Housing Economics

Spitzer School of Architecture
City College of New York
Fall 2024

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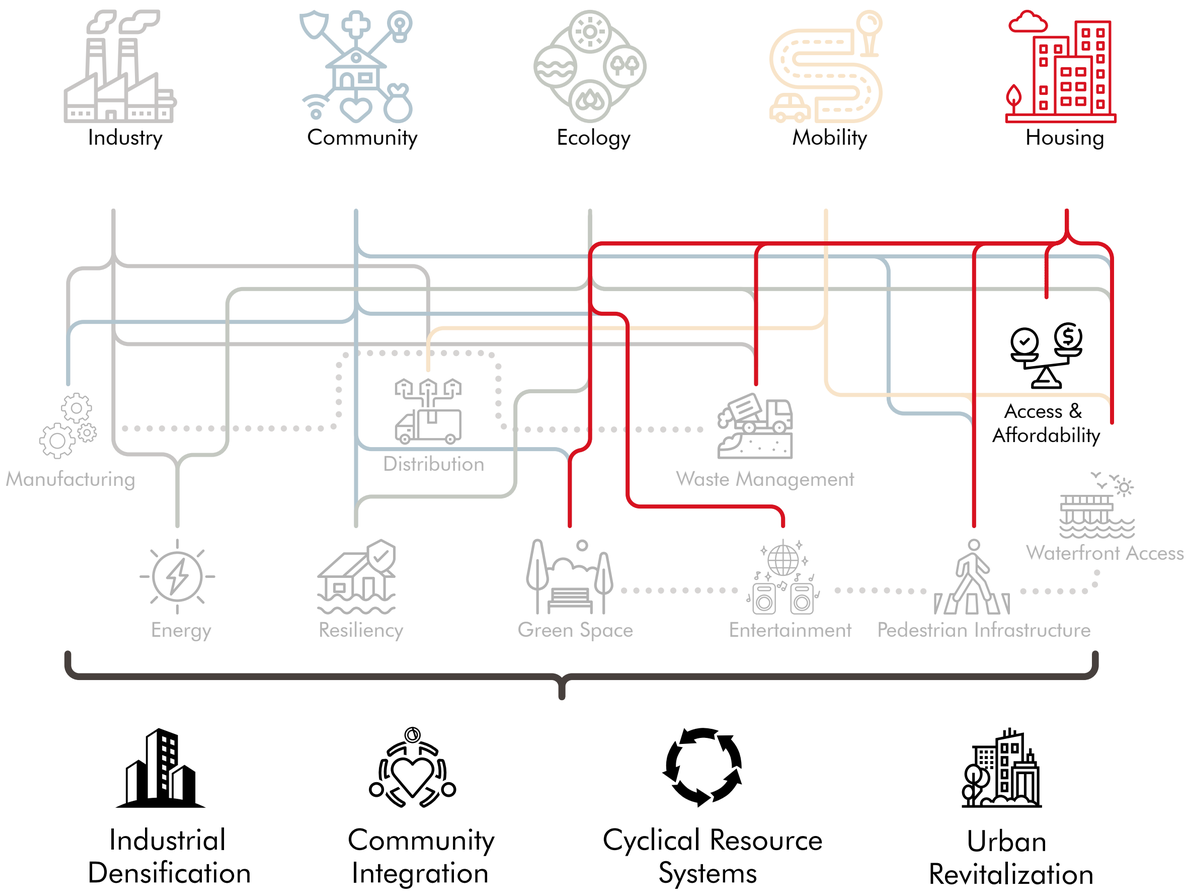
Source: NYC Department of Housing Preservation & Development

Project Overview

New York City, for all its might and strength, grapples continuously with the issue of **affordable housing** - much like many of its mega-city counterparts. This project builds on work done previously which looked at ways to **densify urban industry** in the East Williamsburg neighbourhood but now with the injection of housing.

The project investigates how urban industry can provide an **economic platform** for affordable housing in urban areas. More specifically, how light manufacturing in mixed-use developments can directly subsidise housing.

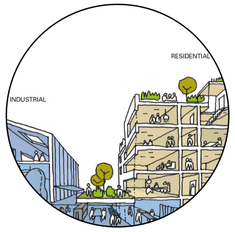


Businesses within New York City's manufacturing zones contribute over **400 billion** dollars to the City's GDP annually. That is a staggering number, considering it only represents 45% of total GDP. With all the economic might showcased in these manufacturing zones, can an economic platform for **affordable housing** be harnessed?

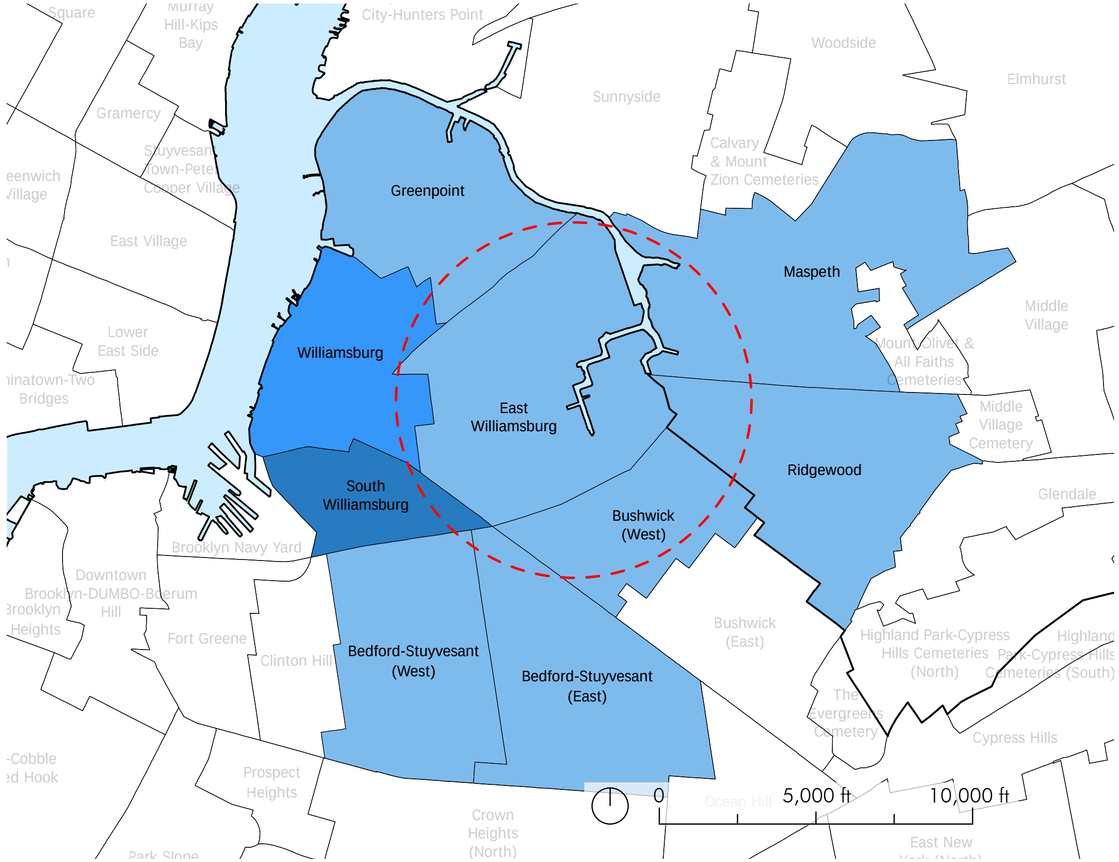
This project questions whether light manufacturing revenues can provide housing subsidies and create enhanced **localised opportunities** in mixed-used developments surrounding the North Brooklyn Industrial Business Zone. With the implementation of a **cross-subsidy program**, can an economic model that drives costs down for residential tenants be devised that also results in more profits for manufacturing tenants?







Study Area



Neighbourhood Tabulation Areas (NTAs)

NTAs were created to project populations at a small area level, from 2000 to 2030 for PlaNYC - the long-term sustainability plan for New York City. Since population size affects the error associated with population projections, these geographic units needed to have a minimum population, which we determined to be 15,000. This criterion resulted in combinations of neighborhoods that probably would not occur if one were solely designating boundaries of historical neighborhoods.

526,665
Population

33.3
Median Age

$50,600
Per Capita Income

2.6
Average Household Size

$85,891
Median Household Income

5.6%
Unemployment Rate

14.3%
No High School Diploma

23.11%
High School Diploma

16.79%
Some College/ Assoc. Degree

45.78%
Bachelor's Degree or more

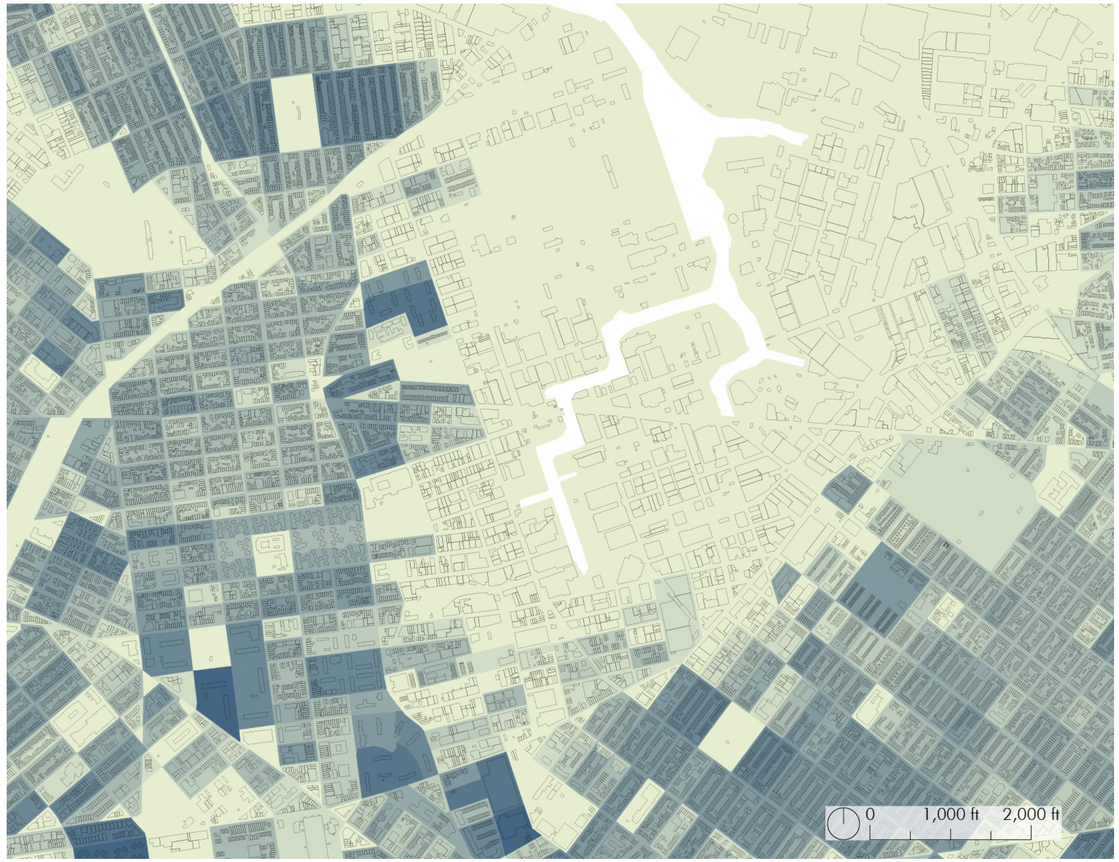
Source: Esri (2024,2029), Esri-Data Axle (2024)

These key facts highlight relevant data about the neighbourhoods surrounding the study area. These datasets have a direct correlation with a person's propensity to earn income, seek housing, and improve their quality of life.

