes.

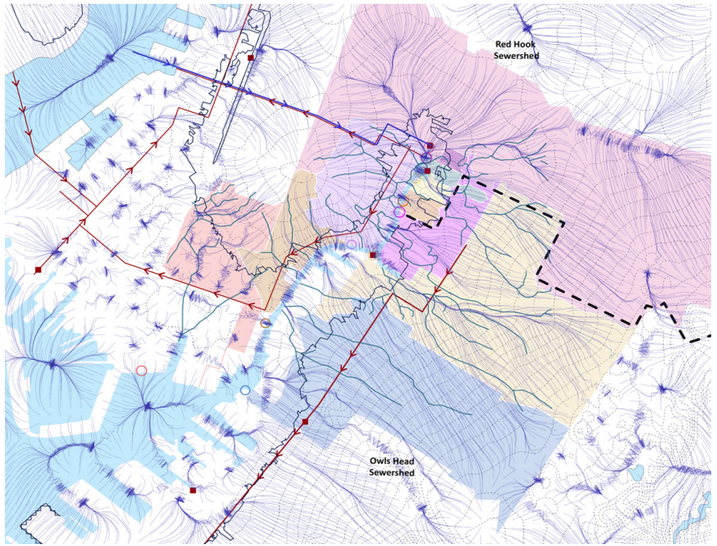


Prevailing summer winds, noted by the blue arrows, can be leveraged to help cool the district.

SITE ANALYSIS & SYSTEMS MAPPING

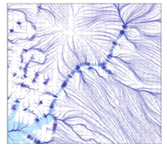
Water

The water networks and watersheds in Gowanus can likewise be harnessed to help cool the district.

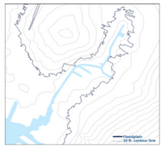


Surface and hidden blue infrastructure in Gowanus.

Underground Streams
Untappedcities.com, Mapped by Eymun Diegel



Rainwater Drainage Runoff
Grasshopper Analysis



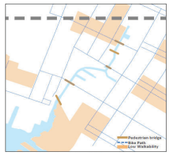
2050s 100-year Floodplain
NYC Open Data

Sewer and Flushing System
Open Sewer Atlas, Gowanus Canal Conservancy

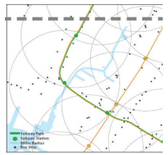
SITE ANALYSIS & SYSTEMS MAPPING

Transportation

From cycling and walking to trains for people and freight, Gowanus is a district full of motorized and non-motorized transportation networks.

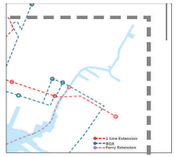


Cycling and Walkability
NYC Open Data, Walkability and Neighborhood Wealth



Public Transportation
NYC Open Data

Truck Routes
NYC Open Data

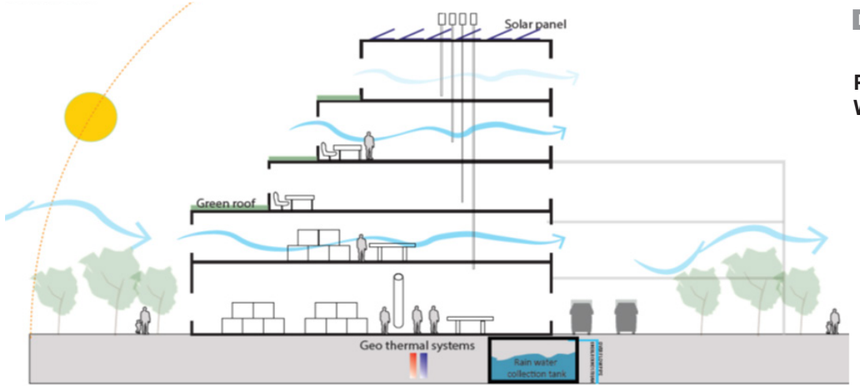


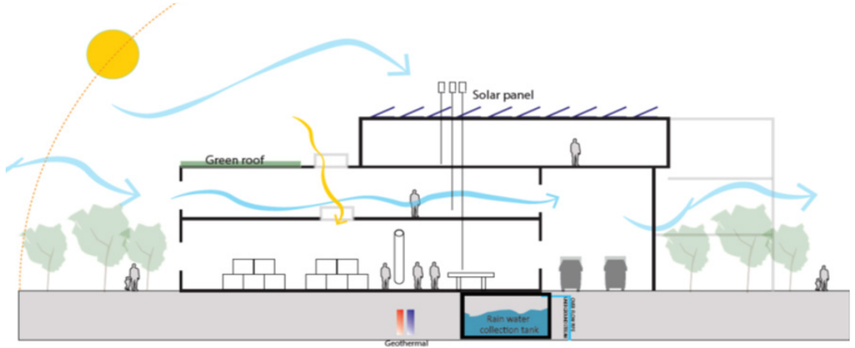
Future Transportation
SWB IBZ Study AECOM

Existing transportation networks, with blue and red lines showing two potential future transit additions.

