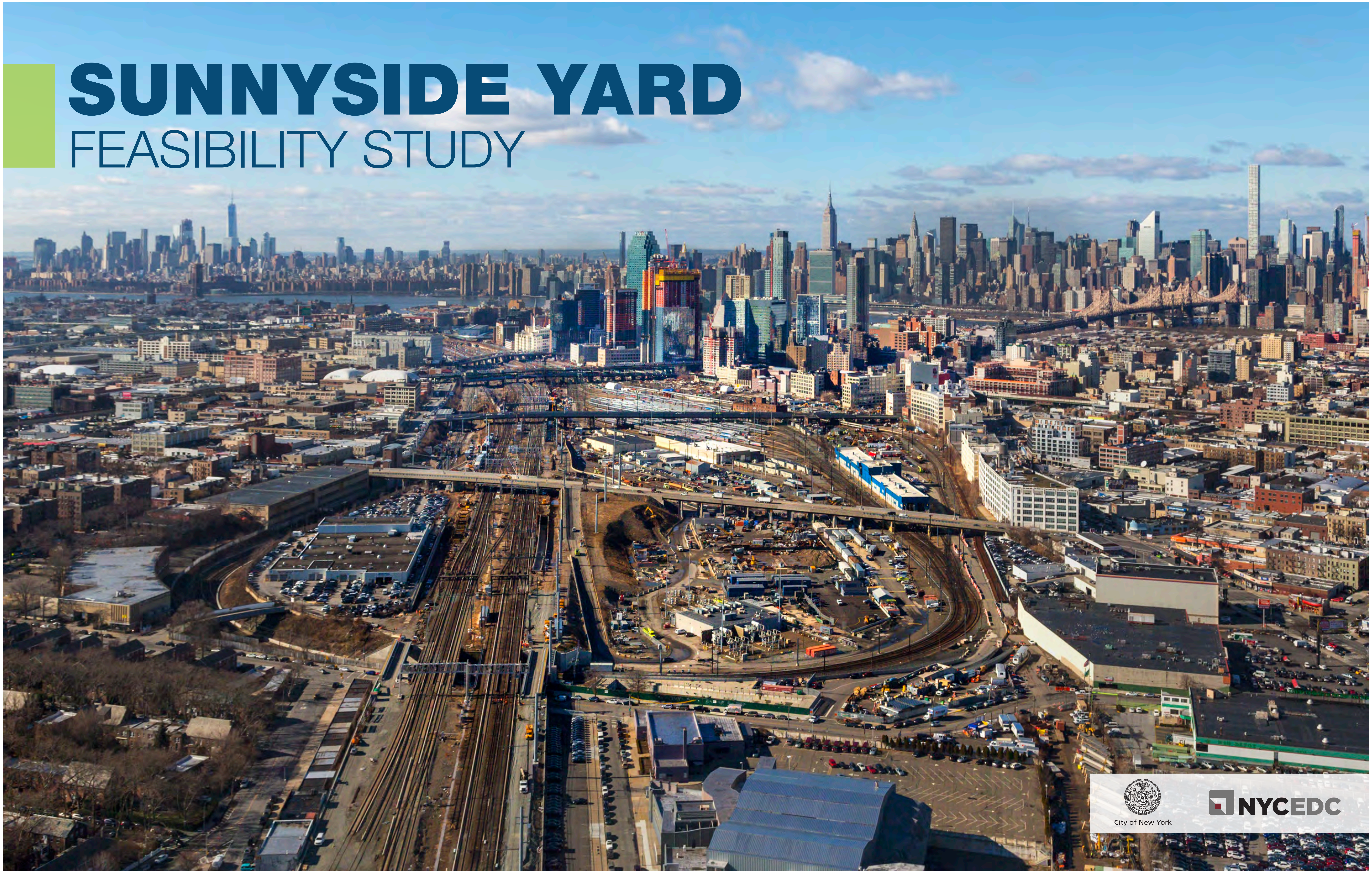
SUNNYSIDE YARD
FEASIBILITY STUDY



City of New York NYCEDC

February 6, 2017

New York City is in the midst of a period of unprecedented growth. Our population has reached a record 8.5 million, and current projections estimate that it will reach an astonishing 9 million before 2040. That growth has helped make the City an even more dynamic place to work, learn, and play, but it has also placed new stress on the core infrastructure serving the City and the region.

At the same time, land has become increasingly scarce. Opportunities to expand the transportation infrastructure we need to move our workforce and the housing stock necessary to shelter our residents are few and far between. The public sector must reach for new and innovative solutions to meet our needs.

In Western Queens, there remains one of New York City's last great opportunities to solve many of these challenges in one place. Sunnyside Yard is a 180-acre site that houses essential rail operations for Amtrak, the MTA, and NJ Transit. It has also divided communities in Queens for decades. In early 2015, Mayor de Blasio announced that the City would analyze the feasibility of taking on the mammoth task of decking over Sunnyside Yard to build a new, fully planned neighborhood in the heart of Queens – all while allowing rail operations to continue underneath. Since the Mayor's announcement, the City has worked with Amtrak to study the future of Sunnyside Yard. This study is the result of that collaboration and represents a comprehensive and detailed assessment of the technical, planning, and financial considerations of building atop Sunnyside Yard.

We thank the many community members, elected leaders, public agencies, and other stakeholders who informed this study. We look forward to continuing our work together to explore an opportunity with the potential to prepare New York City for the next century.

Sincerely,

Alicia Glen

Deputy Mayor for Housing and Economic Development

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LEAD AGENCIES

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A Guide to Using this Feasibility Study

This report provides a comprehensive framework to assess the feasibility of a Sunnyside Yard overbuild. The decision to advance such a large and complex project must take into consideration whether financial, social benefits, and improvements to the built environment outweigh the risks and costs of development.

The chapters of this report are organized to address the engineering, economic, and urban design challenges of an overbuild development at Sunnyside Yard. The first part of the report, Chapters 2-Offsite Conditions, 3-Onsite Conditions, and 4-Overbuild Guidelines, describe the context of the study, technical facts, physical constraints of building over an active railyard, and strategies to optimize feasibility. The second part of the report, Chapter 5-Program Alternatives, describes and tests three development scenarios, each with a different programmatic focus, to evaluate feasibility and identify phasing strategies.

Chapter 1: Executive Summary

An overview of the opportunities, challenges, and findings of the Feasibility Study.

Chapter 2: Offsite Conditions

An assessment of the economic, urban design, and infrastructure context of the neighborhoods surrounding Sunnyside Yard.

Chapter 3: Onsite Conditions

An evaluation of current and planned conditions at Sunnyside Yard, including key physical attributes and future railroad operations.

An examination of engineering concepts and parameters that determine where and how a deck can be constructed above Sunnyside Yard.

Chapter 4: Overbuild Guidelines

Key findings from testing alternative development programs from the perspectives of engineering, economics, and urban design.

Chapter 5: Program Alternatives

Three test case programs that define a range of scenarios and strategies for an overbuild.

Broad urban design guidelines to describe the test case programs.

An analysis of the costs required for overbuild development.

An assessment of the value of onsite development, including whether it could offset both the aggregate costs of construction and necessary onsite and offsite infrastructure improvements.

Chapter 6: Conclusions

Strategies to optimize feasibility.

Next steps to guide the implementation of the project.

Identification of risks and challenges.

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Chapter 1: Executive Summary

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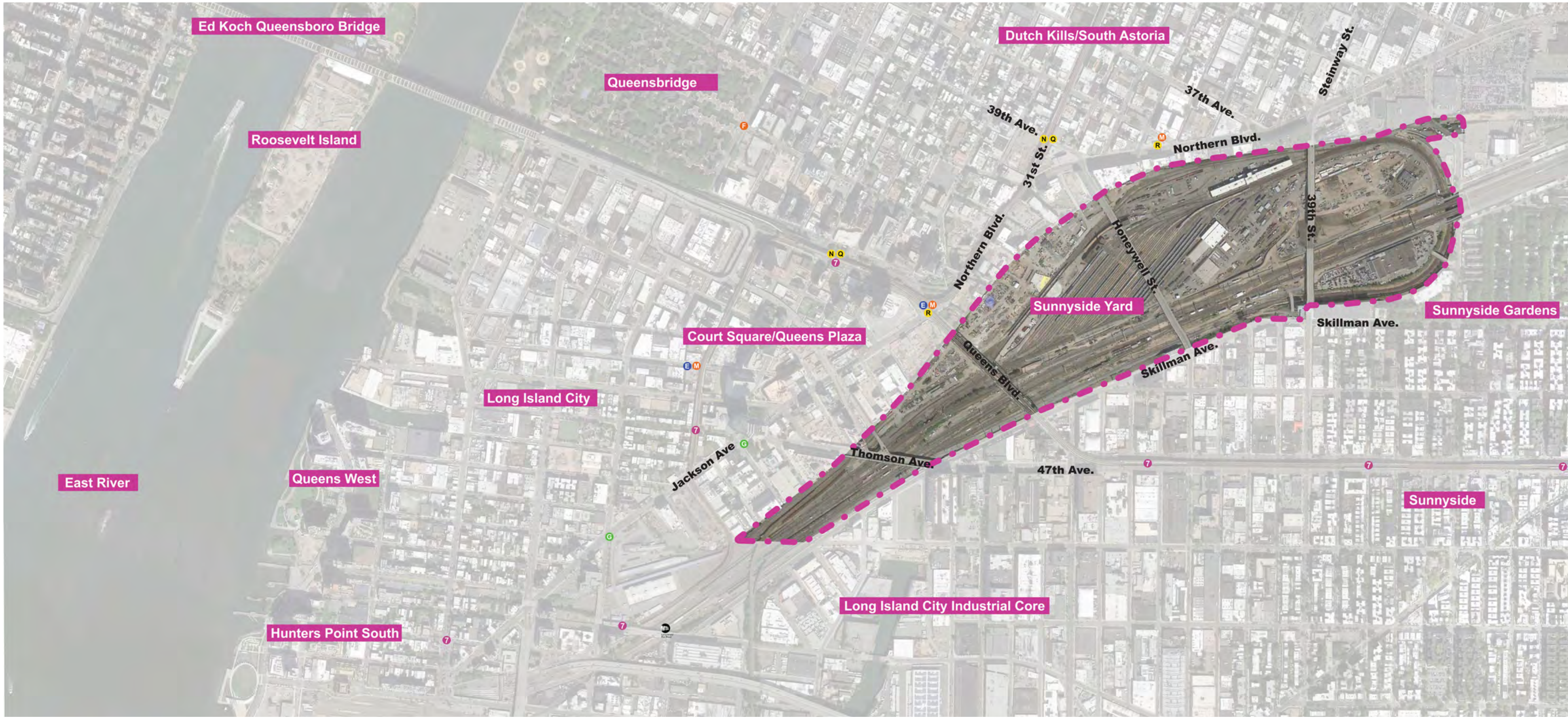


FIGURE 1.1: SUNNYSIDE YARD IN CONTEXT

The Pennsylvania Railroad first opened Sunnyside Yard in 1910. It now covers approximately 180 acres, is over 8,000' long, and varies in width from 400' to 1,500'. It is a key train storage yard and maintenance hub for Amtrak's Northeast Corridor, and serves New Jersey Transit and Long Island Rail Road, which is developing storage tracks and maintenance facilities there as part of its East Side Access Project.