Williamsburg has the area's most favourable numbers, with an income per capita of **$87,448** and a **4.6%** unemployment rate. Conversely, South Williamsburg has a per capita income of just **$17,991** and an unemployment rate of **6.2%**



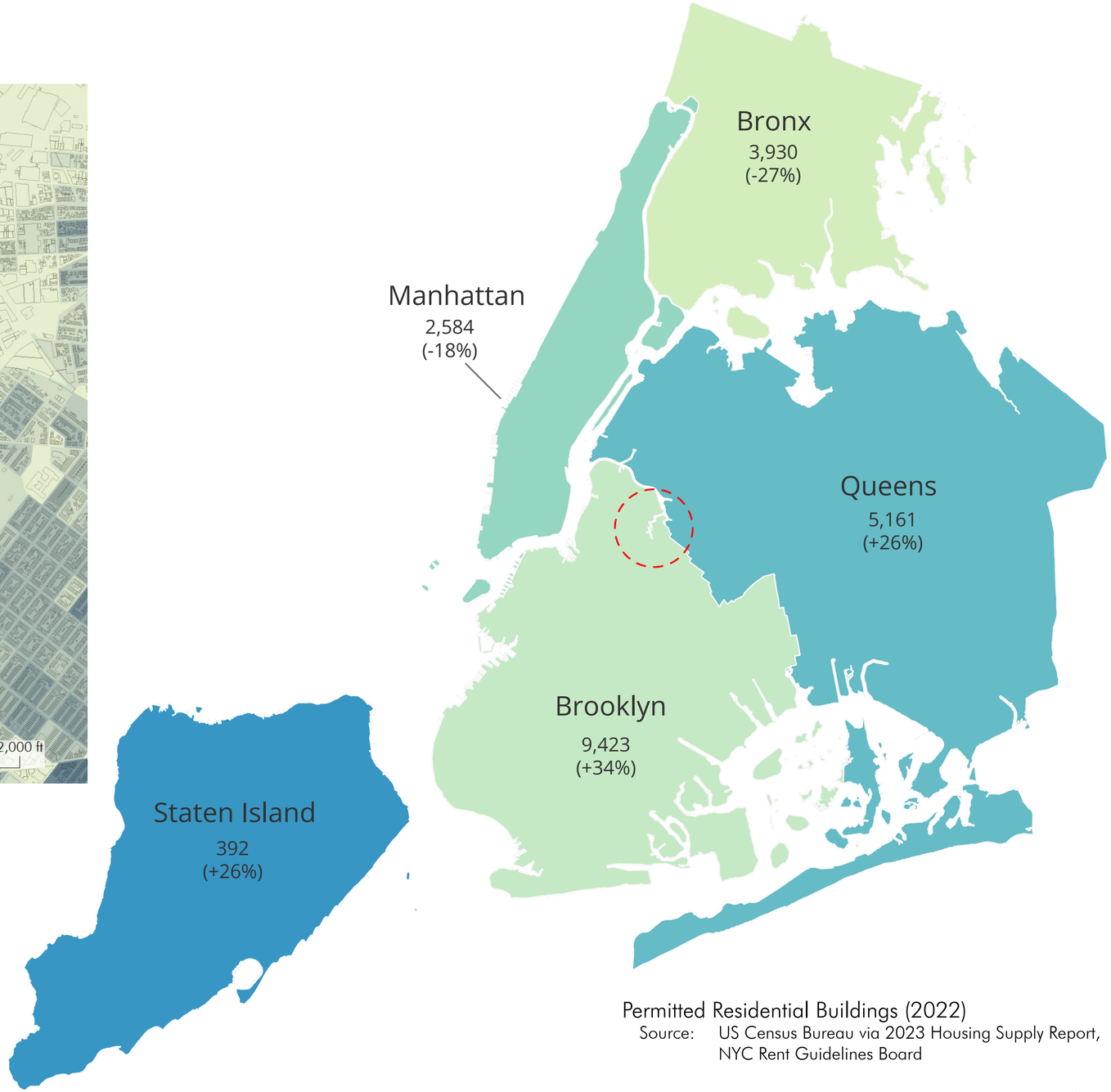
Housing Stock



Total Housing Units (2020) - by census block

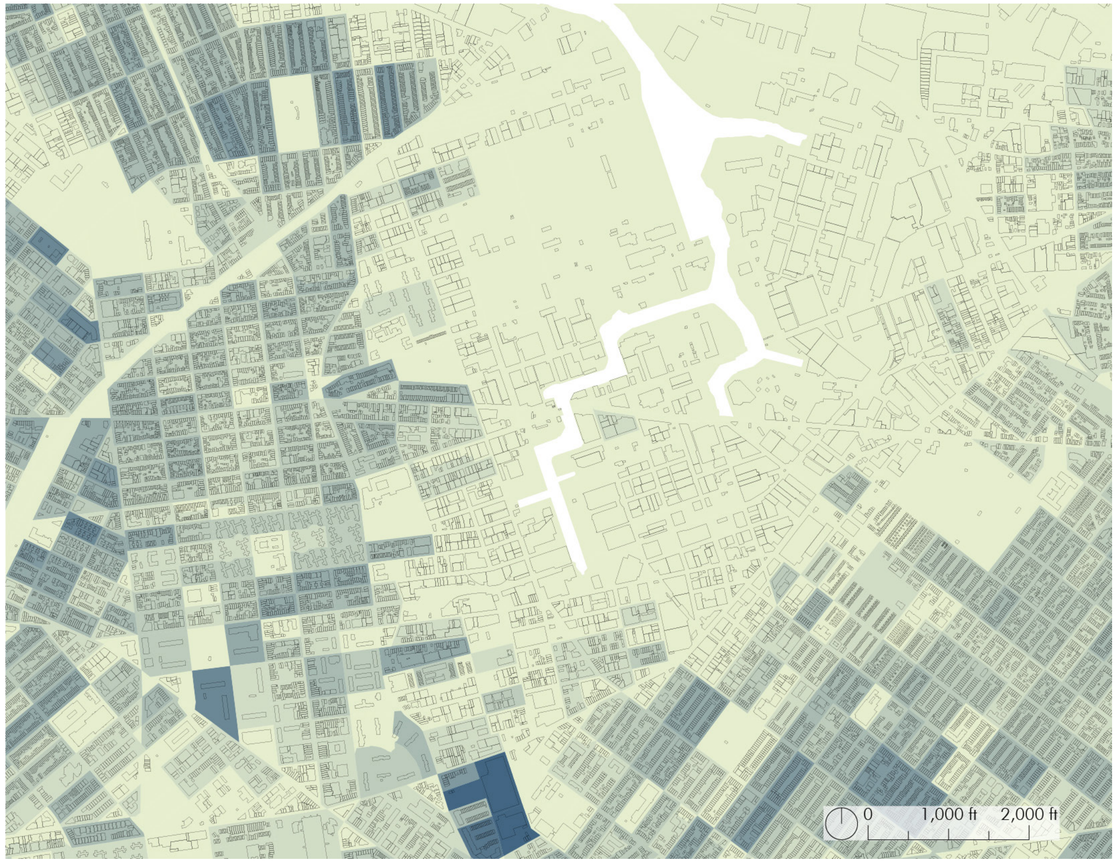
- 0 - 24
- 25 - 67
- 68 - 109
- 110 - 155
- 156 - 210
- 211 - 285
- 286 - 426
- 427 - 632
- 633 - 1163
- 1164 - 2345

As a city, New York is making strides towards alleviating the housing crisis, stretching nationwide. The city has largely seen **increases** in permitted residential buildings in 2022. However there is still a significant **gap** between the **demand** and **supply** of housing.



Permitted Residential Buildings (2022)
Source: US Census Bureau via 2023 Housing Supply Report, NYC Rent Guidelines Board

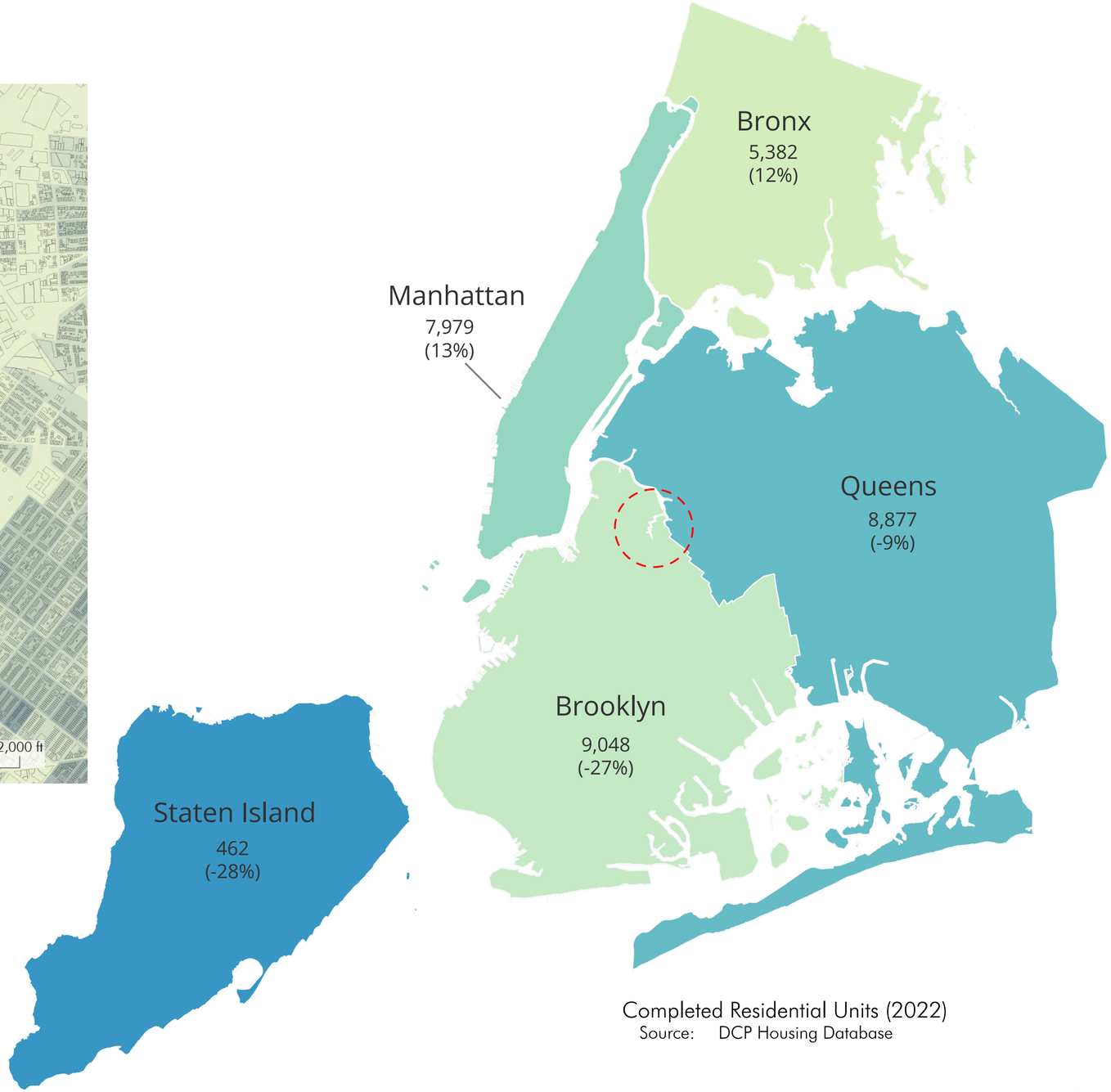
Housing Availability



Vacant Housing Units (2020) - by census block

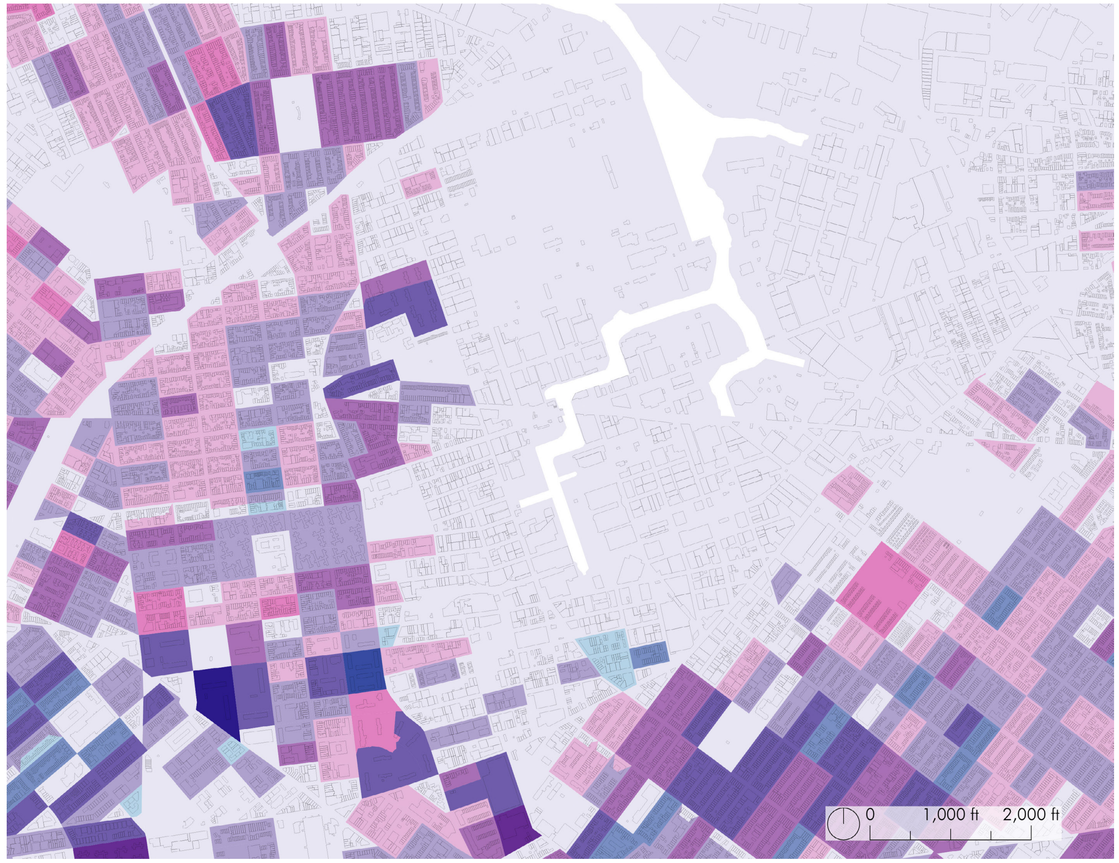
- 0 - 2
- 3 - 7
- 8 - 12
- 13 - 17
- 18 - 23
- 24 - 30
- 31 - 38
- 39 - 52
- 53 - 100
- 101 - 193

In July 2024, **132,076** people slept each night in NYC shelters. Thousands more (there is no reliable number, as the annual HOPE estimate is deeply flawed) slept unsheltered in public spaces, and more than **200,000** people slept temporarily doubled-up in the homes of others. Thus, it can be estimated that more than **350,000** people were without homes in NYC in July 2024.
(www.coalitionforthehomeless.org)