DESIGN TYPOLOGIES

Prototype for Hybrid Live-Work Manufacturing

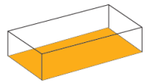




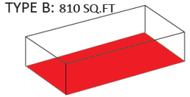
NYIT Urban Design Climate Lab, 2019

Residential

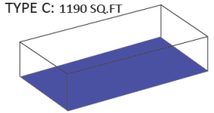
TYPE A: 540 SQ.FT



TYPE B: 810 SQ.FT



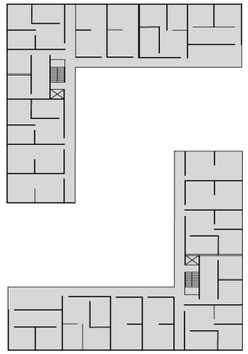
TYPE C: 1190 SQ.FT



FLEXIBLE GROUND FLOOR SPACE
During normal conditions, the flexible podium functions as a space for community, public events, and commercial uses. During flooding conditions, the podium prioritizes temporary uses, focusing on green infrastructure to absorb flood waters.

Potential Mix of Uses and User Groups Within a Building

TYPICAL FLOOR PLAN



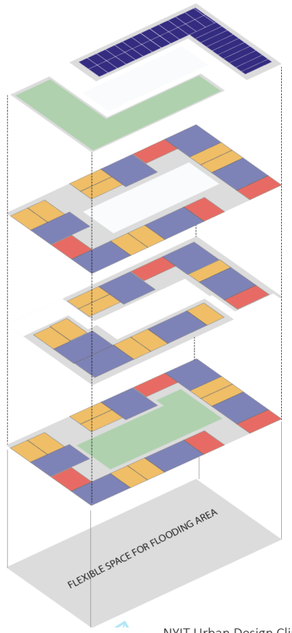
CALCULATIONS

4 STORIES: 188 people
Builtup: 58,800 sq ft
7,350 sq ft PV
Production: 131,022 kWh/year

6 STORIES: 282 people
Builtup: 88,800 sq ft
7,350 sq ft PV
Production: 131,022 kWh/year

8 STORIES: 188 people
Builtup: 117,600 sq ft
7,350 sq ft PV
Production: 131,022 kWh/year

FLOOR PLATES



NYIT Urban Design Climate Lab, 2019

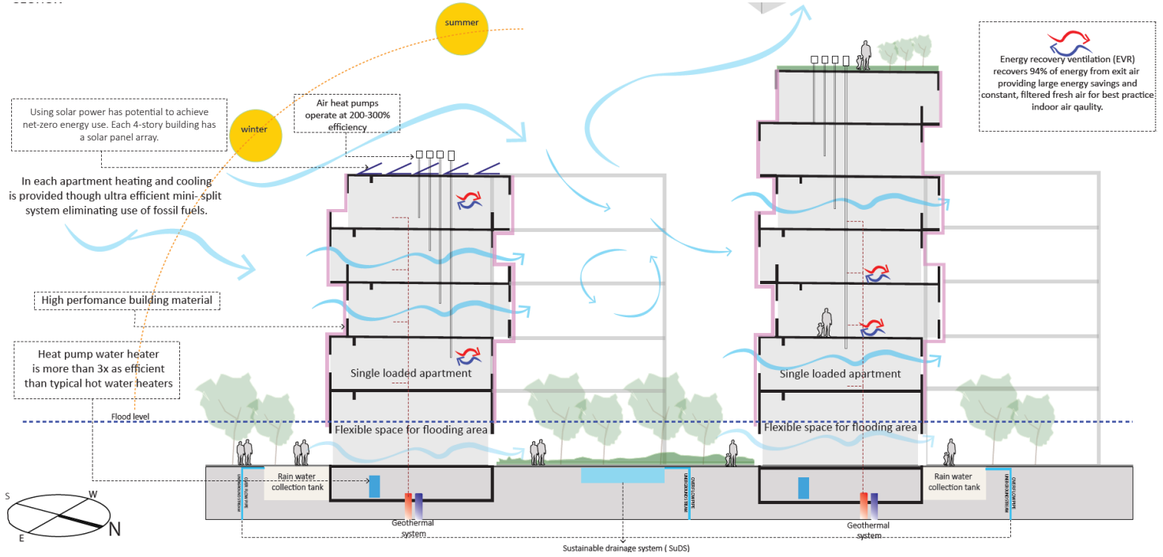
DESIGN TYPOLOGIES

Residential

Mixed -use, passively -cooled residential prototype.