A. Introduction

The Sunnyside Yard Feasibility Study identifies key considerations and planning principles to inform future decision-making with regard to a Sunnyside Yard overbuild. For the purposes of this study, feasibility was evaluated under the perspectives of engineering, economics, and urban design to inform the development of planning principles. If implemented in a coordinated fashion, these planning principles would guide the creation of a neighborhood that integrates with the surrounding urban context, generates substantial public and economic benefits for New York City (the "City") at large and western Queens, and facilitates unimpeded operations of one of the country's busiest rail yards. (Figure 1.1, Figure 1.2) Collectively, these planning principles provide a development framework for a potential overbuild at Sunnyside Yard that could feasibly address engineering, economic, urban design, and public policy considerations.

Overbuild development in Sunnyside Yard has been discussed for nearly a century. Studies in recent decades have suggested a range of potential development opportunities, but none have comprehensively addressed railroad operation constraints, structural engineering requirements, existing infrastructure capacity, market conditions, and urban design standards in a cohesive manner. This study is the first to assemble the data and analyses necessary to integrate engineering, economics, and urban design into a single, systematic assessment.

An iterative process, which modified physical and programmatic configurations in response to financial and engineering analysis, informed the development of these planning principles. Multiple options and scenarios were tested. Although complex constraints narrow the range of alternatives, the three test cases presented in this study are by no means the only potential overbuild scenarios at Sunnyside Yard. The analysis of data and resulting principles provide a resource to inform future planning and decision-making.

The feasibility of an overbuild at Sunnyside Yard is influenced by several factors that are in flux. Rail traffic in Sunnyside Yard is expected to significantly increase in coming years and both Amtrak and the Metropolitan Transportation Authority (MTA) plan to implement reconfigurations of tracks and rail operations. As these and other projects progress, they will need to take into consideration a potential overbuild to preserve project feasibility. This study's findings can aid the initial coordination necessary between multiple ownership entities for a future overbuild at Sunnyside Yard.

B. The Study

The goal of this study is to identify a set of principles to guide feasible development from the perspectives of engineering, economics, and urban design. For the purposes of this study, feasibility was defined as follows:

- **Engineering - Rail operations and structural considerations:** A conceptual structural system for overbuild, above an active and expanding railyard, capable of supporting development and minimizing impact on rail operations.
- **Economics - Market demand and real estate development parameters:** Development strategies that leverage value, minimize costs, and generate economic and public benefits for the City and surrounding neighborhoods.
- **Urban Design – Surrounding communities and planning standards:** A framework that complements the existing adjacent neighborhoods, allows mixed-use districts to be phased over time, and meets policy goals across a fully developed project.

Three test cases were developed to explore the feasibility of different programs. All test cases include a significant proportion of residential use but vary in focus:

- Test Case 1 (Residential)
- Test Case 2 (Live/Work/Play)
- Test Case 3 (Destination)

While the three test cases varied in mix of uses, program and phasing, each were aligned with the following public policy objectives:

- Create housing options for low- and moderate-income New Yorkers, new office space to support local and citywide employment growth, and venues for community and cultural uses;
- Serve local neighborhoods and help accommodate ongoing growth;
- Produce mixed-income, mixed-use communities, including schools, libraries, police and fire stations, and other community amenities;
- Promote significant public parks, open spaces, recreational facilities, and a connected network of green streets and pedestrian routes; and
- Respect and respond to existing neighborhood contexts and improve physical connections between the neighborhoods of western Queens.

FIGURE 1.2: SUNNYSIDE YARD: EXISTING CONDITION

A summary of the test case programs is illustrated in Figure 1.3. Given the preliminary nature of the program definition, all program assumptions are expressed as ranges.

The evaluation of the three distinct test cases provides the analytical framework to test strategies for minimizing impacts on railroad operations, improving financial feasibility, supporting integrated mixed-used urban design, and achieving public policy objectives. The collective analysis of the three test cases resulted in certain conclusions, considerations, and principles such as:

- Potential locations for columns and walls that support an overbuild with a full range of structures and uses without impacting rail yard activity;
- Overbuild coverage area, building typologies, and structural systems that address complex engineering requirements in the most efficient manner;
- Access point and street-grid strategies that support overbuild and connect, integrate, and respond to surrounding neighborhoods; and
- Phasing considerations that take into account market demand and absorption and coordinate with Amtrak's planned improvements at Sunnyside Yard, pursuant to their 2014 Master Plan.

	Test Case 1 Residential	Test Case 2 Live/Work/Play	Test Case 3 Destination
Residential	18.0 M – 24.4 M	14.2 M – 19.3 M	16.3 M – 22.0 M
Total # of Residential Units	18,000 – 24,000 units	14,000 – 19,000 units	16,000 – 22,000 units
30% Affordable Units**	5,400 – 7,200 units	4,200 – 5,700 units	4,800 – 6,600 units
Class A Office	0	3.5 M – 4.8 M	0
Creative Office	0	600 k – 800 k	0
Neighborhood Retail	700 k – 900 k	500 k – 700 k	600 k – 800 k
Mixed-Use	200 k – 300 k	110 k – 150 k	1.1 M – 1.5 M
Community Facilities/Schools	1.5 M – 2.0 M	1.0 M – 1.4 M	1.1 M – 1.5 M
# of Schools	13 – 19 schools	10 – 14 schools	10 – 14 schools
Higher Education	0	1.0 M – 1.4 M	0
Parking	700 k – 1.0 M	1.0 M 1.3 M	1.2 M – 1.6 M
# of Parking Spaces	2,400 – 3,300 spaces	3,300 – 4,500 spaces	3,900 – 5,300 spaces
Total Floor Area	**21.1 M – 28.6 M**	**22.0 M – 29.8 M**	**20.3 M – 27.4 M**
Open Space	38 – 52 acres	37 – 50 acres	31 – 42 acres

FIGURE 1.3: TEST CASE AREA COMPARISON*

* All numbers are in total square feet unless otherwise noted.
** Affordable housing follows MIH guidelines

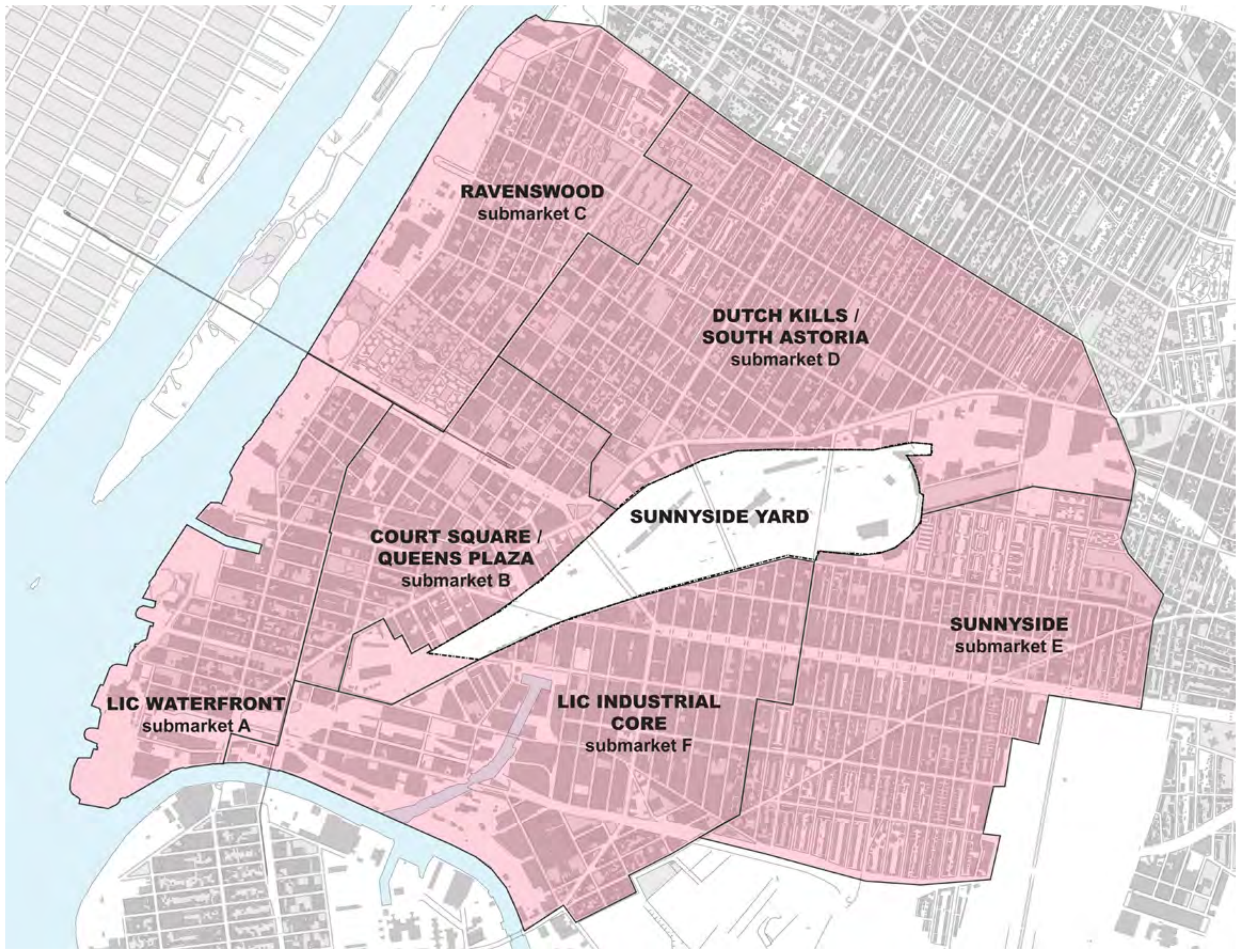


FIGURE 1.4: STUDY AREA

C. Context

Assessing the feasibility of an overbuild at Sunnyside Yard requires consideration of both offsite influences and onsite constraints. The offsite contextual considerations include adjacent neighborhoods, transportation and utility infrastructure, and market conditions. The onsite constraints consider ownership and railroad operations, including the Amtrak Master Plan.