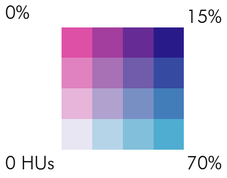


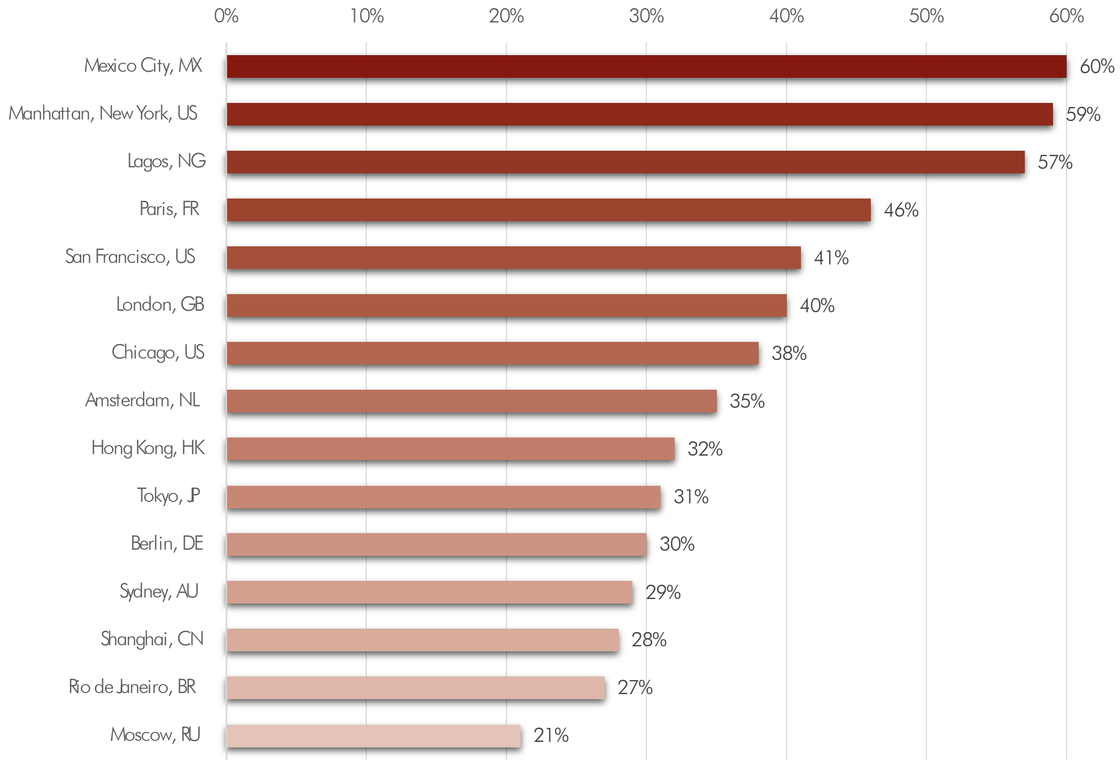
Completed Residential Units (2022)
Source: DCP Housing Database

Affordability Concerns



Percentage of Units with Rent +50% of Income - by census block





Source: ResearchGate

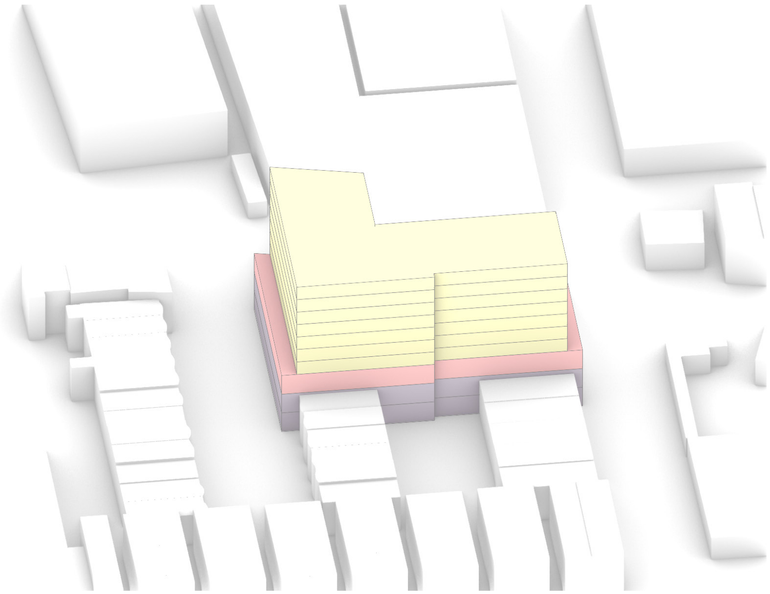
Rent-to-Income Ratios of Cities Worldwide

Over 40% of all renters in New York City spend **+30%** of their income on rent, and **25%** of renters spend **+50%** of their income on rent (nyc.gov). It clearly indicates that there needs to be innovative solutions to reduce the cost of housing, beginning with the construction process and transitioning through to operation. There are already several programs that subsidise housing for tenants. However, a lot of these programs are often **crisis-oriented**, meaning one has to be homeless and/or in a shelter to qualify for assistance. Like any other crisis, innovation must be at the forefront of problem-solving. (www.nyc.org)



Design Economics

What is the solution, then? A vast number of renters are **rent-burdened** in NYC. What if developers and manufacturers were **incentivised** to subsidise the rental costs of their residential counterparts? In current systems, profits and income are taxed at a specific percentage rate. This solution encourages developers and manufacturers to contribute **pre-tax dollars** to a private subsidy fund. Their contributions are rewarded with a tax break of up to 10%. Developers' incentives are limited to their financial contributions; however, manufacturers' contributions and willingness to hire staff from their immediate surroundings are awarded with tax breaks.



Site X

Size 19,192 SF

FAR Guidelines		
Manufacturing	2.0	38,384 SF
Commercial	1.25	23,990 SF
Residential	6.0	95,960 SF

Assumptions

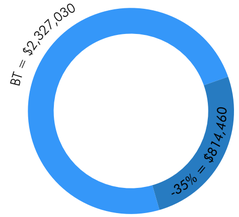
(i)	Unit Size Average (Res.)	750 SF (128 units)
(ii)	Rent per SF (Res.)	$3
(iii)	Rent per SF (Manuf.)	$25
(iv)	Profit per SF (Manuf.)	$125
(v)	Rent per SF (Comm.)	$45
(vi)	Profit per SF (Comm.)	$135
(vii)	Manuf. & Comm. Overheads	30%
(viii)	Tax Deductions	35%
(ix)	Rent Subsidy Contributions	12% (max)

Current

BT = Before Taxes
AT = After Taxes
BR = Before Rent
AR = After Rent

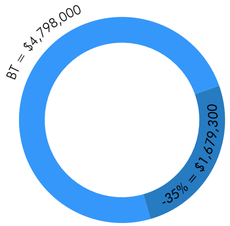
Developer

AT = $1,512,569



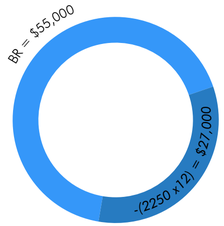
Manufacturer

AT = $3,118,700



Residential Tenant

AR = $28,000



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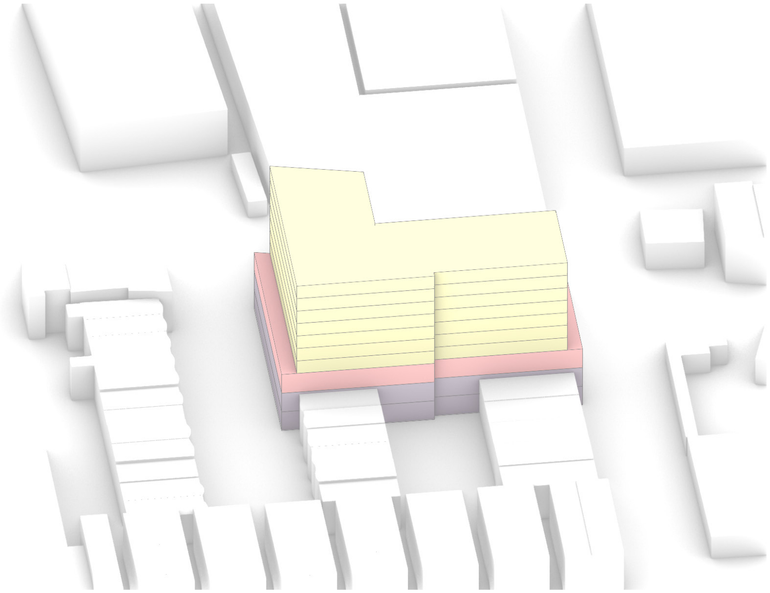

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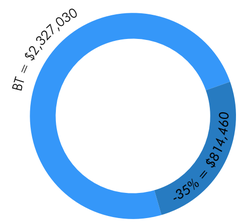

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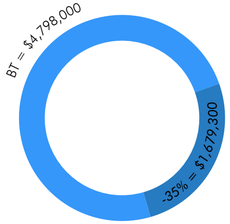

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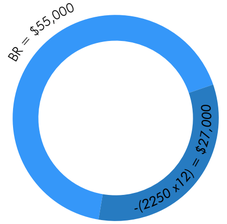

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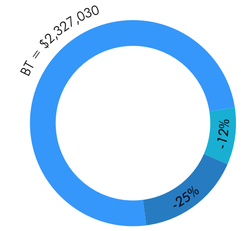
BR = Before Rent
AR = After Rent

Proposed

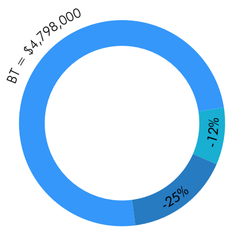
Developer

AT = $1,535,839 **(+$23,270)**



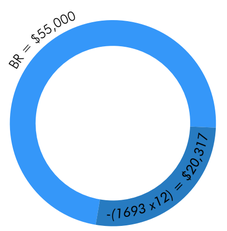
Manufacturer

AT = $3,166,680 **(+$47,980)**



Residential Tenant

AR = $34,682 **(+$6,682)**



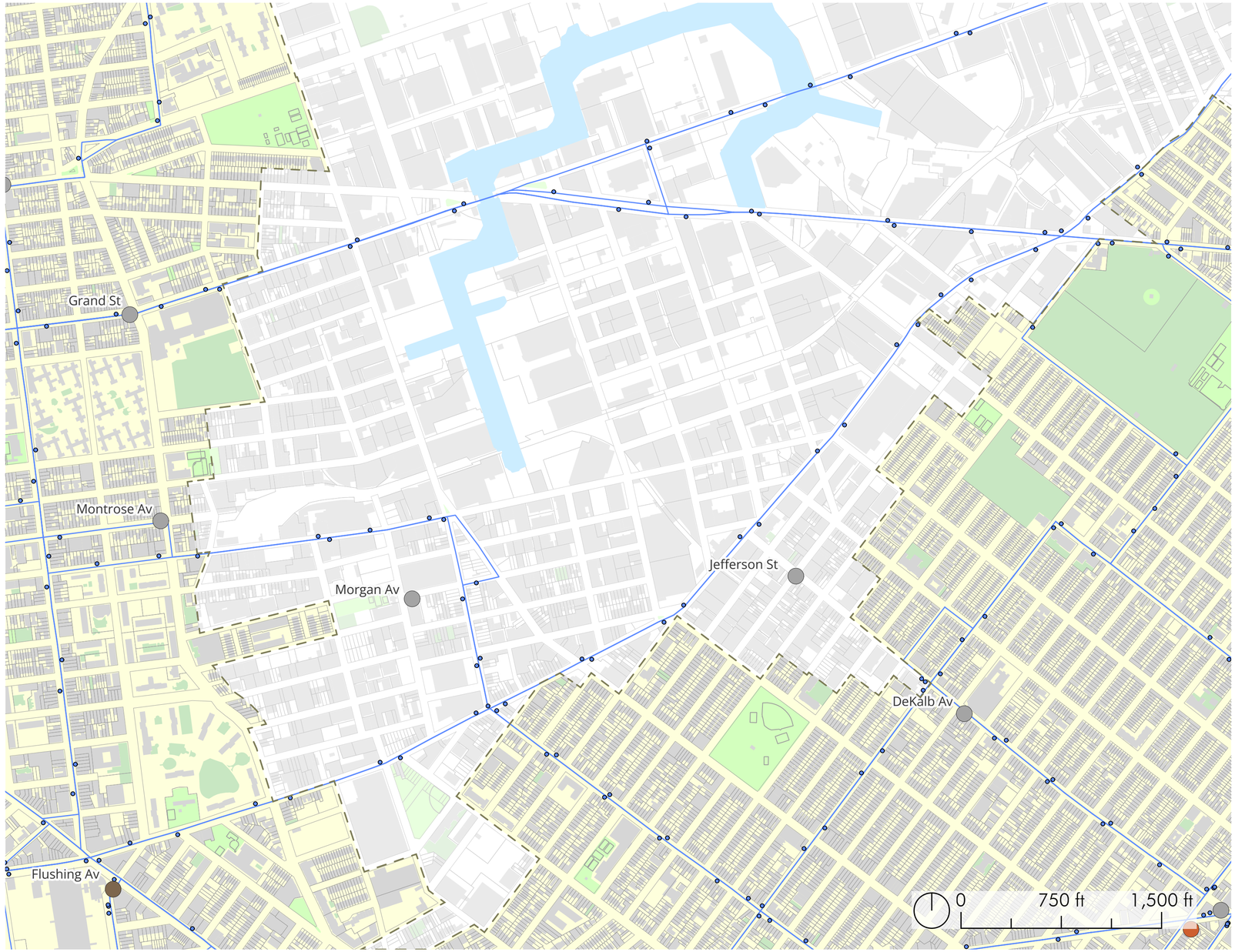
Incentives

(i) For every 2.4% of pre-tax dollars paid into subsidy fund = 2% tax break, up to 10% (Developer and Manufacturer)
(ii) For every 5 employees with home of record within 1 mile radius= 1% tax break, up to 10% (Manufacturer)



Subsidy funds to be distributed evenly between all residential tenants in development

Favourable Conditions



Housing:

- Adjacency to Community Amenities
- Transit Accessibility
- Natural Light and Ventilation
- Air Quality
- Sustainable and Resilient Construction

The needs for housing are often more qualitative than not. **Access** to natural light, running water, and good air quality have been basic requirements for decades in New York City. However, the **proximity** to amenities such as parks, libraries, schools, transit, and employment opportunities helps to build robust and resilient communities.