Flexible ground spaces could comprise two functions:

1. Flexible space for community events and commercial uses.
2. Space to absorb flood waters.



NYIT Urban Design Climate Lab, 2019

Testing Form & Layout

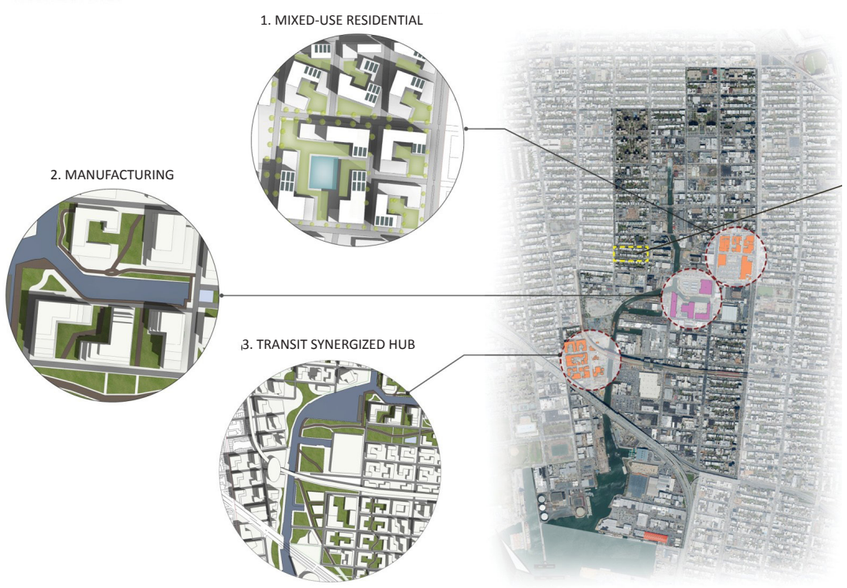
Testing Strategic Sub-districts

The climate modeling teams identified key sub-districts in Gowanus to test UTCI reduction approaches. Students explored outcomes applying energy, health, and comfort parameters specific to each scenario.

Sub-districts:

- Mixed-use Residential
- Manufacturing
- Transit Synergized Hub

Three Sub-districts to Test Climate Analysis



NYIT Urban Design Climate Lab, 2019

Testing Form & Layout

Intermodal Transit-Synergized Hub

NYIT Urban Design Climate Lab, 2019

Testing Form & Layout

Efficiency of Urban Systems: Transit-Synergized

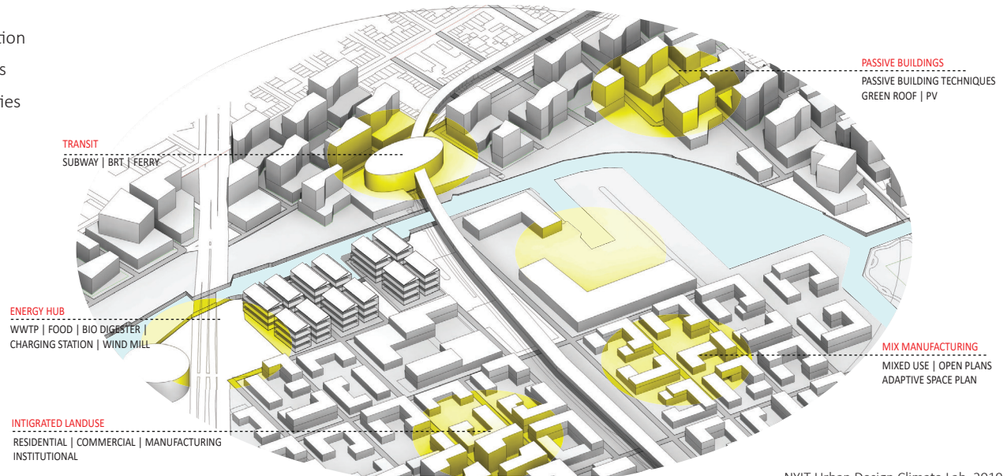
The climate modeling teams proposed synergizing transit through the creation of an inter-modal transit hub linked to multi-modal electric freight and passenger mobility within the district, city, and region. The facility generates energy from regenerative braking from trains and electric vehicles. This energy is networked into a micro-grid that harnesses synergies from the surrounding sub-district.

System Components

- On-site energy generation
- Energy storage facilities
- Waste-to-energy facilities

Energy transfer activities between sub-districts are provided through active coordination between sub-district user groups, varied land uses, and off-peak hours of operations.