Adjacent Neighborhoods

Sunnyside Yard is located at the confluence of four distinct neighborhoods. (Figure 1.4) A wide range of land use patterns and neighborhood characteristics comprise the "Study Area," defined as a one-mile radius from Sunnyside Yard. These characteristics include:

- Rapid transformation from an industrial area to a mixed-use, multi-story residential neighborhood in the areas to the west, including Long Island City;
- A range of multi-story commercial loft buildings and single-story industrial uses in Dutch Kills/South Astoria and Greater Sunnyside to the north and southeast of Sunnyside Yard, respectively;
- Traditional office uses clustered around Queens Plaza; and
- Tracts of low-rise, one- to three-family row houses in many parts of the Study Area.

Where development is taking place, new high-rise towers are altering the built environment and urban experience. These trends are resulting in new demand for the services and conveniences that typically exist in dense residential neighborhoods. The need for schools is increasing, as is the community's desire for parks, public space, and retail amenities.

Transportation and Utility Infrastructure

A combination of subways, commuter rail, and transit buses are available close to all sections of Sunnyside Yard, with the greatest access provided at the western half of Sunnyside Yard. Key infrastructure elements include:

- Eight MTA subway lines serving approximately 13 subway stations or complexes are located within the study area and walking distance to the project site.
- Many MTA bus routes either stop within or pass through the Study Area.
- With the exception of subway and parking capacity, transportation in and around the Sunnyside Yard Study Area is generally available, accessible, and at or below capacity under current conditions.
- Pedestrian routes operate effectively, the bicycle network is generally well connected, and levels of service for vehicular traffic are generally acceptable.
- Existing utility infrastructure is well developed and is generally adequate for current land uses and new development in areas surrounding Sunnyside Yard; however, some infrastructure, particularly sewer and water supply systems, is aging and may not have adequate capacity to meet future demand.

Market Conditions

The Study Area is home to approximately 5% of Queens' residential population, the largest employment hub in western Queens, and an anchor of the City's industrial economy. Submarkets to the west of Sunnyside Yard are experiencing significant new residential development, while elsewhere in the Study Area, little new residential real estate development has taken place. For commercial properties, increased job growth is spread across a range of industries and building types, including newly-constructed Class A office space and adaptively reused space. Key factors driving the development of the Study Area include:

- Much of the population surrounding Sunnyside Yard is concentrated in principally residential submarkets to the east of Sunnyside Yard, with nearly half residing in the Dutch Kills/South Astoria and Sunnyside submarkets.
- The current base of 9,000 units built since 1999 and is forecasted to increase by an additional 14,500 units over the next eight years.
- Since 2002, employment has increased by 25% and the area is recognized as one of the City's most significant non-Manhattan employment centers.
- Neighborhood retail in the LIC Waterfront submarket is generally competitive with other submarkets along the Brooklyn-Queens waterfront and minimal shopping district retail exists in either Western Queens or North Brooklyn.

Size and Ownership

The Sunnyside Yard Feasibility Study focuses on the identified Study Area, which includes approximately 180 acres of Sunnyside Yard located to the east of 47th Avenue. Key features of the Yard:

- Sunnyside Yard is more than six times the size of Hudson Yards, twice the size of the Battery Park City, and 30 acres larger than Roosevelt Island.
- The Amtrak Northeast Corridor and the Long Island Railroad ("LIRR") Main Line run through the spine of the Yard and are operational at all times.
- Yard ownership is spilt among four parties: Amtrak, which owns most of Sunnyside Yard, MTA which owns the northern and western parcels, the City which owns the air rights above the MTA-owned properties, and General Motors which owns its facility located in the southeastern section of the Yard. (Figure 1.5)
- If constructed, an overbuild above Sunnyside Yard would be the largest and most complex urban development site in New York City.

Railroad Operations and Amtrak Master Plan

Sunnyside Yard is currently one of the country's busiest rail yards. Multiple railroad entities actively use the space for operations, storage, and maintenance. Future plans by MTA/LIRR, Amtrak, and New Jersey Transit ("NJT") to upgrade the rail facilities will intensify this activity. Key considerations influencing railroad operations:

- Currently, Sunnyside Yard has 32 active storage tracks.
- Harold Interlocking, a major railroad junction serving the tracks within the Yard, routes trains from Pennsylvania Station to either the Northeast Corridor or the LIRR Main Line.
- Amtrak is one of the major users of the Yard, and Sunnyside Yard is a key train storage yard and maintenance hub for their Northeast Corridor operations.
- At Sunnyside Yard, Amtrak stores and services its Northeast Corridor trains, utilizes its high-speed rail (HSRF) maintenance facility for Acela service, and operates a commissary building for preparing onboard food and beverages.
- MTA/LIRR is currently constructing the East Side Access project at the Yard, and will be developing storage tracks and maintenance facilities.
- NJT uses Sunnyside Yard primarily as a midday lay-up area for storing trains between

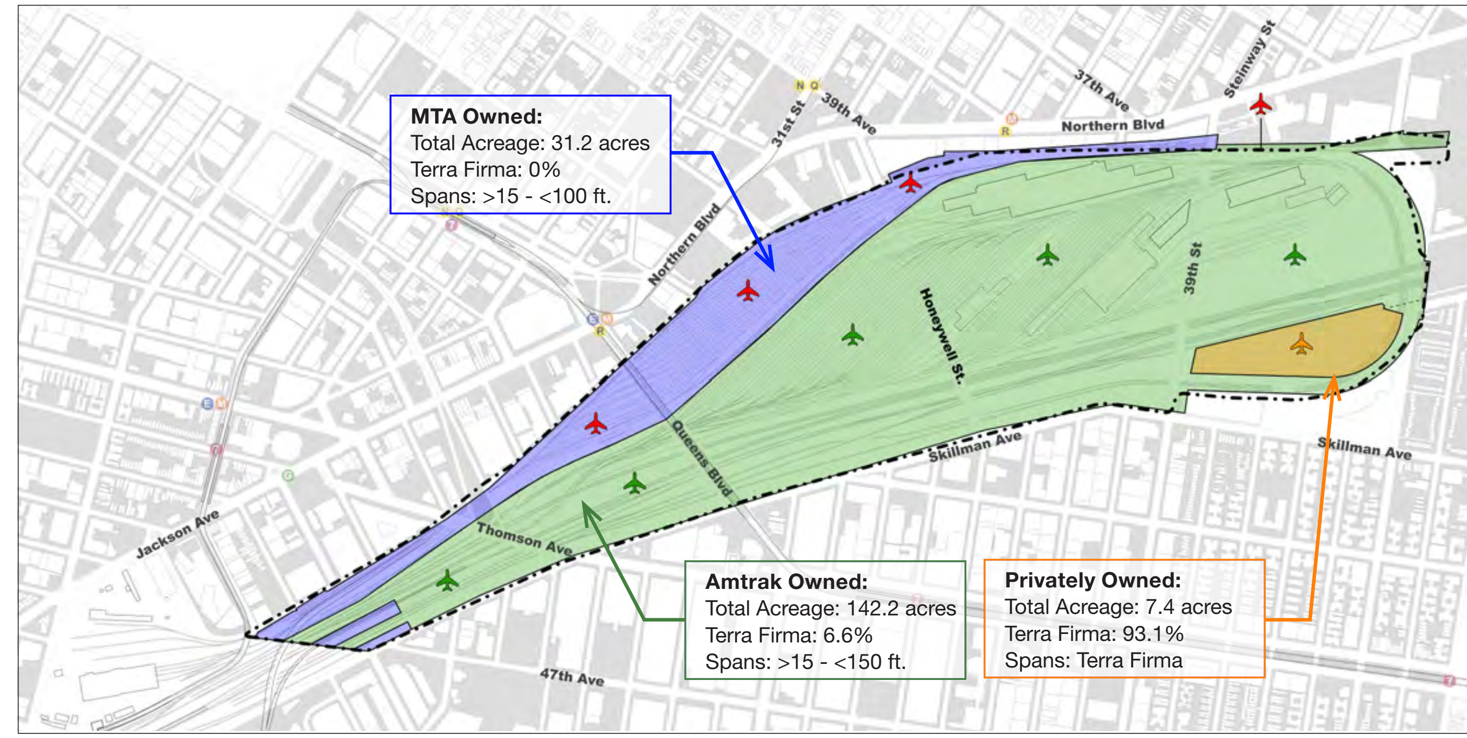


FIGURE 1.5: SUNNYSIDE YARD OVERBUILD: LAND AND AIR RIGHTS OWNERSHIP

- Amtrak Land Ownership
- MTA Land Ownership
- Private Land Ownership
- Amtrak Air Rights Ownership
- City of New York Air Rights Ownership
- Private Air Rights Ownership

morning and evening rush hours.

- The Amtrak Yard Expansion project, as detailed in its Master Plan, would enable Sunnyside Yard to accommodate approximately double the number of trains that it does today.
- Amtrak is planning to rehabilitate East River Tunnels damaged during Hurricane Sandy.
- Amtrak is planning to complete ongoing state-of-good repair work (maintenance and equipment upgrades) as well as other miscellaneous projects around Sunnyside Yard.
- The MTA has at least six known projects that are either under construction, planned, or envisioned over the next 15 years and beyond that will impact the Yard.