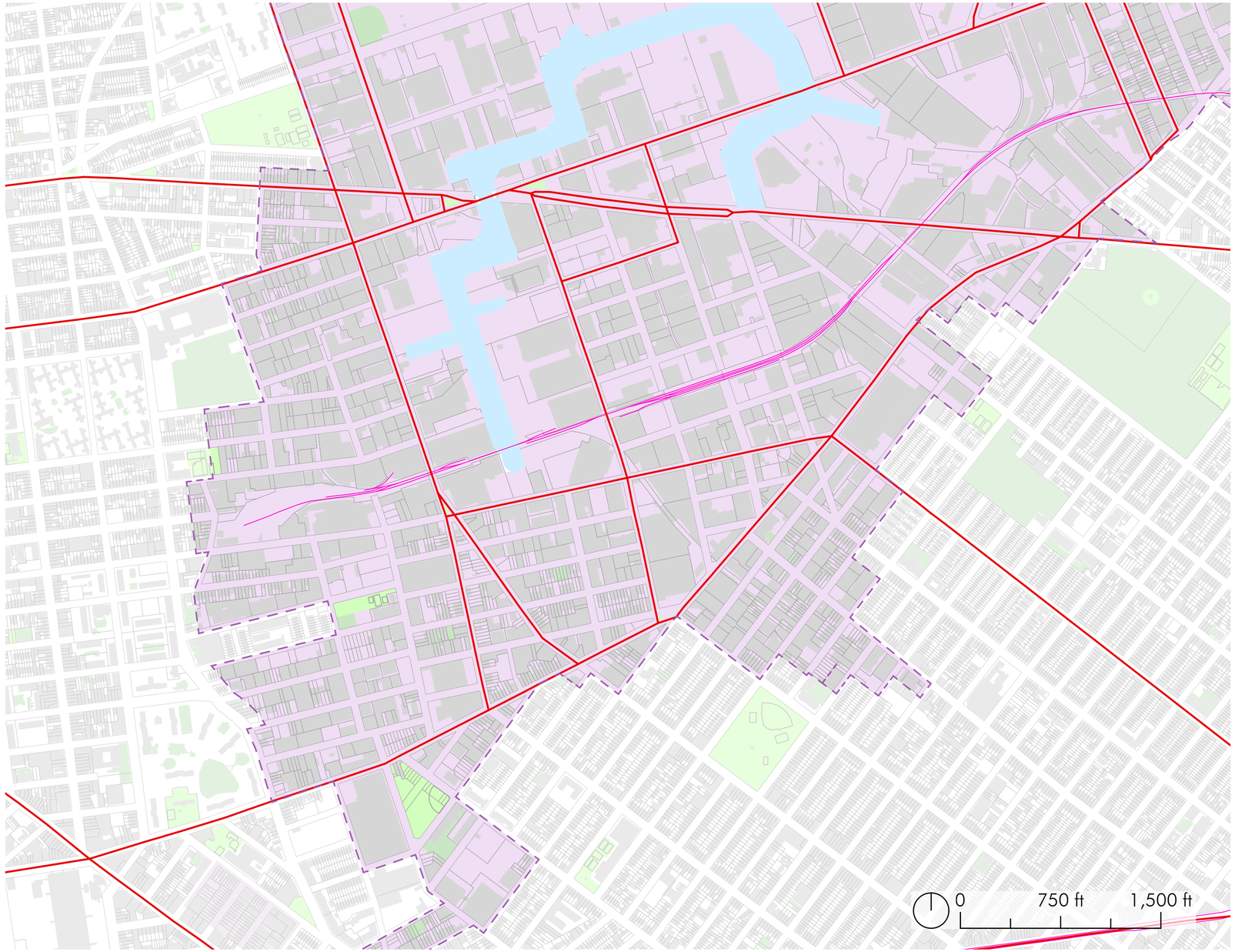
Building Footprint
Tax Lot Outline
Parks | Open Space
Residential Zone
Newtown Creek

Transit
Bus Routes
Bus Stops

Subway Stations
L Line
J/M Line
M Line



Favourable Conditions



Manufacturing Characteristics:

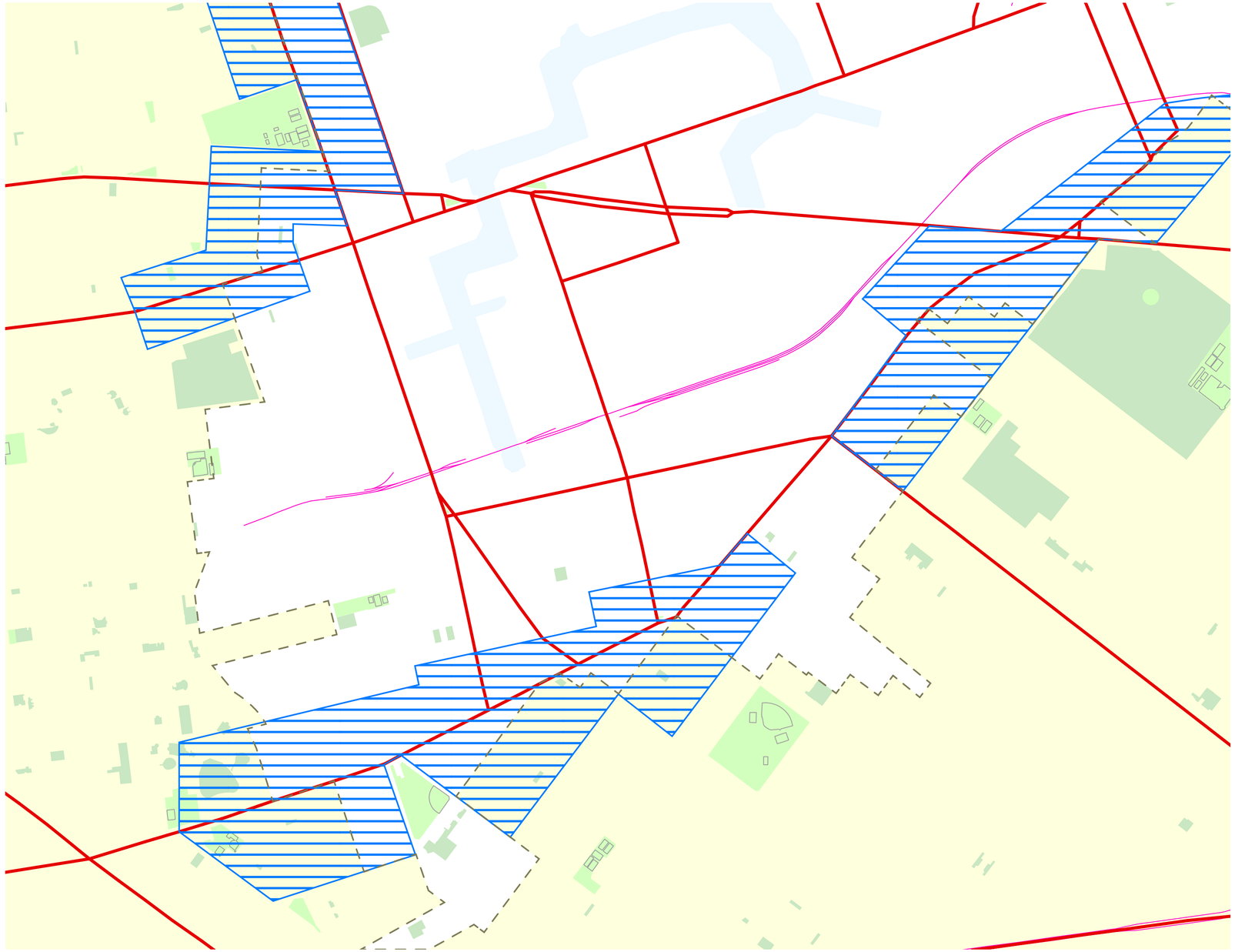
- Large, Open Floor Plates
- Loading Accessibility
- Transportation Accessibility (Shipping & Receiving)
- Proximity to Workforce

Manufacturers require a few essential physical characteristics for optimal operations. **Large, open floor plates** allow for large machinery, assembly line operations, and the manoeuvring of large materials and large finished products. Equally, **access to transportation routes** and suitable areas for shipping and receiving are paramount for their operations.

Building Footprint
Tax Lot Outline
Parks | Open Space
Manufacturing Zone
Newtown Creek
Railway
Truck Route



Creating New Districts



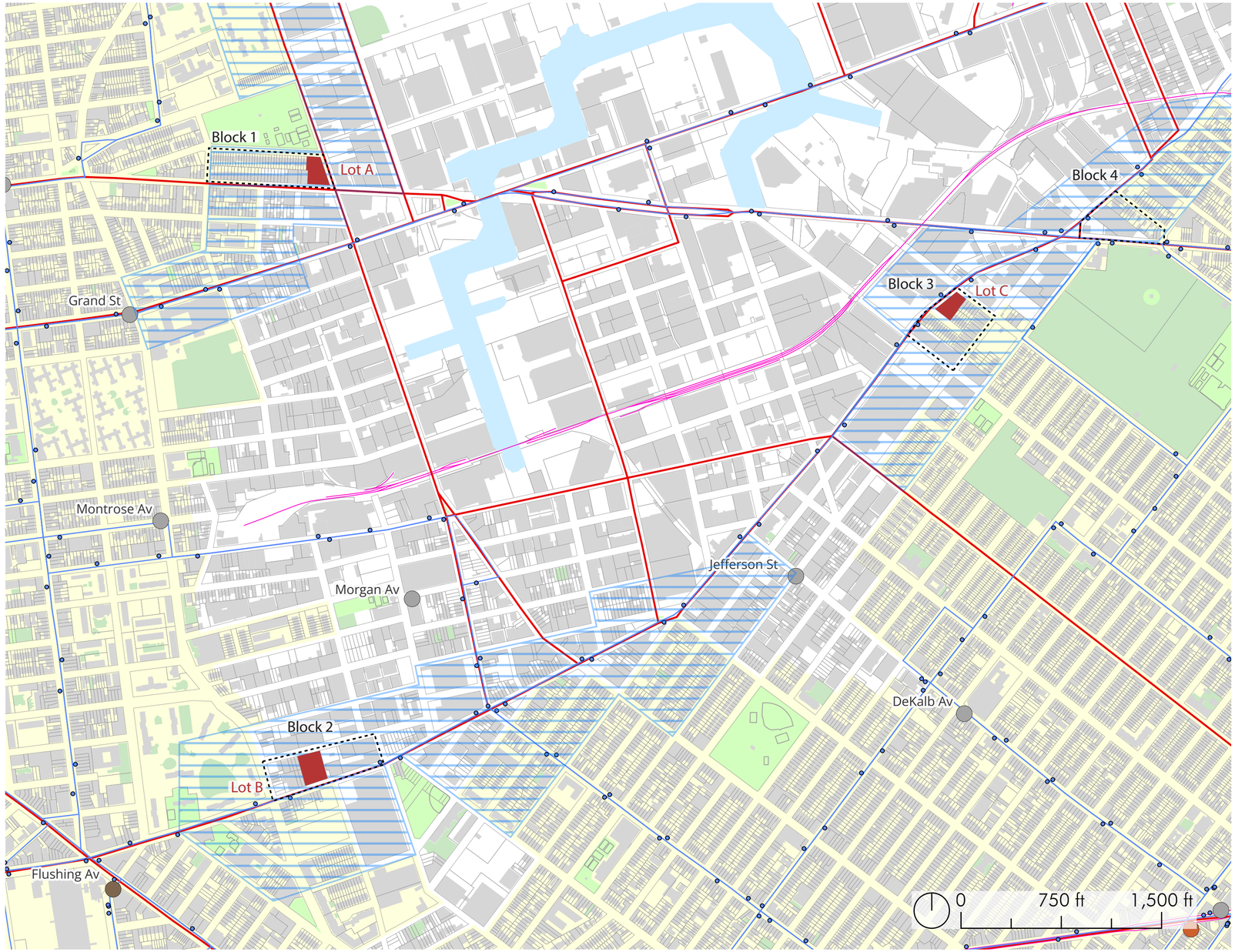
Manufacturing Mixed-Use Districts

Overlaying these characteristics on top of existing infrastructure, like parks, transit, zoning, and truck routes, will create new districts. These districts provide the most **conducive conditions** for mixed-use projects of this nature to be feasible and flourish. Maintaining the adjacencies mentioned before, projects in these districts allow manufacturers to operate under **favourable conditions** while residents can continue to enjoy all the characteristics of an accomplished neighbourhood.