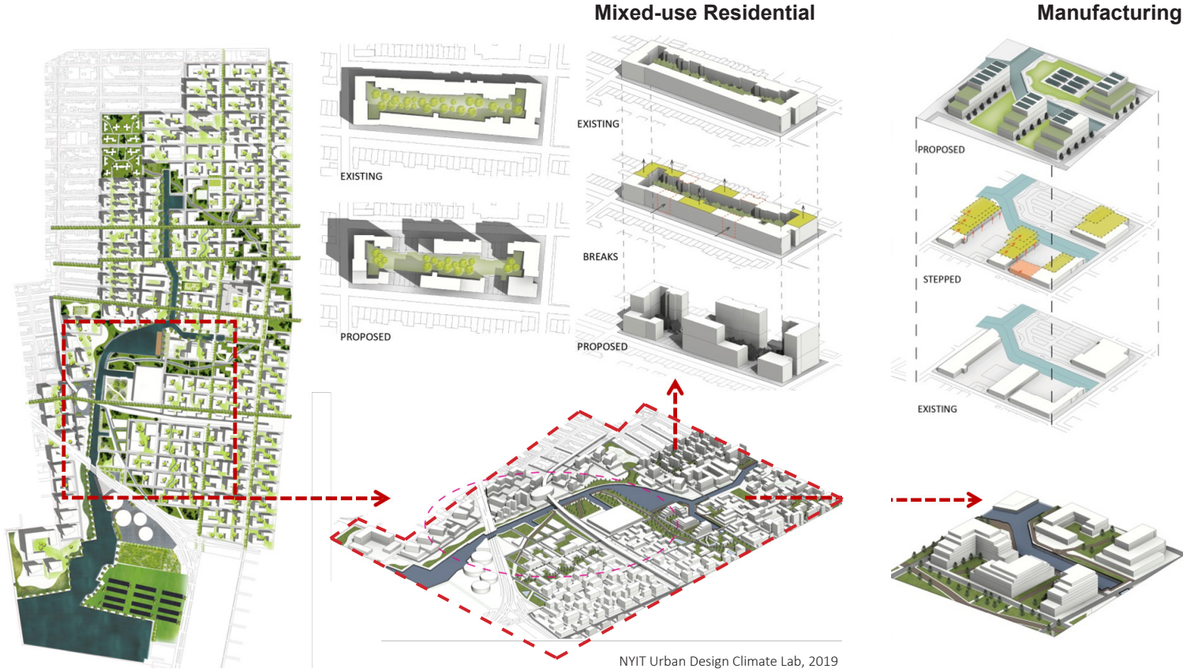
Transit-Synergized Hub



NYIT Urban Design Climate Lab, 2019

Testing Form & Layout

Sub-Districts: mixed-use residential and manufacturing prototypes

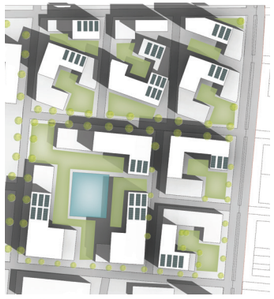


NYIT Urban Design Climate Lab, 2019

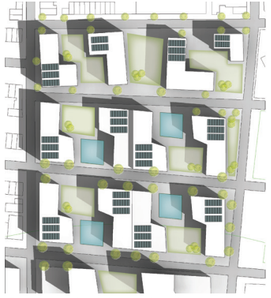
SUB-DISTRICTS

Testing Form & Layout

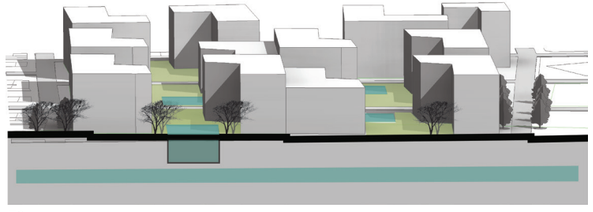
The climate team modeled the residential and mixed-use blocks to enhance natural ventilation during summer months, making use of natural windflow patterns over water bodies and evaporating surfaces. The team also refined its modeling to align linear parks with underground streams to leverage the potential cooling benefits associated with naturally-occurring water bodies.