Combined, those physical, operational, structural, and economic conditions will impact overbuild development at Sunnyside Yard. While these development conditions are challenging and continuously evolving, they frame a set of principles that can be used to guide development of a future overbuild.

D. Key Considerations and Planning Principles

Existing and future conditions were used to evaluate the three test cases and to inform a set of planning principles. Given the complexity and scale of this project, the findings of this study are subject to inherent risks that are beyond the control of any single entity. The success of this project could be influenced by several onsite and offsite factors. A project of this nature faces risks due to shifting political priorities, as well as changes in expected revenue and/or cost assumptions. Modifications of density or the planned program could alter feasibility, as well as impact existing transportation networks and other offsite considerations. Multiple railroads, complex infrastructure, and the sheer scale of such an overbuild project would require exceptional coordination and a long-term perspective from all involved parties.

With these caveats, the following considerations and planning principles are identified to inform future decision making in regards to a Sunnyside Yard overbuild.

Engineering

The existing and future railroad operations will impose significant constraints for overbuild feasibility. Assumptions involving Amtrak's Sunnyside Yard Master Plan are predicated on its 2014 vision of its 2030 operations. As the Master Plan implementation progresses over time, assumptions may need to be reconsidered and the plan for the overbuild adjusted accordingly. Key considerations and planning principles with respect to rail operations include:

- Detailed cooperation will be necessary at all levels between the railroad companies, the City, any development entity, and developers.
- Track outages, work hours, and construction work zones should be streamlined to maximize contiguity and continuity, while minimizing disruptions to railroad operations.
- Whenever possible, overbuild construction should be performed concurrently with other planned construction of railroad infrastructure.
- Overhead wires that supply electrical power for trains will need to be lowered and supported under the deck. Other overhead wires may need to be rerouted or buried.
- Required railroad clearances above the tracks affect the height of the deck, limiting the vehicular access to only the existing roads and bridges and inflating building heights. Some variances should be required from standard track clearances to locally reduce deck height.
- It is assumed that the existing bridges cannot be replaced.
- Certain areas of the Yard, particularly above the Main Line tracks, are exceptionally encumbered by heavy rail traffic and physical infrastructure. These areas were determined to be infeasible for decking as they exist today.

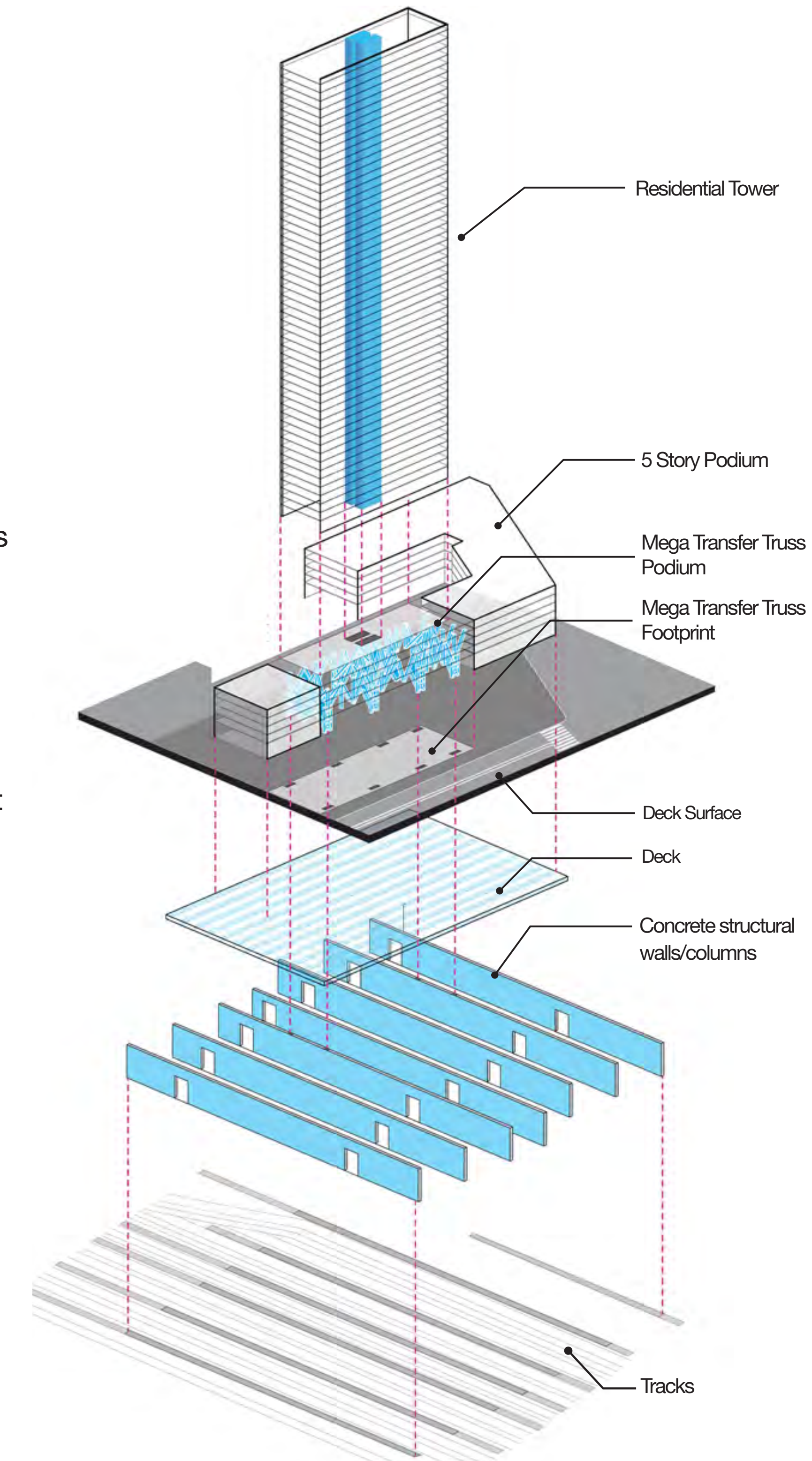


FIGURE 1.6: TOWER AND TRACK STRUCTURE RELATIONSHIP

- Overbuild poses some safety considerations such as adequate exhaust of heat and diesel fumes generated by stored trains, fire and life safety ventilation, standpipes, and egress.

Structural systems will need to accommodate the constraints imposed by railroad operations, the restrictions dictated by yard geometry, and the structural requirements for a substantial overbuild. (Figure 1.6) Key considerations and planning principles with respect to structural constraints include:

- Structural steel construction is preferred for the deck, as it is lighter than precast concrete and therefore easier to maneuver and install in congested areas.
- Structural support walls or columns must be located outside of required railroad track clearances.
- Deck/platform depth (vertical thickness between upper surface and underside) will vary between 9' and 16'. Deck depth increases with span length and may be adjusted to accommodate urban design considerations.
- Deck spans would vary across Sunnyside Yard. Shorter spans between support walls or columns would allow for taller structures above.
- Buildings under 60' tall, roads, and open space can generally be supported by support columns at track level.
- In general, buildings and towers over 60' tall:

  -Require full support walls at track level.

  -Need to be oriented with their long axis perpendicular to the direction of the tracks, with support walls running between tracks, in order to provide adequate resistance to wind loads.

  -Must span three to four lines of columns (depending on tower length/height). (Figure 1.7)

  -Require a substantial steel truss (a "mega transfer truss") in the building podium to transfer the loads to support walls. The size of the transfer truss varies depending on span and tower height.

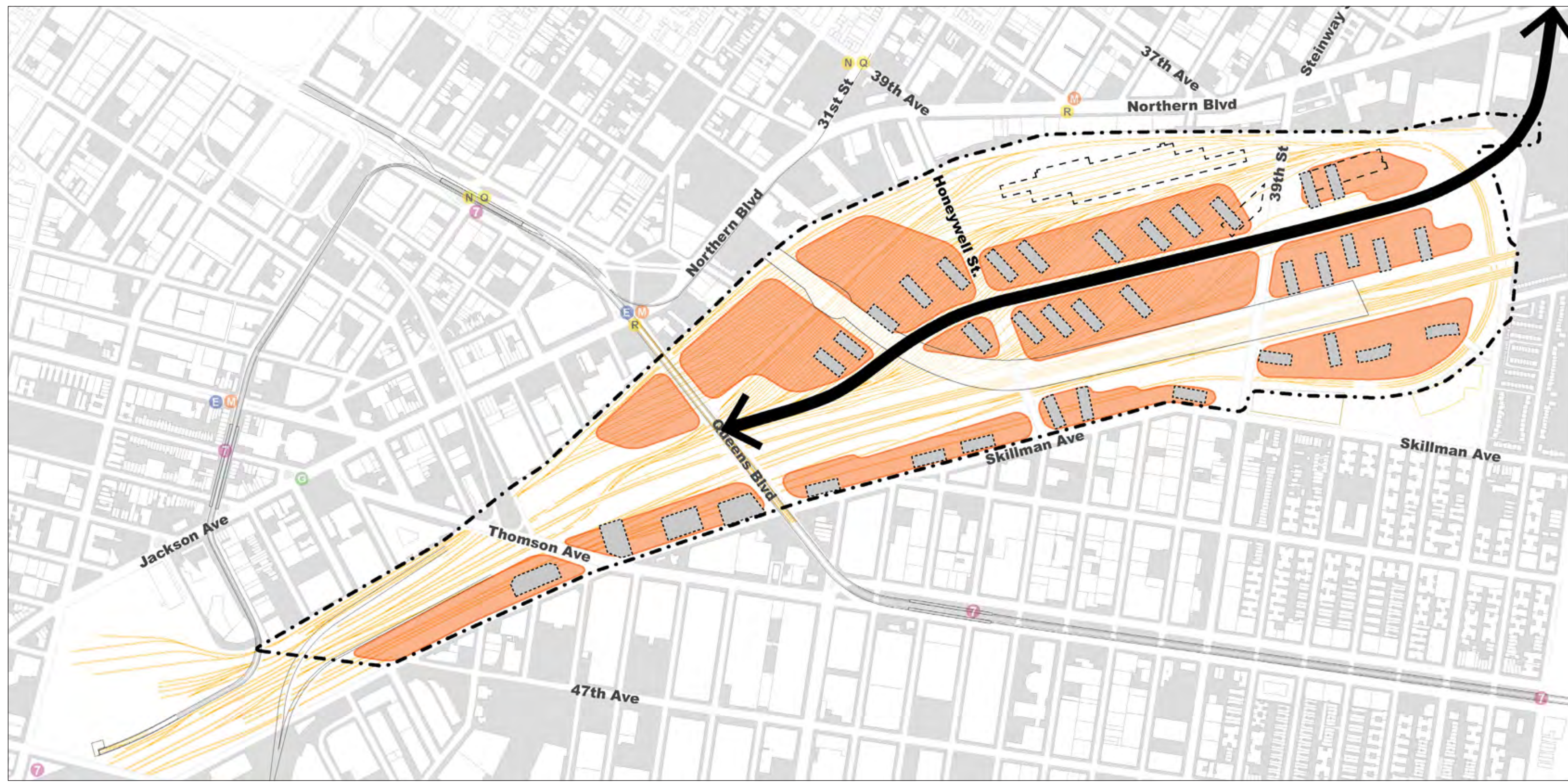


FIGURE 1.7: RAILROAD OPERATIONS AND TOWER LOCATIONS

Structures and infrastructure which interact with proposed deck
Tower Footprints
Future Track Alignment
Optimized Tower Locations
Studied Boulevard Alignment