- Manufacturing Mixed-Use Districts
- Manufacturing/Residential Border
- Truck Route
- Railway
- Parks | Open Space
- Newtown Creek



Harmony of Typologies



Site Parameters:

- Located within M1-(X) Zone
- Adjacency to Residential Zone
- Dual Road Access (min.)
- Along Truck Route
- Large, Open Floor Plates
- Loading Accessibility
- Proximity to Workforce
- Transit Accessibility

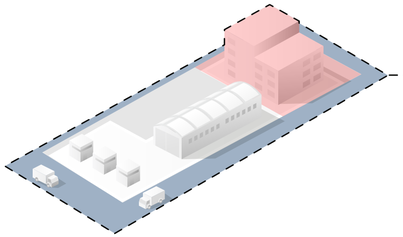
Once the favourable physical conditions for both residential and manufacturing typologies have been established, a site needs to be identified. This development can happen at a **block or site** scale. However, there needs to be moments of **exchange** throughout the development to develop true **harmony** between the two typologies. Regardless of scale, synergies that foster an exchange or sharing of infrastructure, labour, materials, training, and/or services must exist.

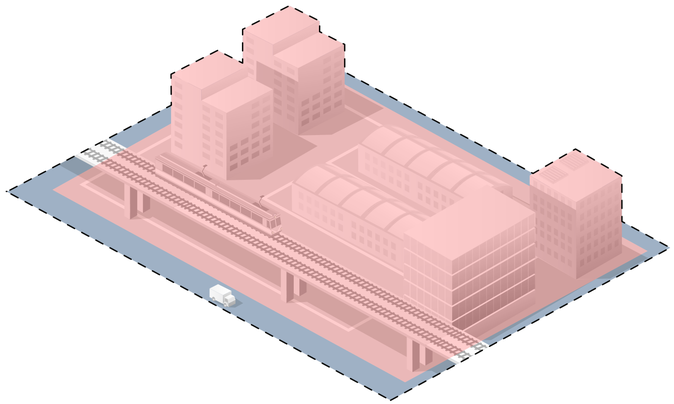
Manufacturing Mixed-Use Districts
Potential Sites
Building Footprint
Tax Lot Outline
Parks | Open Space
Residential Zone
Buffer Zones
Newtown Creek
Railway
Truck Route

Transit
Bus Routes
Bus Stops
Subway Stations
L Line
J/M Line
M Line



Lot vs Block



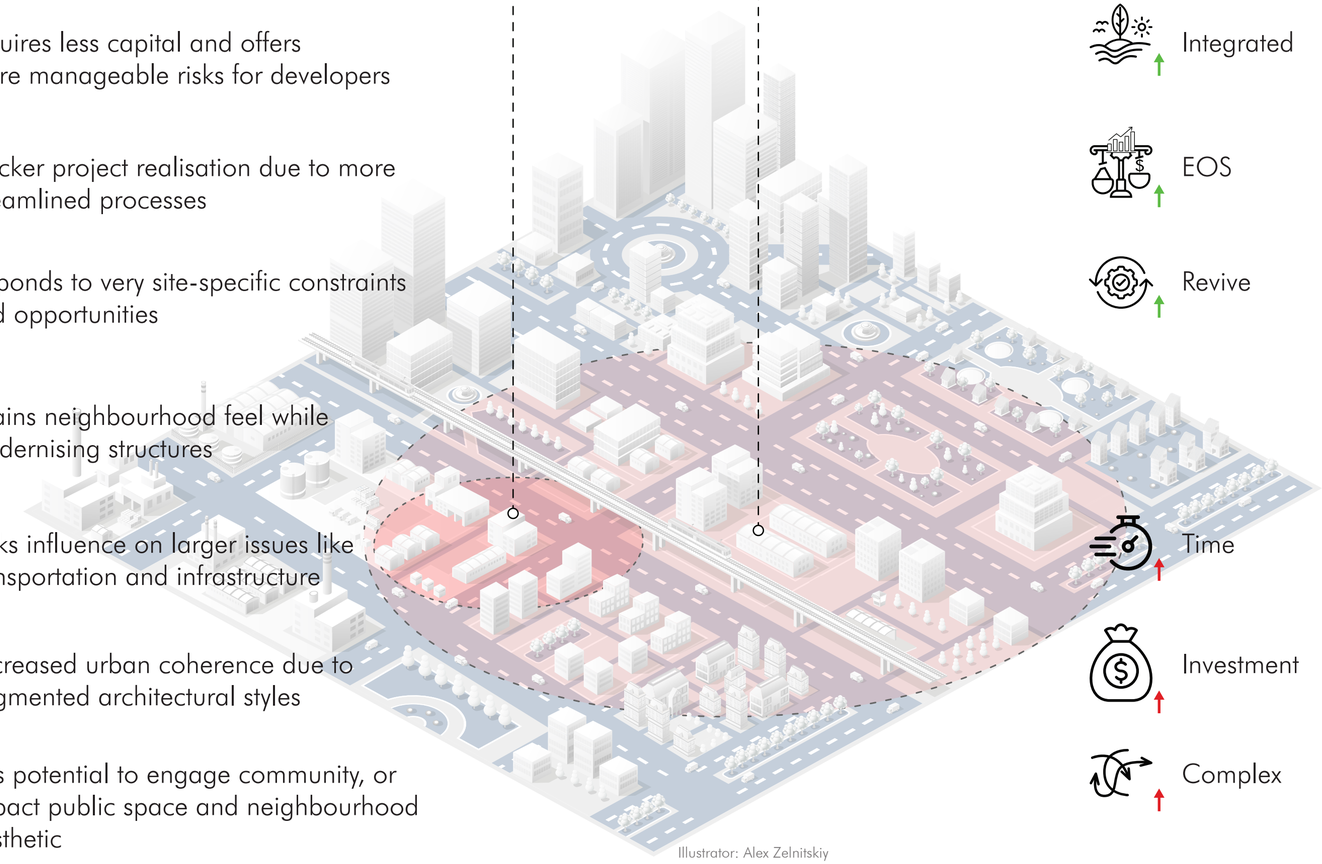


PROS

Investment	requires less capital and offers more manageable risks for developers
Speed	quicker project realisation due to more streamlined processes
Bespoke	responds to very site-specific constraints and opportunities
Character	retains neighbourhood feel while modernising structures

CONS

Scope	lacks influence on larger issues like transportation and infrastructure
Inconsistent	decreased urban coherence due to fragmented architectural styles
Impact	less potential to engage community, or impact public space and neighbourhood aesthetic

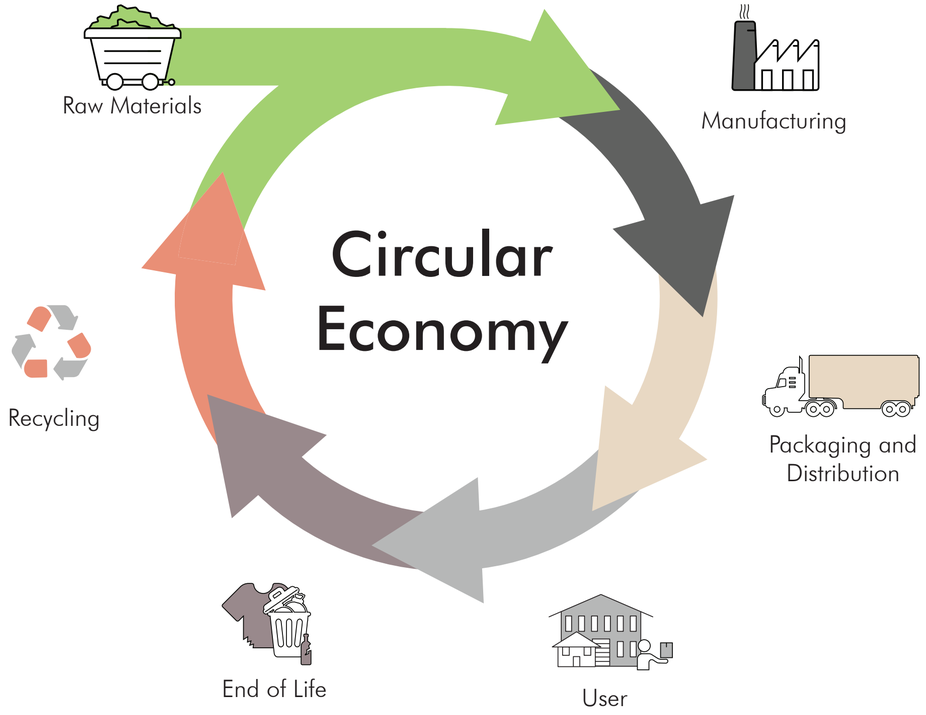


Illustrator: Alex Zelnitskiy

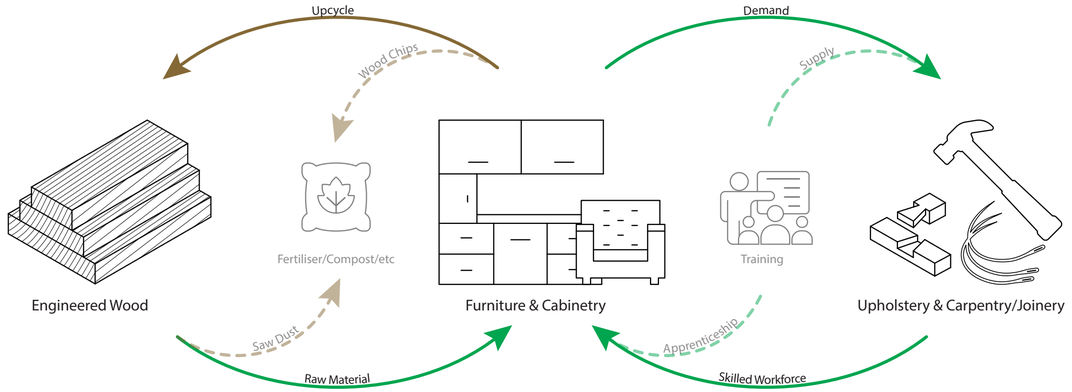
Integrated	creates cohesive relationship between buildings, infrastructure, green spaces, etc.
EOS	utilise Economies of Scale and distribute costs creating efficiencies across project
Revive	updates utility infrastructure improving sustainability and efficiency

Time	scope and regulatory requirements cause projects to take years
Investment	requires substantial capital with a great deal of financial risk
Complex	involves multiple stakeholders and regulatory bodies making project management harder

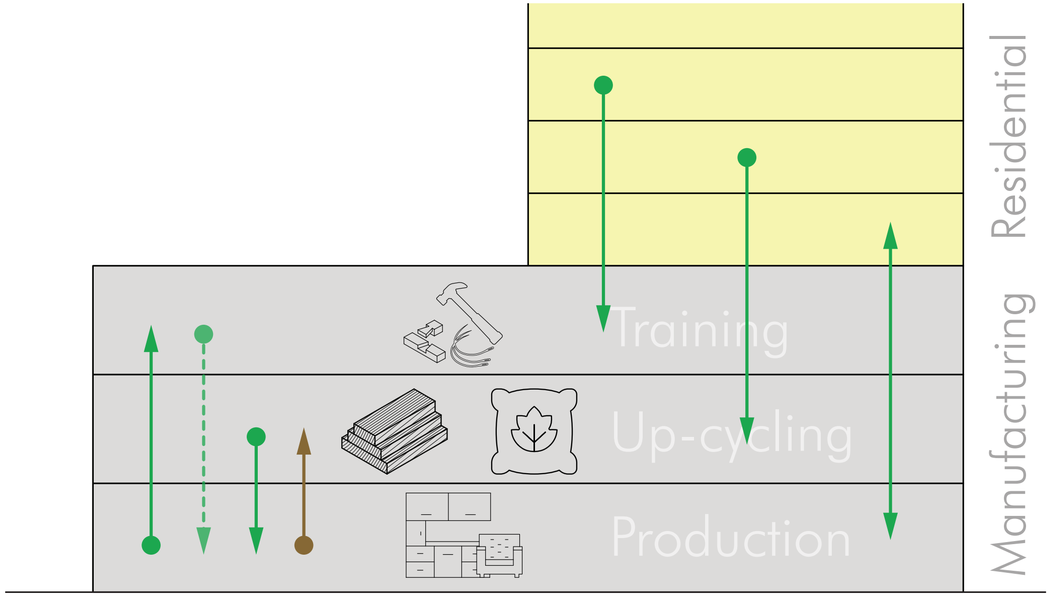
Identifying Industry - Lot



Development at the lot scale allows the opportunity to respond to **specific** needs. This does not mean much for housing, and traditionally, it did not mean much for manufacturing either. However, with the densification (stacking) of manufacturing processes, there is an opportunity to create **localised synergies** within a development that promotes exchanges. Regardless of scale, the aim is to create circular economies with less wastage and more upcycling, reducing the injection of raw materials and the burden it places on the environment.