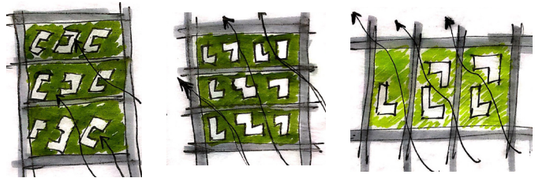


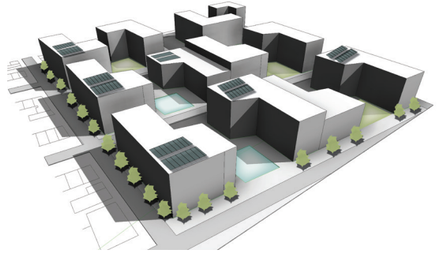
Buildings oriented to leverage wind direction

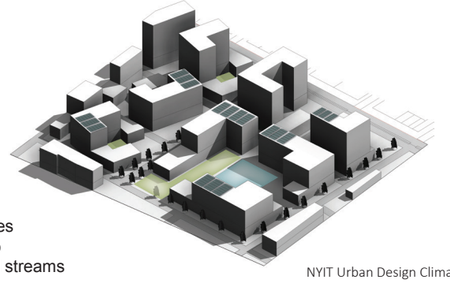


Courtyards oriented to leverage wind direction

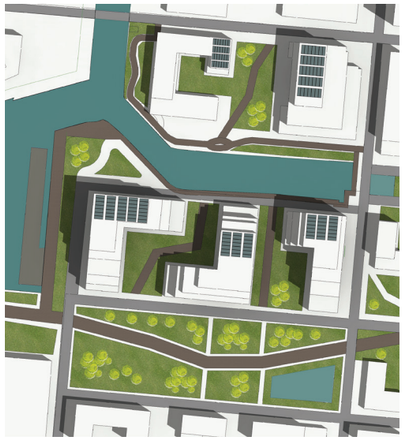




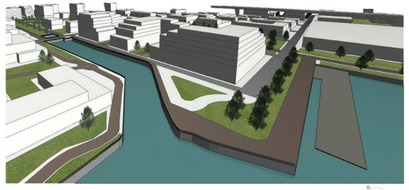




Water squares connected to underground streams



Light manufacturing with training facilities

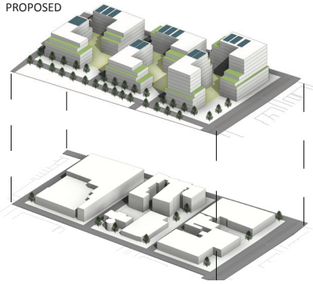


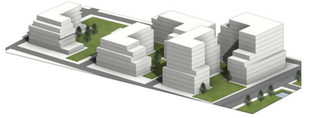
View showing adjacent jetty for freight

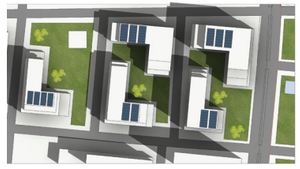
SUB-DISTRICTS

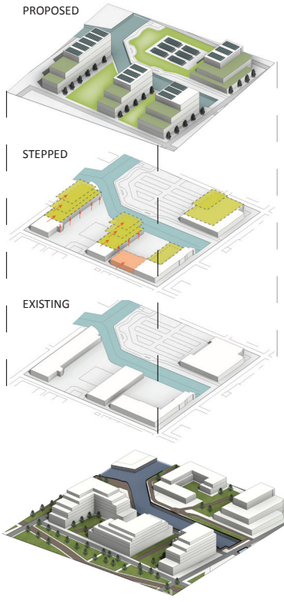
Testing Form & Layout

Manufacturing prototypes were reconceived as mixed-use, stacked spaces, which would be well-served by multi-modal services on land and water.