Urban Design

Urban design considerations aim to create balanced, vibrant, and well-connected urban neighborhoods within operational, structural, and financial constraints. (Figure 1.8) Key considerations and planning principles with respect to urban design include:

- A strong but flexible vision for development is necessary for a successful long-term and phased buildout.
- The deck generally sits 20-40' above surrounding streets. Vehicular connections to the deck should be adjacent to existing bridges wherever possible, where the elevation of the deck will be close to the elevation of the bridge. The existing bridges at 39th Street, Honeywell Street, and Queens Boulevard should be utilized as the primary north-south vehicular connectors.
- A central, roughly east-west-oriented boulevard along the length of Sunnyside Yard should be established to link different phases of development.
- Pedestrian connections should be established over un-decked open areas, at surrounding dead-end streets, and along Skillman Avenue. The pedestrian network should be integrated with offsite and onsite open spaces.
- Transit use should be encouraged by providing easy access to existing transit and incorporating new transit, such as the proposed LIRR Sunnyside Station.
- New neighborhood districts should have a clear identity and organization.
- Each development phase should strive to create complete neighborhoods with a balance of uses to meet a broad range of needs.
- New development should respond to the surrounding context. Transitions and buffers should be used to negotiate differences in scale, elevation, and use.
- A system of connected parks and open spaces with a variety of scales and uses should be integrated with new development.

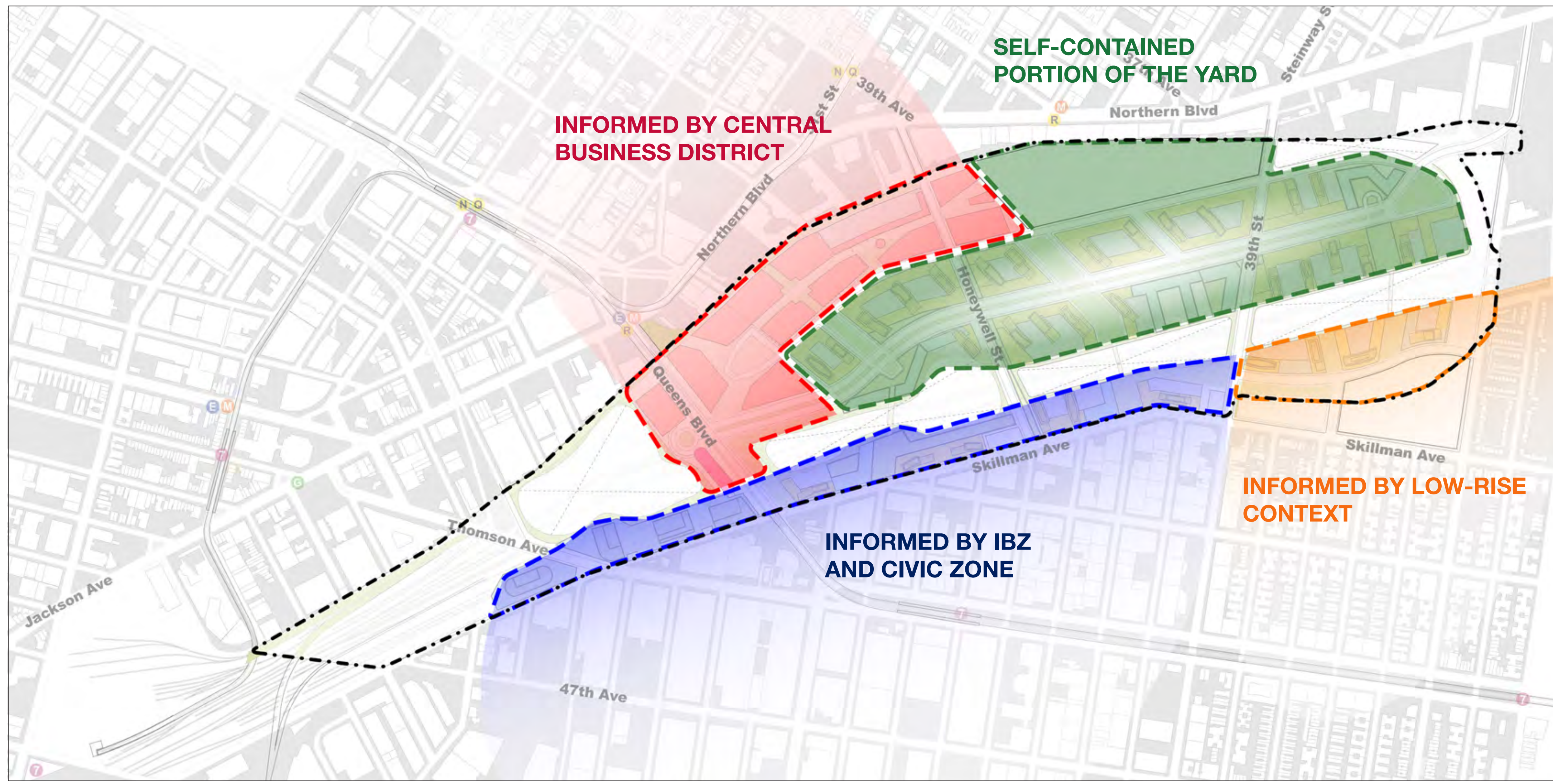


FIGURE 1.8: SUNNYSIDE YARD: NEIGHBORHOOD CHARACTER

Economics

An overbuild development at Sunnyside Yard depends on the strategic placement and phasing of different building typologies to mitigate construction costs and provide for the economic capacity to support critical public infrastructure, including open space, schools, and roads. Key considerations and planning principles with respect to economics include:

- Buildings should be located where they are most structurally feasible and cost-effective, with heights, footprint size, and overall site density maximized where appropriate.
- Parks, roads, and open space should be located where overbuild is more structurally complex and/or costly.
- Areas that are most difficult to build over should be left un-decked. A target of 80-85% overall deck coverage is appropriate given Yard constraints. (Figure 1.9)
- Construction should be phased to:

  -Coordinate as closely as possible with Amtrak's Master Plan to synchronize track outages, minimize railroad disruption, and reduce potential duplication of rail reconstruction work.

  -Leverage time value of money by delaying less-accretive uses to later phases.

  -Capitalize on the mix of uses to allow non-competitive uses to be absorbed simultaneously.