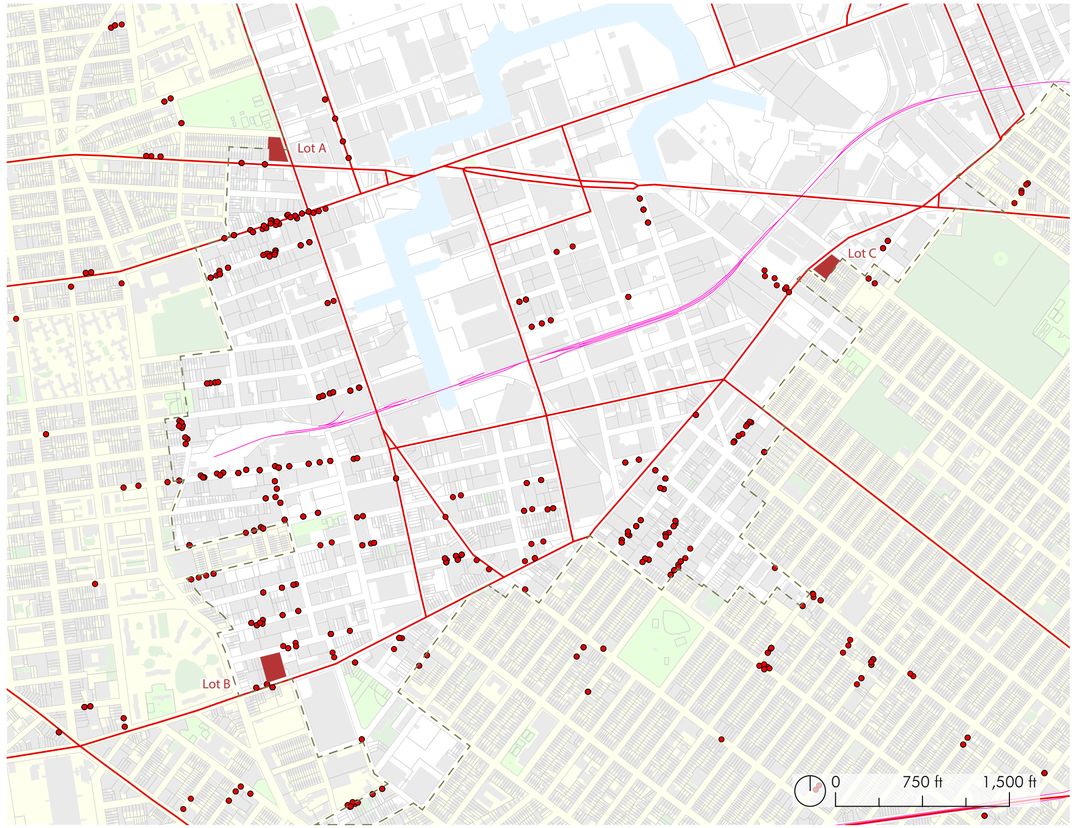


Lot-scale Manufacturing Synergies



Exchange Section Diagram

Loading Access Conditions - Lot

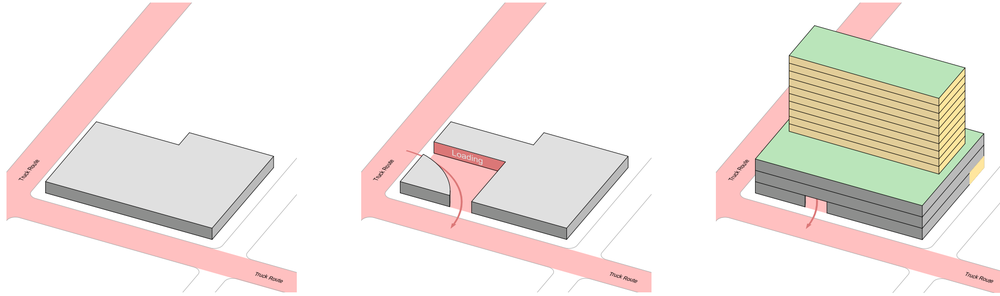


- Potential Sites
- Parks | Open Space
- Residential Zone
- Newtown Creek
- Railway
- Truck Route
- Loading Zones

Transportation and loading are **integral** parts of the manufacturing process. Street loading zones often contribute significantly to road **congestion**. By moving these loading zones into a site, the street becomes free to become parking or other pedestrian friendly uses. The study area provides a few conditions that can used as a benchmark for fostering efficient **on-site loading** operations.

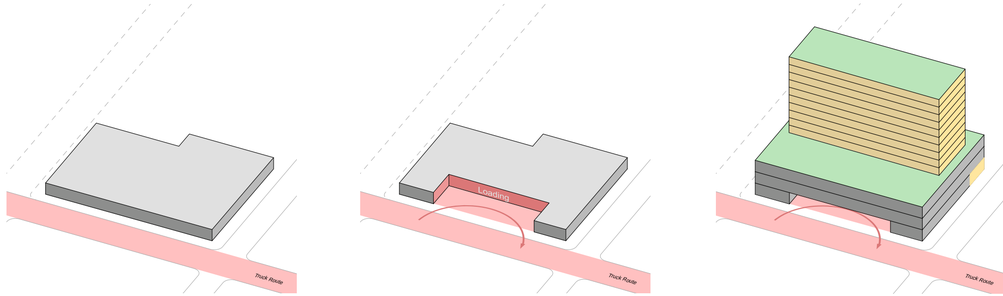
Condition 1 - Dual Access Corner

A corner lot with dual truck route access creates an opportunity to have a one-way lane through the site. It keeps traffic flowing and reduces the need for awkward manoeuvring of transportation vehicles. The space carved and left at the corner can be used as a pedestrian activator, providing space for small retail/commercial operations.



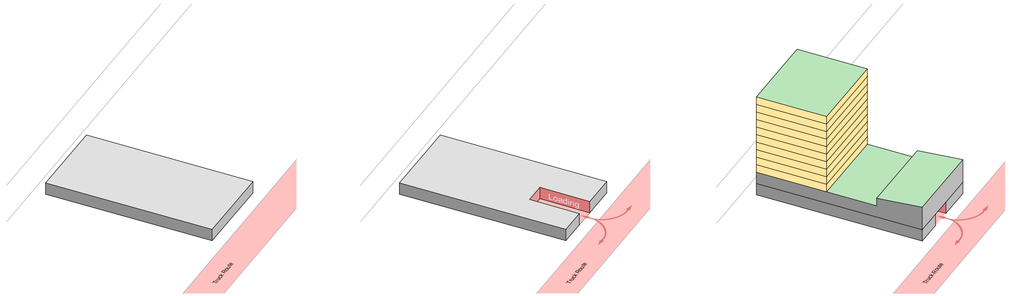
Condition 2 - Portico

Condition 1 is uncommon as most sites will offer one truck route access. In this case, a loading zone similar to that of many hotels can be borrowed and expanded to accommodate the large turning radii of trucks.

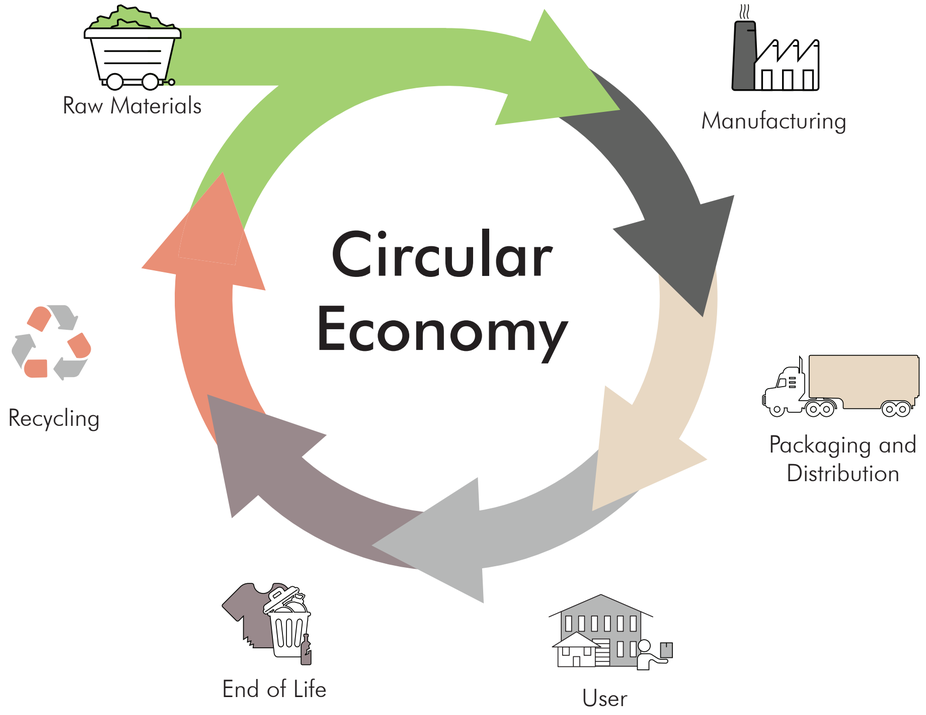


Condition 3 - Garage

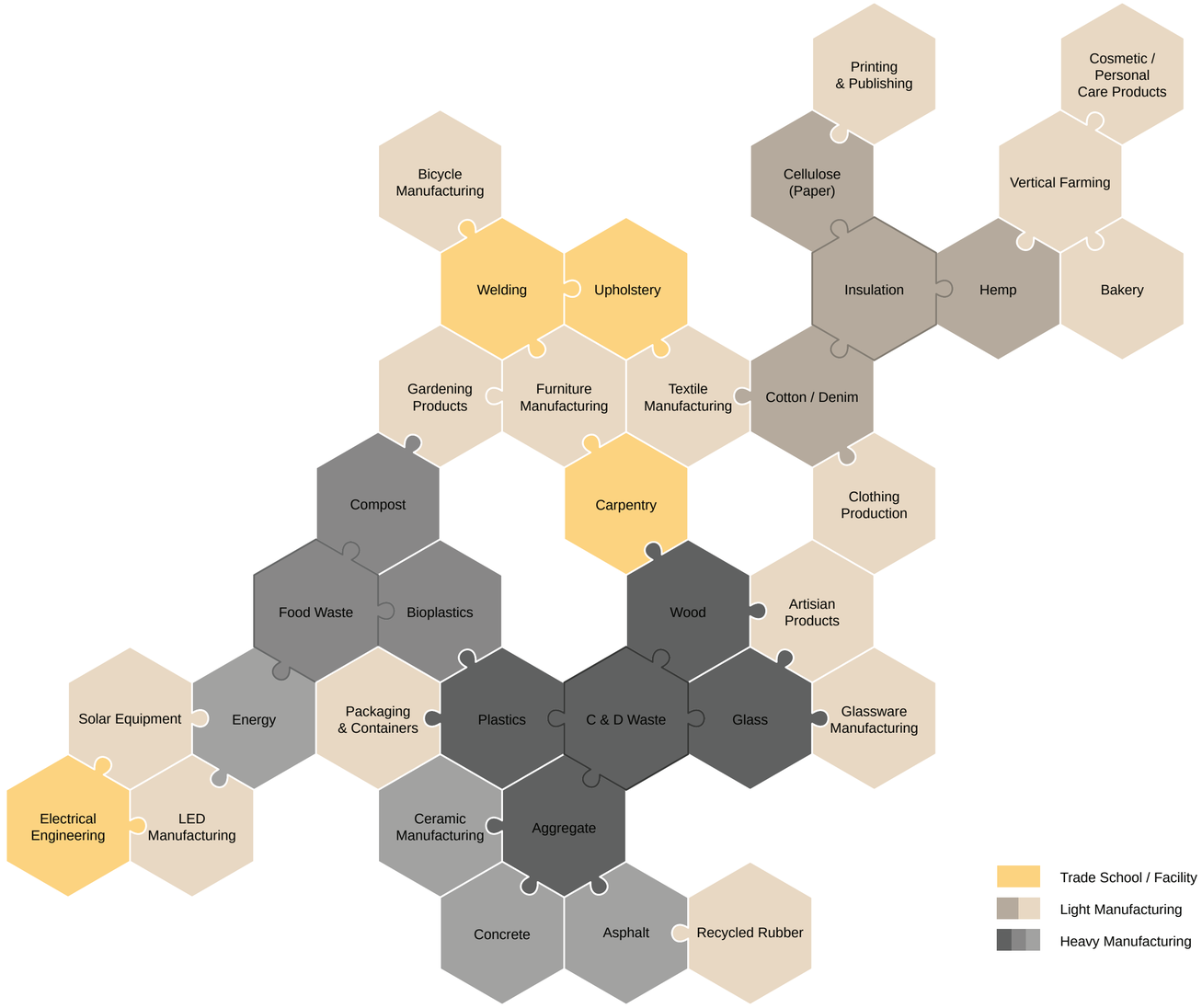
A more traditional approach can be taken for through-lots, especially if they are relatively narrow. Having a loading zone that trucks reverse into may cause momentary congestion while manoeuvring but, once parked, can go about their operations without impeding on street traffic.



Identifying Industry - Block

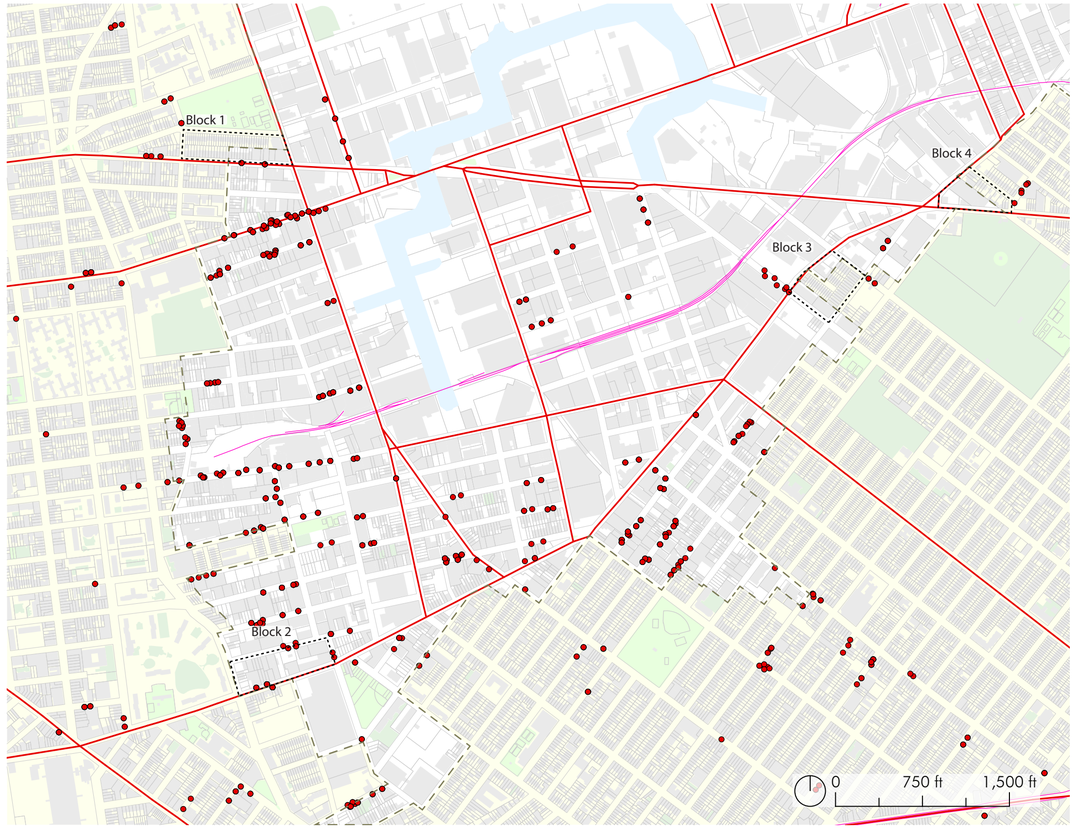


The impact of development at the block scale is far more **integrated** with infrastructure and impacts an even wider community. The synergies fostered in these developments can be pushed further to involve many more participants and create massive **circular** systems that impact regions. There will be more pooling of resources, more upcycling, less waste going to landfills, and even energy production. Although these projects are far more **complex**, time-consuming, and require massive investments, the long-term impacts of **improved** sustainability, economies of scale, and infrastructural improvements are undeniable.