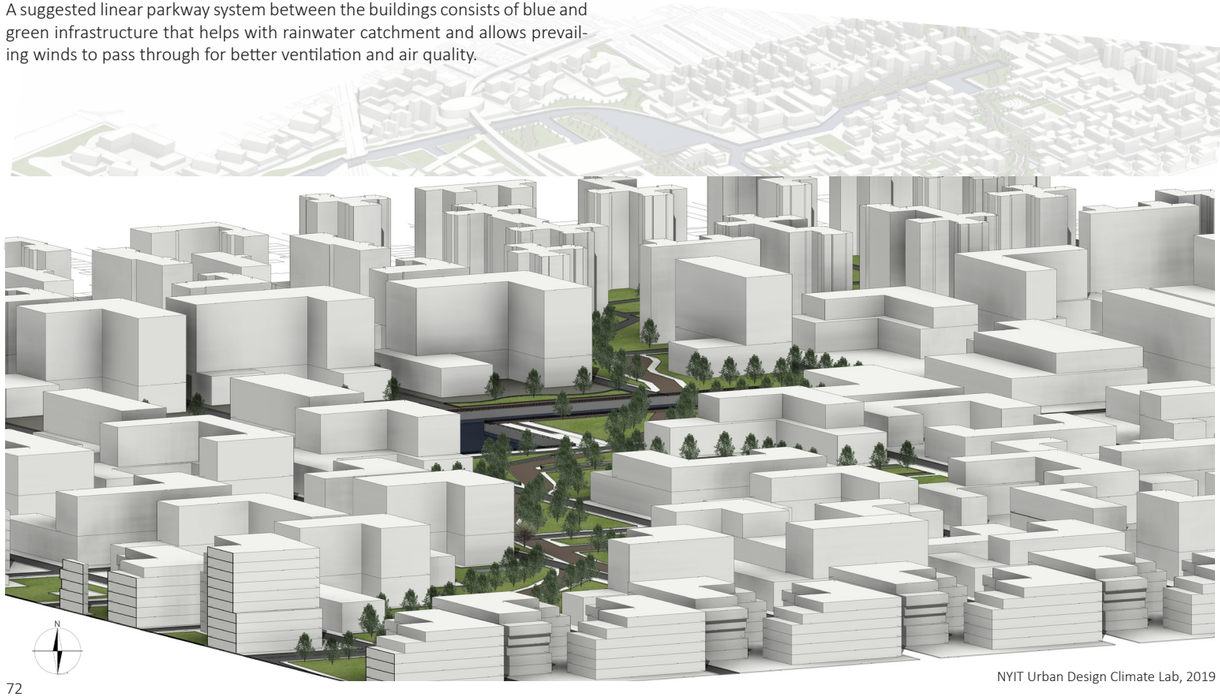


NYIT Urban Design Climate Lab, 2019

SUB-DISTRICTS

Testing Form & Layout

A suggested linear parkway system between the buildings consists of blue and green infrastructure that helps with rainwater catchment and allows prevailing winds to pass through for better ventilation and air quality.



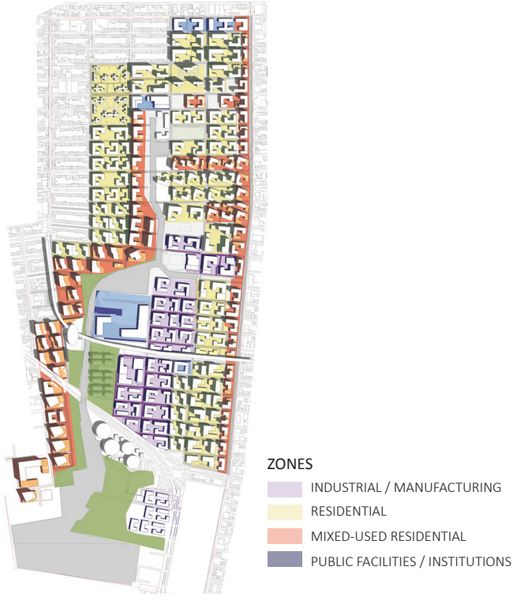
NYIT Urban Design Climate Lab, 2019

NYIT Urban Design Climate Lab, 2019

SUB-DISTRICTS

Testing Form & Layout

A prototypical land use scenario would blend linear green corridors with revised zoning to assist in leveraging the cooling benefits of green and blue infrastructure and increased wind via adjusted building heights and block configurations.



SUB-DISTRICTS

Testing Form & Layout

Linear Parks

The green path, used as a pedestrian and cycling trail, is naturally ventilated by the wind and accompanied by streams and permeable landscape for stormwater management.

Jeffrey Raven 2016

NYIT Urban Design Climate Lab, 2019

Jeffrey Raven 2016

SUB-DISTRICTS

Testing Form & Layout

Recreation

A proposed green area, created for flood mitigation and combined with large energy infrastructure, could be used as communal recreational space.

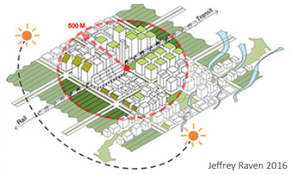
NYIT Urban Design Climate Lab, 2019

SUB-DISTRICTS

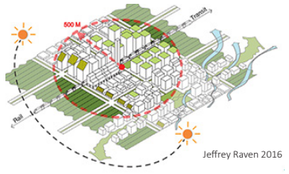
Testing Form & Layout

Food Hub

Expanding the canal to allow for ferry rotation and circulation, creates an opportunity for enriching the food hub with freight arriving from the canal.



NYIT Urban Design Climate Lab, 2019



SUB-DISTRICTS

Testing Form & Layout

Urban Farming

Creating a hub for green training could generate jobs for local communities and connect a carbon-neutral environment with a vital equity strategy.

NYIT Urban Design Climate Lab, 2019

PHYSICAL MODEL

Urban Design Process, 3D Model

The 3D model developed by the NYIT Urban Design Climate Lab was an important planning tool for students and also conveyed key planning approaches to the ULI taskforce and stakeholders. The model was created to display three layers of information in context with the built form.