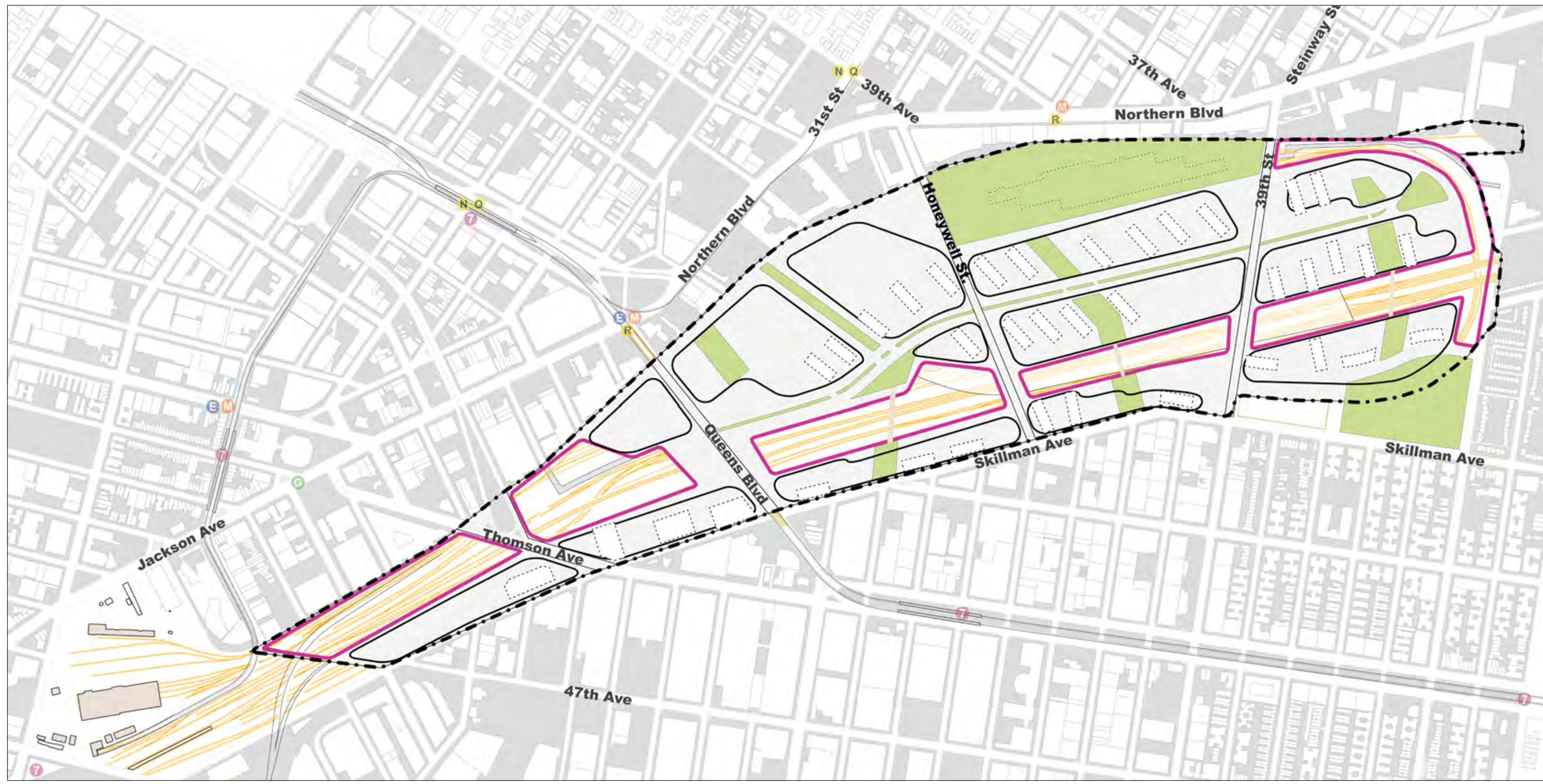


FIGURE 1.9: OPTIMIZED DECK COVERAGE, OPEN SPACE AND TOWER FOOTPRINTS

Outline of Non-Decked Areas
Public Open Space
Tower Footprints
Tower Zones

E. Development Feasibility

Each of the three test cases evaluated contained a specific programmatic and public policy focus - Residential, Live/Work/Play, and Destination. Each test case was evaluated based on the same assumptions regarding railroad operations, structural system strategies, and planning principles, and each test case varied in its mix of uses, program and phasing. Multiple options and scenarios were tested as part of this study, and the three test cases are by no means the only solution for the development challenges presented. Other configurations – both of program and physical form – are possible. More detailed study and planning of Sunnyside Yard and the Study Area may result in better solutions.

An overbuild development of Sunnyside Yard as measured by the three test cases could bring substantial benefit to the City, including between 14,000 and 24,000 total new housing units, 31 to 52 acres of open space, and new schools, community facilities, and retail amenities to serve new residents and surrounding communities. Development at Sunnyside Yard could create at least 4,200 to 7,200 new permanently affordable housing units, helping to meet City policy goals. This study follows MIH guidelines as a minimum standard of affordability.

Following the development of the test cases, the full overbuild was divided into seven zones, “A” through “G”. (Figure 1.10) The development zones were defined based on ownership, railroad operations, physical landmarks and barriers, and construction constraints. Each zone was independently evaluated for the feasibility of development based on a number of factors, including ownership, planning parameters, street grid and connections, tower placement, land uses, and open spaces.

To estimate project-wide feasibility, a number of financial analyses were completed to measure total project costs against total potential project revenues. The horizontal elements outside of the building footprints including utilities, certain decking, mechanical and public safety infrastructure, roads, and open space were analyzed together. The mega transfer truss and deck costs below a building footprint were analyzed separately. The mid-point of each vertical program range was assumed for purposes of these analyses. The financial measurements used to evaluate financial feasibility include:

- **Total Development Costs:** All of the horizontal costs (both in and outside of building prints) and all vertical costs associated with the development of the overbuild.
- **Gross Land Proceeds:** Value a developer would pay for the land and development rights, considering normal development costs if this were a typical development on terra firma.
- **Overbuild Premium:** Cost premium for the deck and mega transfer truss within the building footprint(s).
- **Onsite and Offsite Horizontal Costs:** Costs for horizontal development outside of a building footprint including railroad force accounts and other site-wide systems such as streets, open space, municipal buildings, and utilities, and costs related to offsite utilities to support density and capacity on Sunnyside Yard.

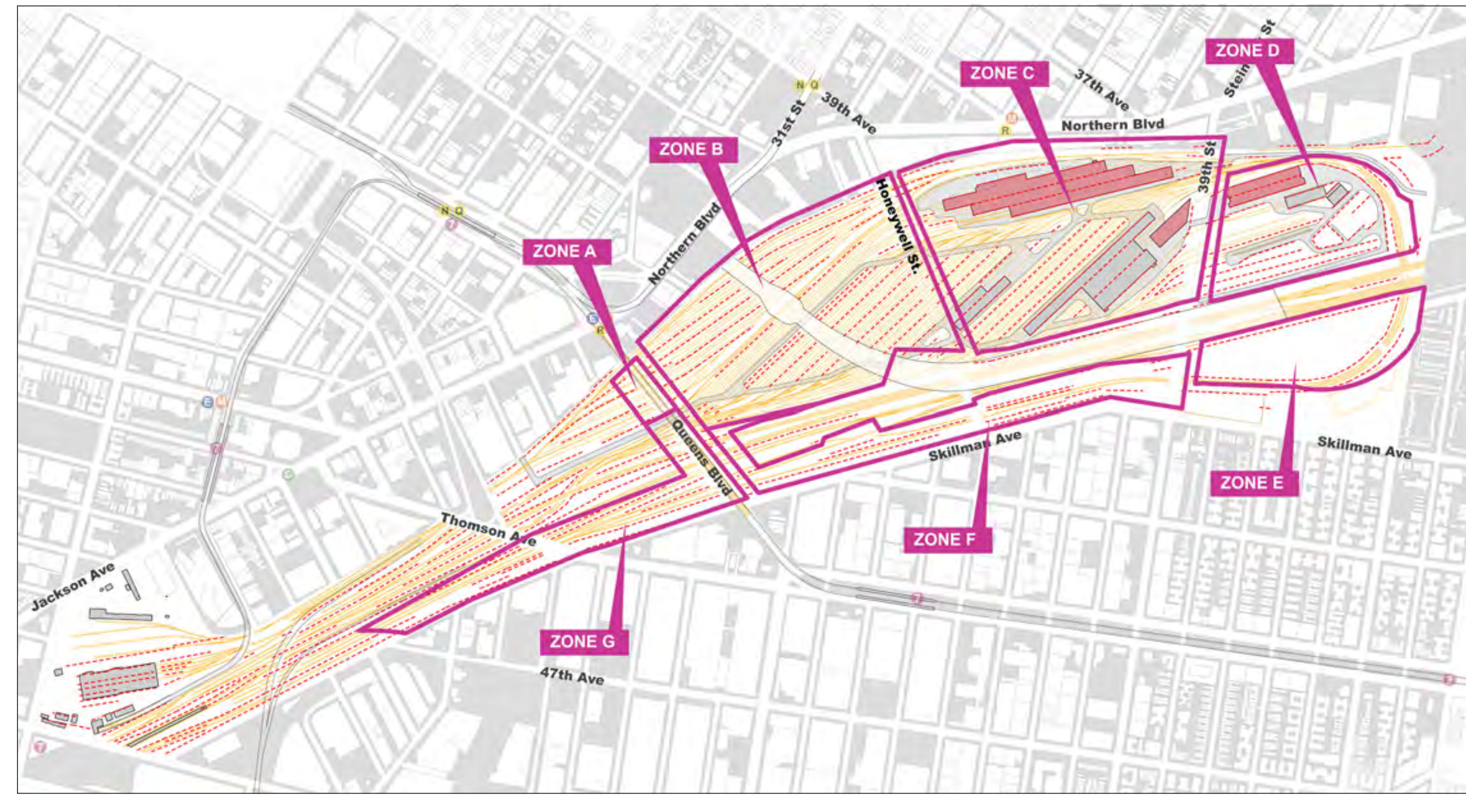


FIGURE 1.10: SUNNYSIDE YARD ZONE BOUNDARIES

- **Residual Land Value:** Gross land proceeds, less overbuild premium and onsite and offsite horizontal costs.

Financial feasibility is strongly influenced by use mix, density, number of roads, amount of open space, and share of affordable housing. Horizontal project costs are generally consistent between test cases and vary only modestly due to differences in phasing and the number of roads, size of open space, and other horizontal program elements. Total development cost is estimated to range from approximately $16 billion to $19 billion in 2017 dollars. The test cases generate between approximately $3.33 billion and $3.98 billion in gross land proceeds. Overbuild premiums are estimated to cost between $2.38 billion and $3.38 billion. Onsite and offsite horizontal costs are between approximately $2.93 billion and $3.43 billion and result in between -$3.48 billion and -$1.73 billion in residual land value. While a negative residual land value suggests that public investment is necessary to facilitate development, significant public benefits in the form of new public facilities such as schools and open space would be delivered because of this project. In addition, the project would unlock potential future tax revenue, including but not limited to real estate taxes. The magnitude of public benefits and taxes is significant. For example, the total onsite real property tax generated by the test cases over 40 years could be between $1.31 billion and $1.53 billion.

Core Yard

Based on an understanding of the technical constraints and the lessons learned by optimizing feasibility for the three test case scenarios, the Core Yard, defined as Zones D, C, and B-South covering approximately 70 acres, has been identified as an area most viable for development, and would be a likely early phase of the total overbuild project.

Based on railroad operations and the future track layout, the Core Yard could support a high density of residential uses. The majority of the area is under Amtrak ownership and overlaps with elements of the Amtrak Master Plan requiring immediate coordination. Development in the Core Yard would encourage consistent block and street grid formation and the creation of a central east-west boulevard to facilitate future phases of development. The area is connected to the existing road and bridge network and is large enough to accommodate a complete and economically feasible neighborhood. (Figure 1.11)

The development of the Core Yard could bring substantial benefit to the City, including approximately 11,000 to 15,000 total new housing units, 15 to 20 acres of open space, and new schools, community facilities, and retail amenities to serve surrounding communities and new residents. The Core Yard could create at least 3,300 to 4,500 new permanently affordable housing units, helping to meet City policy goals. Across the test cases, the Core Yard produces similar levels of financial feasibility. By evaluating the impacts of the range of uses, number of roads and open space, the Core Yard program was refined to improve financial feasibility. Total development cost is approximately $10 billion in 2017 dollars. Using the mid-point of a refined Core Yard program, the project could generate approximately $2.84 billion in gross land proceeds. After accounting for approximately $1.81 billion in overbuild premium and approximately $1.84 billion in onsite and offsite horizontal costs, the Core Yard can have an estimated residual land value of -$798 million. A negative residual land value indicates that public investment will be required in the project. The financial feasibility of the project was evaluated by analyzing the public goods and tax proceeds that would be generated by this potential investment. The Core Yard could deliver housing, substantial public benefits in the form of affordable open space, and public facilities at a cost that is comparable to other major infrastructure investments and large scale developments led by the City. Moreover, the Core Yard could generate significant tax proceeds. The real property taxes alone (approximately $934 million over 40 years) could exceed the total cost of investment.