Block-scale Manufacturing Synergies

Loading Access Conditions - Block



- Potential Sites
- Parks | Open Space
- Residential Zone
- Newtown Creek
- Railway
- Truck Route
- Loading Zones

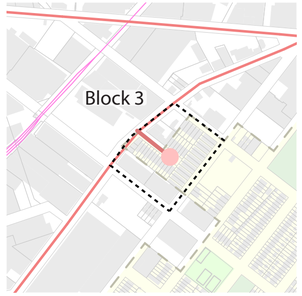
With a block development, loading processes will be **intensified**, giving an even greater importance to alleviating the street. A **pedestrian-friendly**, **congestion-free** street will likely be received well by community stakeholders, making the project more palatable.

Additionally, development at this scale allows for much greater **integration** on-site and regionally. The project can take advantage of rainwater harvesting, greywater systems, and even energy generation.

Condition 1 - Garage

At this scale there can be multiple garages that divide shipping and receiving into first and last-mile categories. This can further improve loading efficiency and operations. Garage conditions for this type will require a large amount of floor area to accommodate truck manoeuvring, much of which can be recovered on upper floors.

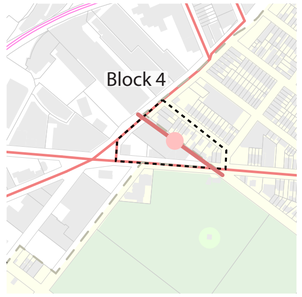


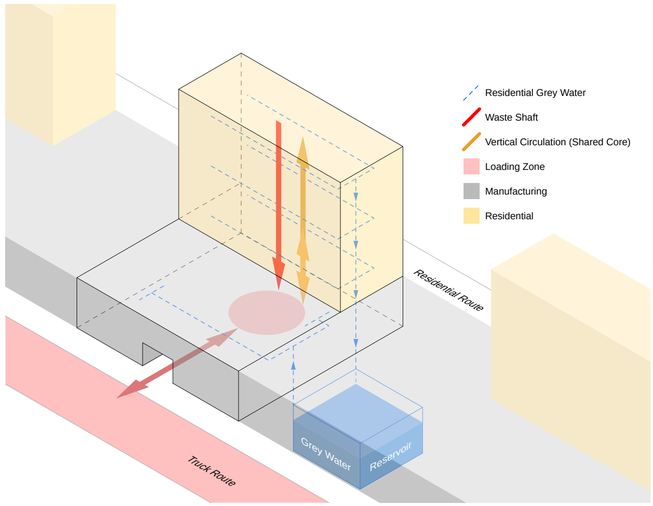


Condition 2 - Through Lane

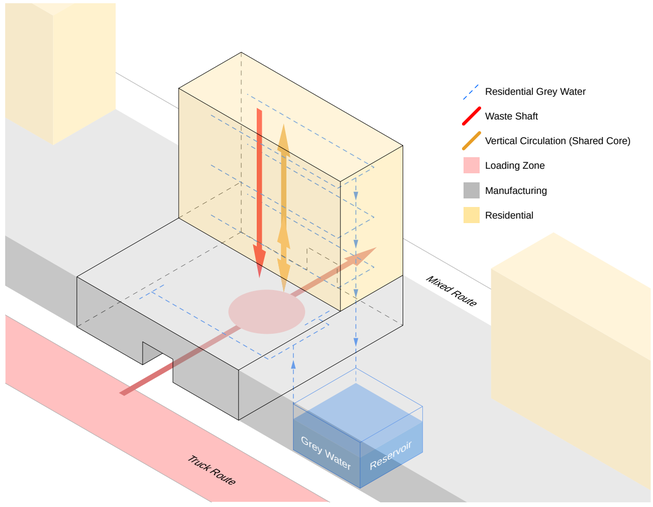
Through lanes will help limit the square footage used by loading processes. They can be beneficial in conditions that do not have an existing residential zone opposite to truck routes. If multiple lanes are possible, they can also be split into first and last-mile categories.



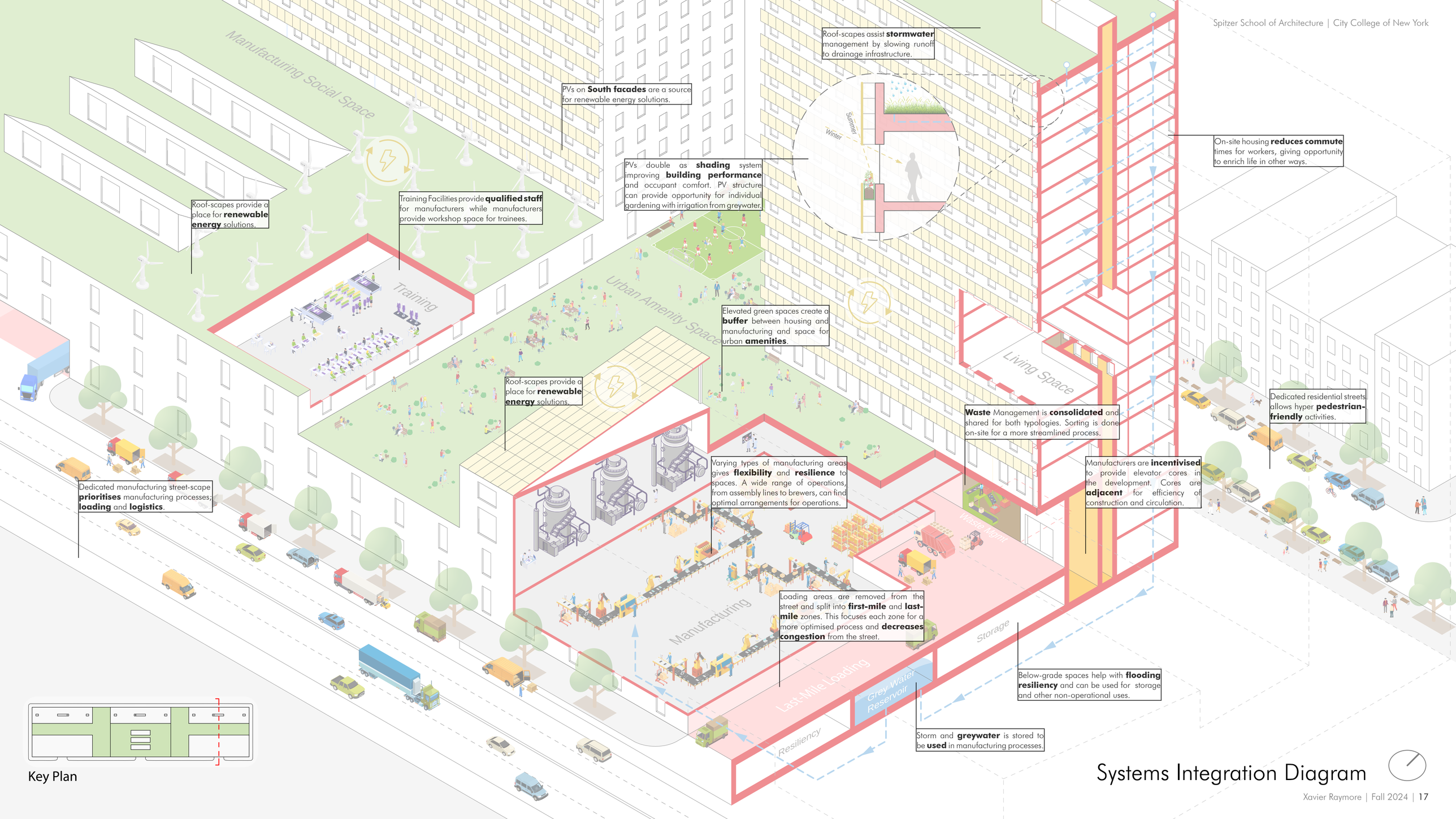




Loading & Systems Diagram 1



Loading & Systems Diagram 2

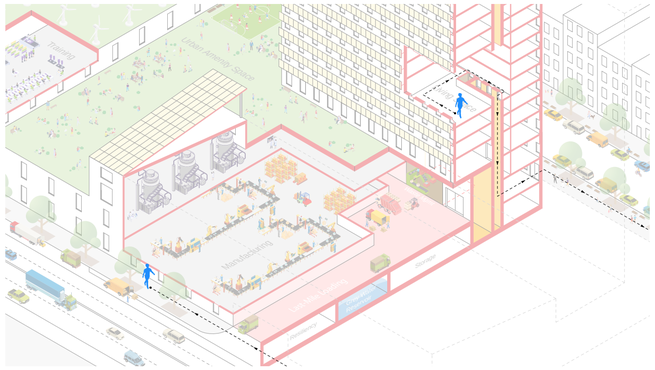


Key Plan

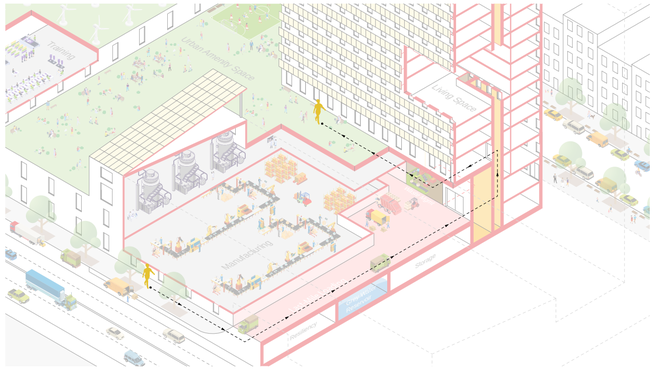
Systems Integration Diagram

Walkability

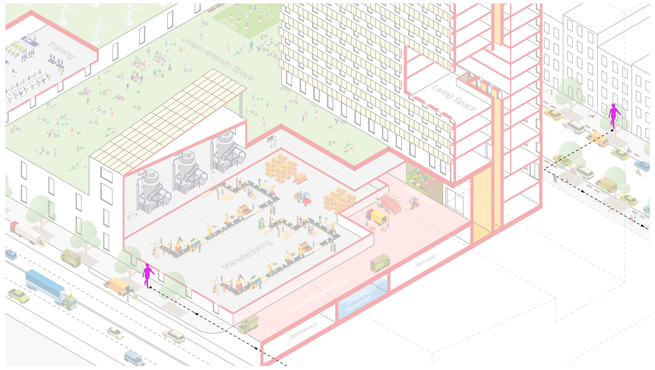
Mixed-use developments promote walkability by integrating residential and manufacturing/ commercial spaces. These adjacencies **reduce** the need for long commutes and promote pedestrian-friendly environments. This has several advantages, like reducing transportation costs and **lowering carbon emissions**. Living close to work also improves quality of life, enhances work-life balance, and boosts community interaction. Walkable neighbourhoods create vibrant, interconnected communities that support local businesses and strengthen social cohesion.



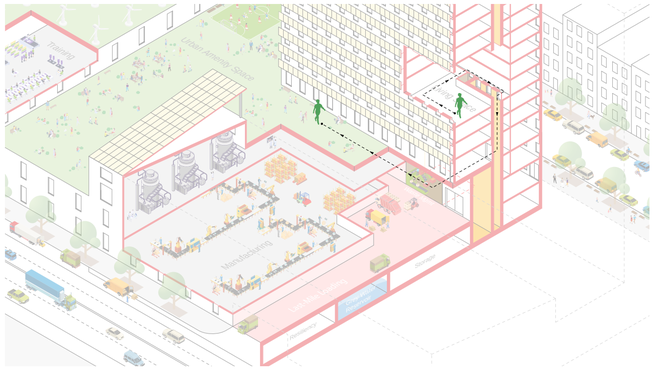
Work - Home 10-15 mins.



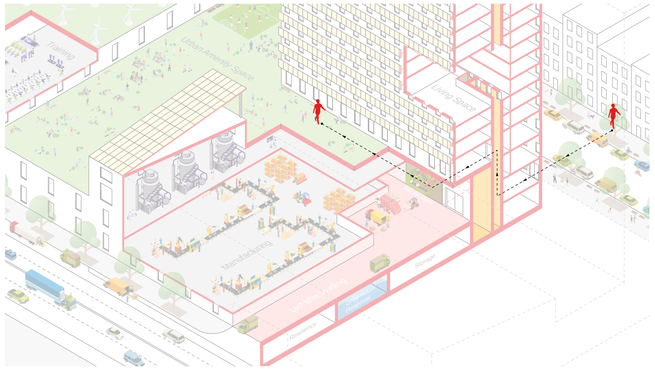
Work - Amenity 05-10 mins.