Base Contours

2019

2050 Business As Usual

2050 Best Practice Mockup

NYIT Urban Design Climate Lab, 2019

PHYSICAL MODEL

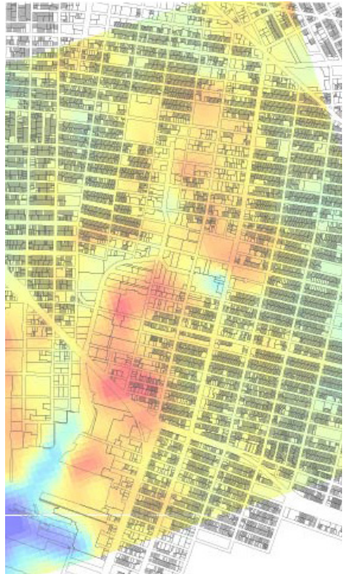
Layers

These images represent individual layers used beneath the physical model developed by students during the design process.

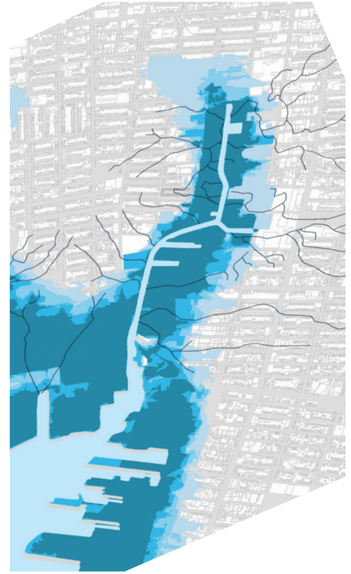
Land Surface Temperature, 2019

NYIT Urban Design Climate Lab, 2019

Land Surface Temperature, 2050



Flood Map & Underwater Streams



CONCLUSION, CONTRIBUTORS and PARTICIPANTS

CONCLUSION

Rezoning (upzoning) will reshape the character and future of the Gowanus neighborhood where new development will serve one of the City's greatest needs – affordable housing. Industrialized blocks, streetscapes void of pedestrian amenities, and the overall lack of parks and open space are physical constraints. However, they also provide extraordinary opportunity for new development to respond to social, environmental, and quality of life issues particularly in the most densely populated and underserved communities. As we seek to mitigate and negotiate the impact of sea level rise, urban heat, and social distancing, we can reference the concepts and their grounding presented herein for inspiration, applicability, and validation. These concepts emerged from the works of graduate urban design students at the New York Institute of Technology (NYIT) in collaboration with the Urban Climate Change Research Network (UCCRN), and participation from the Urban Land Institute's (ULI) New York District Council and Urban Resilience Program, and local project partners at the Fifth Avenue Committee and Gowanus Canal Conservancy. Some of the possibilities presented in this report are lofty, but they represent the mindsight of emerging professionals who will contribute greatly to the adaptation of our cities in the future.

Are the recommendations contained herein ready for implementation? Many pieces including real estate disposition, community engagement, infrastructure investment, entitlements, financing, and design need to fall into place to make this happen. Block by block and building by building, new zoning will open opportunities for responsible planning and development. The ideas presented by this consortium may be a unifying call to action and a significant next step in creating a more sustainable Gowanus community.

This report represents a unique perspective, not grown from the consulting community but from graduate students who viewed this challenge in Gowanus differently. Analysis and recommendations are loosely tied and conceptual, featuring building form, street networks and infrastructure transformation informed by environmental conditions and vulnerabilities. While this report may be overly ambitious in its vision, the scientific data and the evidence point to the existent and looming climate threats to the Gowanus

community – heat stress, flooding, and impact of greenhouse gas emissions – that will require systems-based thinking and broad intervention. The primary goals of this project were to create local and specific climate models, based on the best available data, to propose "actionable" regulatory strategies for the Gowanus community. The results of the students' work are more conceptual yet provocative in their tenor.

As stated previously, the approach derives its value proposition from positive public health and economic growth outcomes and envisions that urban design can help shape transformative climate action in evolving districts like Gowanus. The report gives further voice to the important conversation around mitigating the impacts of urban heat islands and addresses the alignment of urban climate impact with the Gowanus rezoning proposal. The illustrations are conceptual and buildings forms are hypothetical. As a result of zoning, redevelopment and/or adaptive reuse, this report may be useful as a reference tool when considering height, orientation, streetscape design, transit connectivity, and stormwater management in response to future stresses.

Heat, flood risk, walkability, and carbon neutrality are vital concerns in the Gowanus community and for all of New York City. This report suggests that taking no action in response is not a sustainable approach.