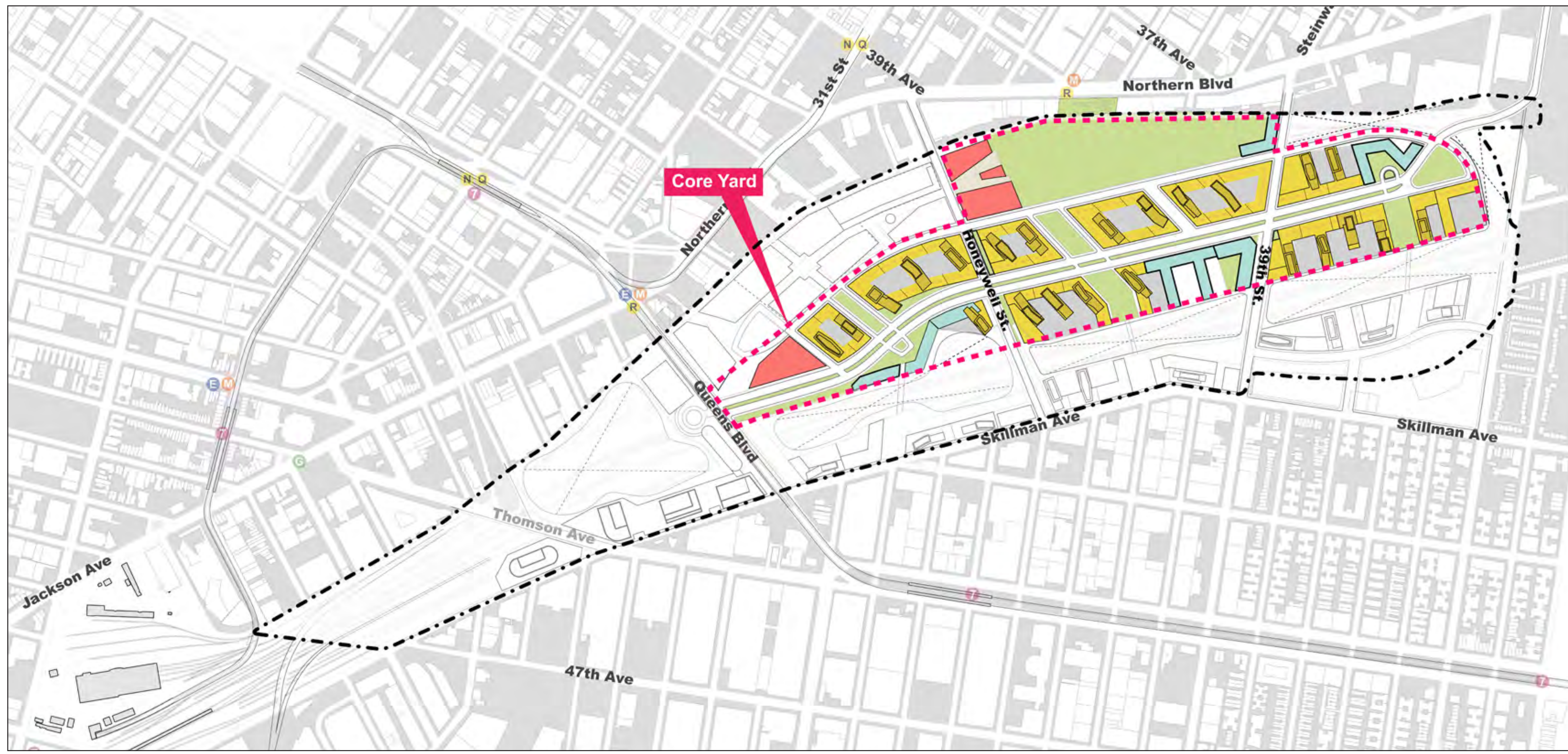


FIGURE 1.11: CORE YARD LAND USE

Residential Podium	Office Podium	School/Community	Landscape Buffer
Residential Tower	Office Tower	Public Open Space	Parking
Creative office	Mixed-Use	Public Open Space	Railroad Facilities

Finally this investment would leverage substantial private investment to catalyze economic impacts at a regional scale. Considering this combination of factors, the Core Yard is financially feasible.

F. Conclusion

This Feasibility Study describes engineering, urban design, and economic parameters for a feasible overbuild approach at Sunnyside Yard.

Some key issues that influence feasibility are beyond the scope of this study, including potential modifications to Amtrak's Master Plan and the related incremental construction costs, offsite improvements to transportation infrastructure, and the specific financing, contractual, and/or governing structures that would be created to support development. (Figure 1.12, Figure 1.13)

Sunnyside Yard is an active railyard situated within a dynamic urban environment. As Amtrak progresses on its Master Plan, and as the economic and urban environment evolves, variations from the studied test cases may be warranted, resulting in changes to specific feasibility findings. Should the project move on to a next stage of planning, more detailed study and design development should be undertaken, with a focus on a more discrete section of Sunnyside Yard—the Core Yard. A comprehensive program of public outreach and engagement would be integrated with additional planning. In tandem, significant coordination between multiple land and air rights owners, careful sequencing of investments, and development of thoughtful value creation strategies each need to occur to support a feasible project.

FIGURE 1.12: POTENTIAL SITE PLAN BASED ON TECHNICAL FINDINGS

A future overbuild development plan would also have to respond to significant uncertainties. A project of this scale would span several political administrations, multiple economic cycles, and changes to the City's employment base. Cost-effective and operationally-efficient construction of an overbuild will include large up-front expenditures that may not see returns for many decades. Changes to the development program, density, open space, value creation, ownership coordination, technology advancements, railroad requirements, and adjacent development may alter the key considerations and planning principles of this study and impact project feasibility. This feasibility study is only the first stage in a multi-step, multi-year design process needed to realize a project of this scale and complexity.

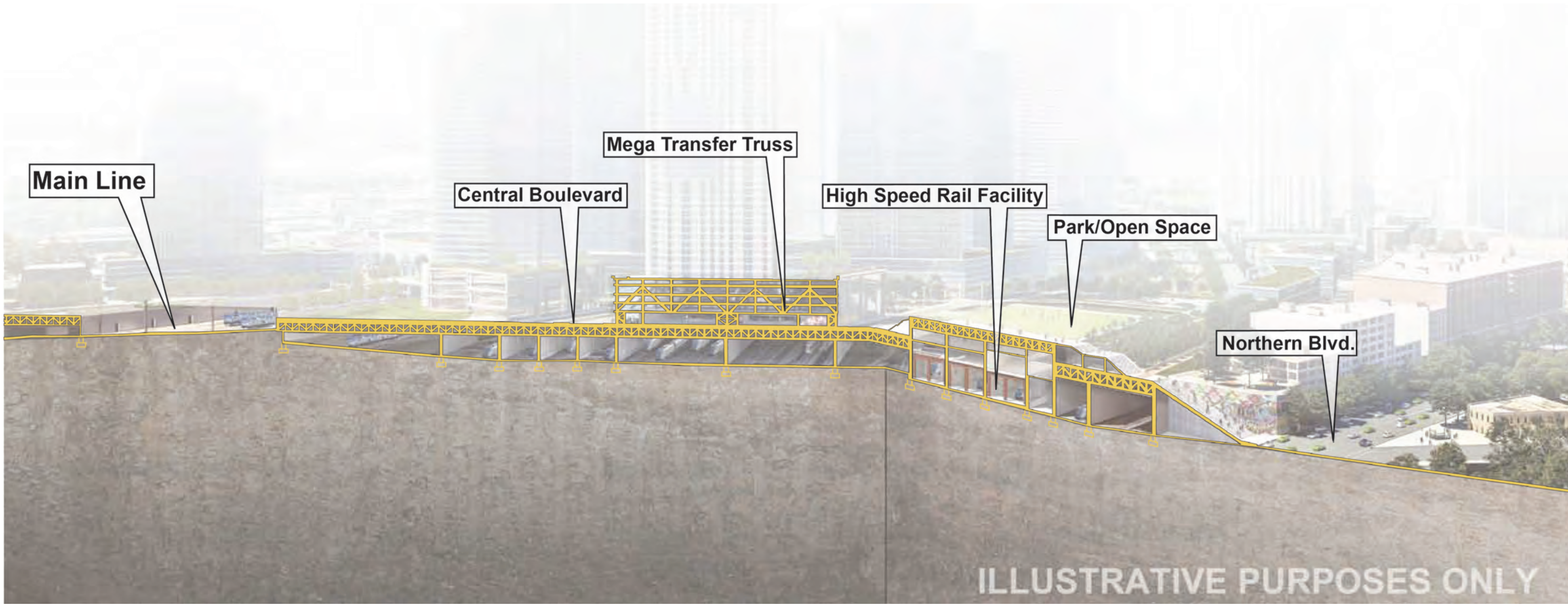
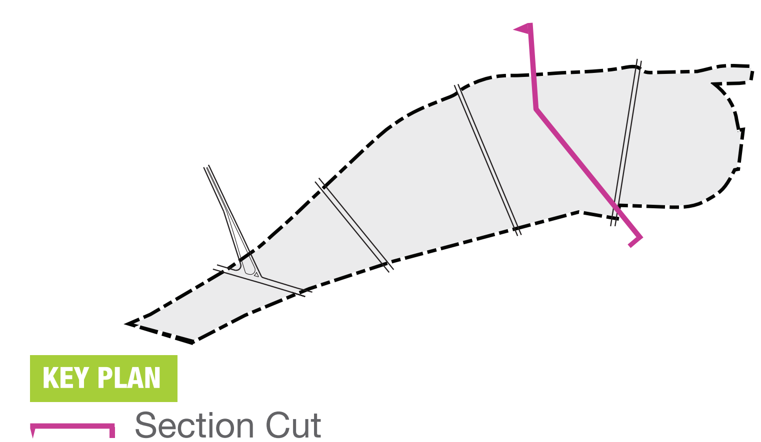


FIGURE 1.13: SECTION RENDERING: AMTRAK HIGH SPEED RAIL SHOP AND STORAGE

'All renderings, illustrations, and plans in this study are intended for illustrative purposes only. There are a variety of potential design solutions and these renderings, illustrations, and plans shall not be construed to be a representation of an intended design solution'



Chapter 2: Offsite Conditions

Table of Contents

A. CHAPTER OVERVIEW

A comprehensive understanding of the existing conditions as observed in the immediate vicinity of the Yard is needed to inform an assessment of overbuild feasibility. This chapter describes the offsite conditions that influence economic, urban design, and engineering feasibility. These offsite conditions include market conditions, neighborhood context, and utility and transportation infrastructure.