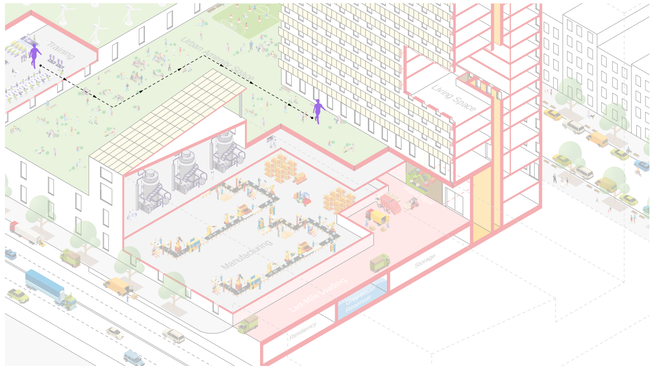
Work - Home (Off-site) 15-20 mins.



Home - Amenity 05-10 mins.



Amenity - Home (Off-site) 10-20 mins.



Training - Amenity 01-05 mins.

Imagining Spaces

So, what do spaces in this light manufacturing mixed-use development look like?

The images on the right offer a glimpse into the lived experience within the highlighted areas of the diagram. These visual representations help translate abstract concepts into relatable, human-scale environments. These images help **imagine** the interactions, activities, and atmosphere of the spaces within this manufacturing mixed-use development by showcasing how people might navigate, inhabit, or engage with the built environment.



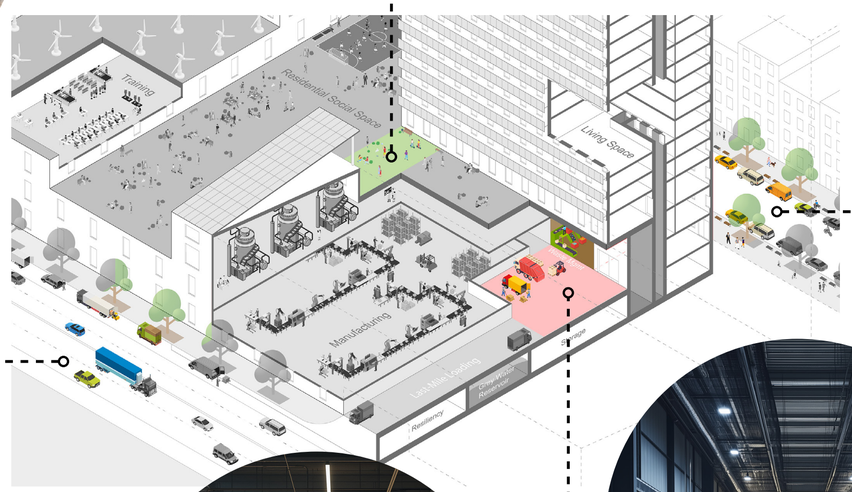
Rooftop (Zen) Garden



Rooftop Park and Playspace



Pedestrian-friendly Street-scape





Retail/Residential Street-scape



Purely Manufacturing Street-scape



Manufacturing/Commercial Street-scape

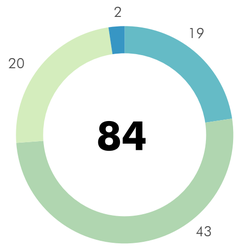


Last-Mile Loading Zone



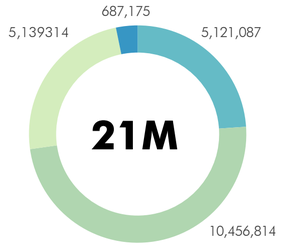
First-Mile Loading Zone

City-wide Simulation



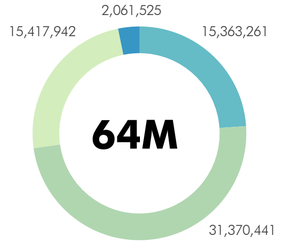
Total: 84

Number of Sites



Total: 21,404,390 (Sq. Ft.)

Manufacturing Capacity



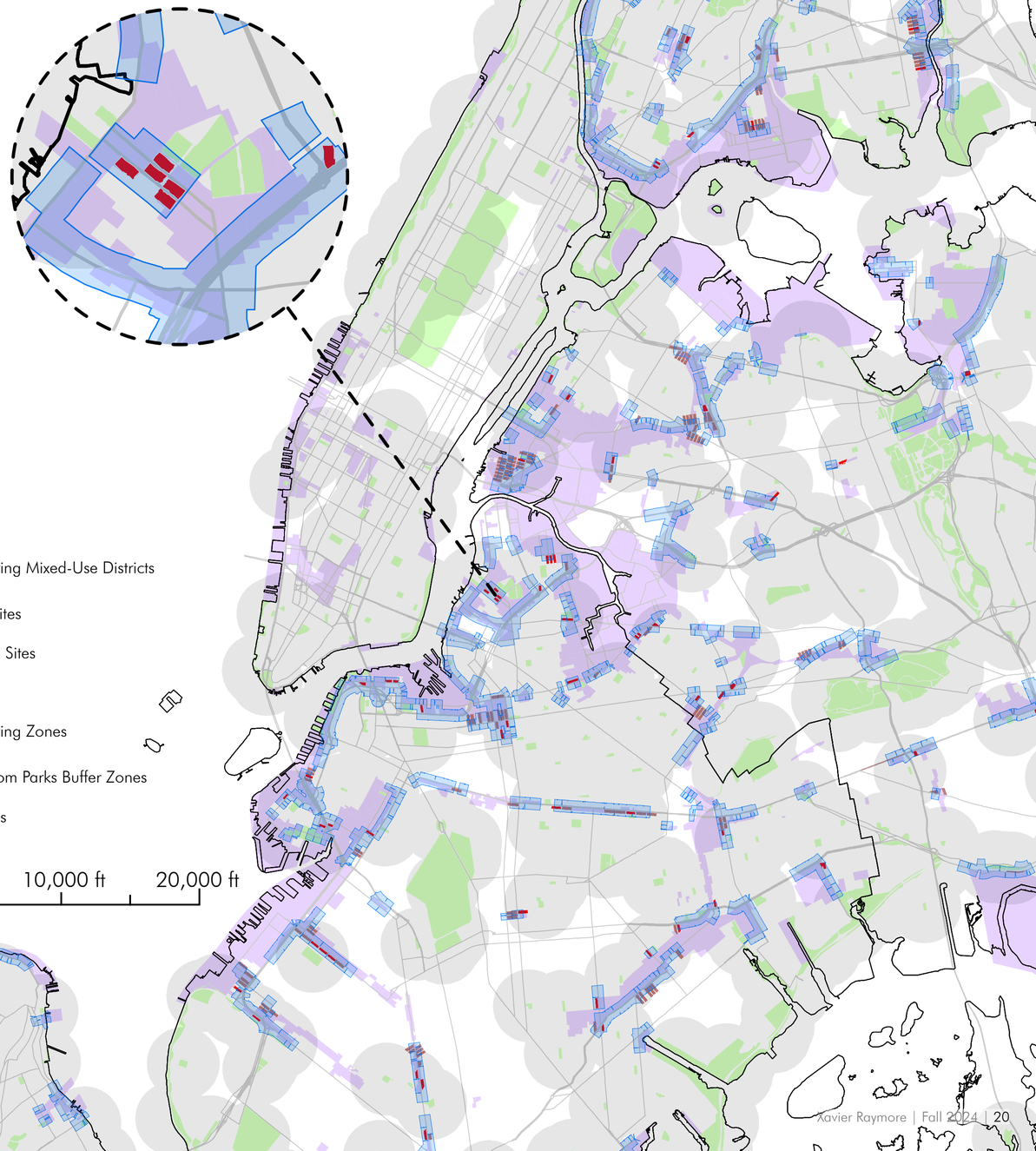
Total: 64,213,169 (Sq. Ft.)

Residential Capacity

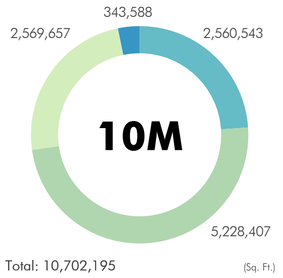
Bronx
Brooklyn
Queens
Staten Island

Once these developments are mastered at the neighbourhood scale, there can be considerations for **city-wide** implementation. To get the City of New York involved, there must be tangible **evidence** of the potential to impact the lives of many positively. This project does so by **asking** and answering the following questions:

i. How many areas across the city meet the zone parameters established?
ii. How many sites within those areas are genuinely suitable for development based on the physical parameters established for both residential and manufacturing?
iii. How many jobs can these developments provide?
iv. How many housing units can these developments produce?

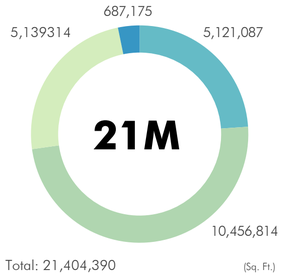


City-wide Simulation



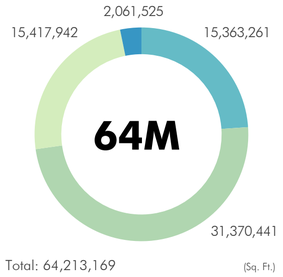
Total: 10,702,195 (Sq. Ft.)

Site Sizes



Total: 21,404,390 (Sq. Ft.)

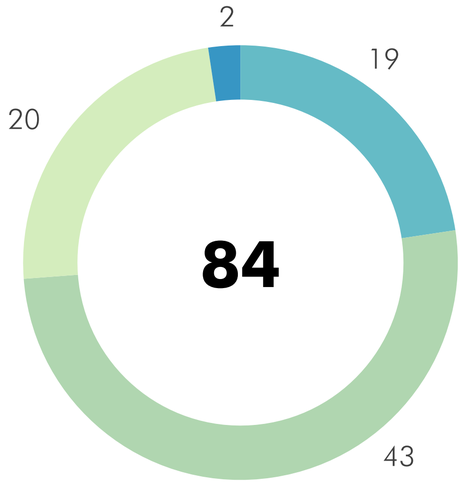
Manufacturing Capacity



Total: 64,213,169 (Sq. Ft.)

Residential Capacity

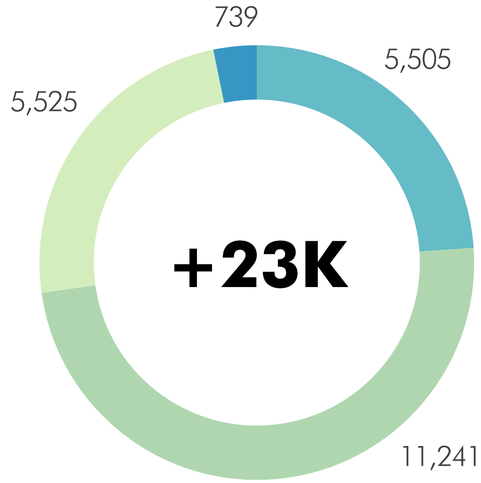
Bronx
Brooklyn
Queens
Staten Island



Total: 84

Number of Sites

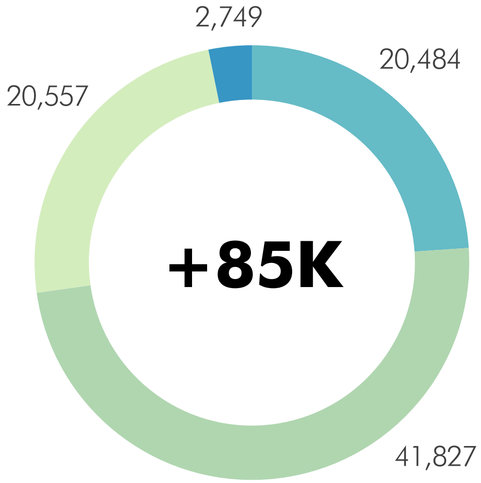
Considering everything, there are about 84 sites across the Bronx, Brooklyn, Queens, and Staten Island that can produce over **21 million** and **64 million** square feet of space for **residential** and **manufacturing** uses, respectively.



Total: 23,009

Manufacturing Jobs

With over 21 million square feet, the City can continue strengthening its **robust** industrial sector by dedicating more space to these processes. Many light manufacturing activities, such as food production, small-scale assembly, or craft making, often require **minimal** formal education or specialised skills. With this space, an estimated **23,000+** jobs can exist, providing employment opportunities to sections of communities that may face employment barriers.



Total: 85,618

Housing Units

The City will only continue to face **challenges** with housing as people flock in search of opportunities. The potential 64 million square feet that this initiative can create is a step towards **alleviating** the strain caused by current and future populations. A whopping **80,000+** housing units can be created across the four boroughs, improving housing stock, reducing homelessness, and improving the quality of lives of many.

Assumptions

Average Industrial space per employee	930 SF	Block Size	80,000 - 200,00 SF
Average size of housing unit	750 SF	Minimum Park Size	80,000 SF
Manufacturing FAR	2.0	Maximum Distance from Parks	0.5 mi / 10 min walk
Residential FAR	6.0		

Spitzer School of Architecture
City College of New York
Fall 2024

Xavier Raymore

Special Thanks To:

NYC Department of Design and Construction
Town + Gown

NYC Department of Sanitation