CONTRIBUTORS & PARTICIPANTS

Gowanus Urban Design Climate Workshop Team

Urban Design

New York Institute of Technology (NYIT)
Graduate Program in Urban + Regional Design (MSAURD)
Faculty: Jeffrey Raven, Associate Professor + MSAURD Program Director; Michael Esposito, MSAURD Adjunct Faculty, Senior Environmental Designer and Building Analyst at Elementa - Integral Group; Luciana Godinho, Urban Designer, Loci Architects, MSAURD 2018
MSAURD Graduate Students: Yuval Eynath; Poornima Elangopandian*; Naqeeb Mohammed; Rosario Foinquinos*; Smriti Jaiswal*; Ishan Shah; Surabhi Kale; Maria Morales
RAVEN A+U Architecture + Urban Design LLC.: Jeffrey Raven, FAIA, LEED BD+C, Principal

Climate Science

NASA Goddard Institute for Space Studies (GISS) / Urban Climate Change Research Network (UCCRN)
Dr. Christian Braneon, Remote Sensing Specialist
Kathryn McConnell, Doctoral Candidate at Yale School of Forestry & Environmental Studies

American Institute of Architects New York Chapter (AIANY)

Stefan Knust, AIA, Senior Associate & Director of Sustainability, Ennead Architects
Frances Huppert, FAIA, Principal, Frances Huppert Architect

**Publication Editorial Team*

Urban Land Institute (ULI)

ULI Taskforce

Donna Walcavage, FASLA, LEED AP, Principal, Stantec
Gary Sorge, FASLA, CSLA, AICP, Vice President, Stantec
Janice Barnes, Founder, Climate Adaptation Partners
Nancy Choi, Associate, Arup
Michelle de la Uz, Executive Director, Fifth Avenue Committee
Sabine Aronowsky, Community Development Consultant, Fifth Avenue Committee
Andrea Parker, Executive Director, Gowanus Canal Conservancy
Amy Motzny, Watershed Manager, Gowanus Canal Conservancy

ULI Staff

Felix Ciampa, Executive Director, ULI New York
Sofia Guerrero, Senior Manager, ULI New York
Katharine Burgess, Vice President, Urban Resilience, ULI
Elizabeth Foster, Manager, Urban Resilience, ULI

Copy Editing & Design Support
Kelly Annis, Branch Communications

Other

Urban Design Climate Lab Jury – NYIT Graduate Urban Design Program

Timon McPhearson, PhD, Director, Urban System Lab; Associate Prof. Urban Ecology, The New School
Christian V. Braneon, PhD, Remote Sensing Specialist, NASA Goddard Institute for Space Studies
Anne Shellum, Engineer, Cities Group at BuroHappold Engineering; Co-Chair, Committee on the Environment, AIANY
Stefan Knust, AIA, Senior Associate & Director of Sustainability, Ennead Architects
David Briggs, AIA, Partner, Loci Architecture; Executive Dir. Gowanus by Design
Gregory Haley, Associate Principal, Grimshaw
Guido Hartray, Partner, Marvel Architects
Jessica Morris, Michael Graves College, School of Public Architecture; AIANY
Kathryn McConnell, Doctoral Candidate, Yale School of Forestry & Environmental Studies
Juan Pedro Liotta, Urban Designer, MSAURD 2018
Luciana Godinho, Urban Designer, Loci Architects, MSAURD 2018
Beyhan Karahan, AIA, Professor, MSAURD SoAD NYIT; Beyhan Karahan & Assoc.
Amy Leitch, Integrated Planning, Arup; MSAURD faculty
Dong-Sei Kim, Assistant Professor, SoAD NYIT
Tom Verebes, Associate Dean & Professor, SoAD NYIT

Integrated Climate Adaptation & Climate Mitigation – Net Zero District

InSource – Belmont Sustainable Urbanisation Global Initiative Team*
Jeffrey Raven, Associate Professor, MSAURD Program Director, SoAD NYIT (co-PI)
Ziqian (Cecilia) Dong, PhD, Associate Professor, School of Engineering and Computing Science, NYIT (PI)
American Institute of Architects New York Chapter (AIANY)
Stefan Knust, AIA, Senior Associate & Director of Sustainability, Ennead Architects (Climate Mitigation)
Frances Huppert, FAIA , Principal, Frances Huppert Architect (Climate Adaptation)
NASA Goddard Institute for Space Studies (GISS) / Urban Climate Change Research Network (UCCRN)
Dr. Cynthia Rosenzweig, Senior Research Scientist, Co-Chair of the New York City Panel on Climate Change (NPCC)

** Supported by the National Science Foundation under Grant No. 1830718*

Urban Land Institute

URBAN DESIGN

NEW YORK INSTITUTE OF TECHNOLOGY

School of Architecture & Design

URBAN CLIMATE CHANGE RESEARCH NETWORK