Today, the Study Area, defined as a one-mile radius of Sunnyside Yard, represents a full range of urban conditions–a true mix of uses and urban forms. The areas to the north and southeast, Astoria and Sunnyside, reflect stable residential neighborhoods, while the areas to the west, Long Island City and its waterfront, have grown from an industrial area to a residential neighborhood with many new buildings under construction. The Study Area is home to 112,000 people, nearly 9,000 jobs, and recognized as one of the City's most significant non-Manhattan employment centers.

Where development is taking place, new high-rise towers are altering the built environment and urban experience. This new development is resulting in new pressures for neighborhood-supporting services and conveniences, increased capacity of certain elements of the local transportation systems, and an increased demand for more schools, parks, public space, and related amenities.

B. Economic Context

To examine the demographic, economic, and real estate context of Sunnyside Yard, a primary Study Area that encompasses a selection of Western Queens communities located within an approximate one-mile radius of the site was defined.

1. Submarket Profiles

The primary Study Area was subdivided into six submarkets (Figure 2.1) that principally reflect significant natural and/or built barrier conditions (water bodies, open space, cemeteries, and major roadways) and current zoning designations (separation of principally industrial areas from principally residential areas).

- LIC Waterfront – Submarket A
- Court Square/Queens Plaza – Submarket B
- Ravenswood – Submarket C
- Dutch Kills/South Astoria – Submarket D
- Sunnyside – Submarket E
- LIC Industrial Core – Submarket F

2. Demographic Context

The Study Area is home to 112,000 residents, or approximately 5% of the total Queens County residential population. (Figure 2.2) These residents comprise 49,000 households with 13,300 public school children. A majority of the population surrounding Sunnyside Yard is concentrated in principally residential submarkets to the east of the Study Area, with nearly half (47%) residing in the Dutch Kills/South Astoria and Sunnyside submarkets. Since 2000, the population of the western submarkets has increased as new, high-density development projects adjacent to the waterfront have attracted new residents. Even with this growth, the Study Area has lost population as household size has declined, with all submarkets except the LIC Waterfront and Court Square/ Queens Plaza losing population between 2000 and 2013.

Educational levels vary across submarkets. In all submarkets except for Ravenswood, more residents commute to Midtown Manhattan to work than any other major Central Business District in the City. In total, 83% of the Study Area population works throughout the City. A majority of the population commutes to work by subway, at rates close to twice the borough and citywide averages.

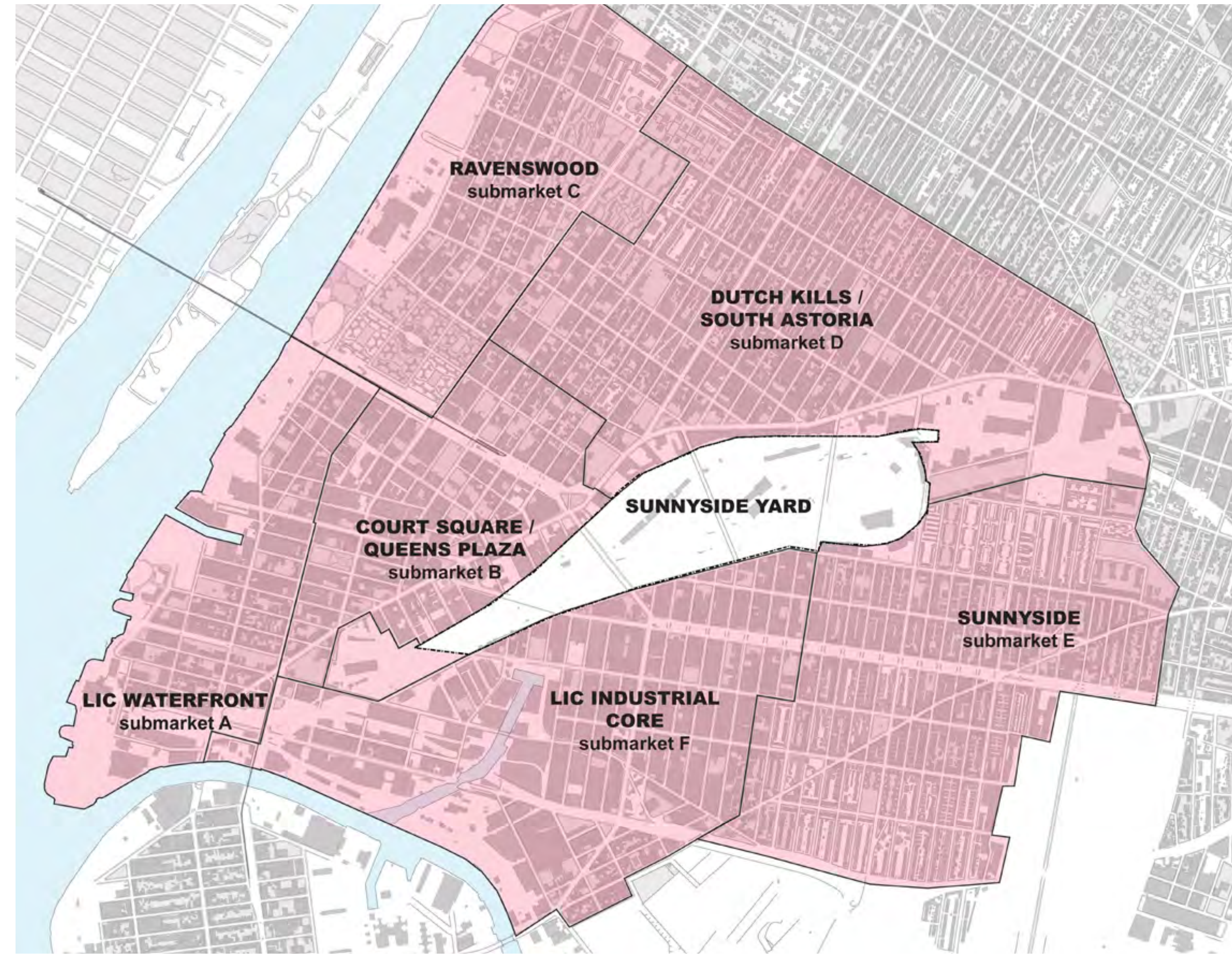


FIGURE 2.1: STUDY AREA

FIGURE 2.2: CORE DEMOGRAPHIC CHARACTERISTICS (2013)

Adjacent Submarket	Population	Households
LIC Waterfront (A)	10,200	5,500
Court Square/Queens Plaza (B)	3,700	1,500
Ravenswood (C)	18,500	8,200
Dutch Kills/South Astoria (D)	24,700	10,700
Sunnyside (E)	52,300	22,000
LIC Industrial Core (F)	2,100	650
Study Area Total	**111,500**	**48,550**
Queens	*2,256,400*	*838,100*
New York City	*8,269,000*	*3,381,000*

Source: US Census Bureau, American Community Survey

FIGURE 2.3: TOTAL EMPLOYMENT AND PERCENT CHANGE IN THE STUDY AREA (2002 - 2013)

Adjacent Submarket	Employment (2002)	Employment (2013)	Absolute Change (2002-2013)	% Change (2002-2013)
LIC Waterfront (A)	11,400	13,400	2,000	18%
Court Square/Queens Plaza (B)	20,500	29,200	8,600	42%
Ravenswood (C)	4,800	6,000	1,200	25%
Dutch Kills/South Astoria (D)	15,400	16,200	800	5%
Sunnyside (E)	4,900	6,100	1,200	24%
LIC Industrial Core (F)	15,100	19,500	4,400	19%
Study Area Total	**72,100**	**90,400**	**18,200**	**25%**
Queens	*469,70*	*524,000*	*693,300*	*21%*
New York City	*3,227,000*	*3,920,300*	*54,300*	*12%*

Source: LODES

Public School Children

According to an analysis of U.S. Census and American Community Survey (ACS) data, the population of public school children in the Study Area declined by 3,300 between 2000 and 2013. This analysis also finds that certain individual submarkets experienced a significant increase in public school children and/or children under 5 years old during this period. The LIC Waterfront and Court Square/Queens Plaza submarkets experienced faster growth in the number of children under 5 years old than in the total number of public school children, a finding that may signal the likelihood of subsequent growth in population in these submarkets.

3. Employment Context

The Study Area is the largest employment hub in Western Queens, and is recognized as one of the City's most significant non-Manhattan employment centers, comprising over 90,000 employees. The 2015 update to PlaNYC, OneNYC: The Plan for a Strong and Just City, identified the Long Island City core as one of six major employment centers in Queens.[1] The 715-acre Long Island City Industrial Business Zone (LICIBZ), one of the city's largest by area, spans much of the area to the north and south of Sunnyside Yard. The LICIBZ has remained a center for light manufacturing and logistics because of its proximity to Manhattan, inventory of price-competitive industrial space, and strong transit access.

Current Conditions

Since 2002, employment has increased by 25% throughout the Study Area, with the greatest gains within Court Square/Queens Plaza and the LIC Industrial Core. These areas have outpaced growth rates for both Queens and the City as a whole. (Figure 2.3)

Employment density in the Study Area is 20,000 workers per square mile – a density 10 times greater than the Queens-wide average, and 2.5 times greater than the citywide average – with concentrations in the LIC Waterfront, Court Square/Queens Plaza, and LIC Industrial Core submarkets. Major contributors include industrial sectors such as Transportation and Warehousing, service sectors such as Administrative Support and Waste Management, the Finance and Insurance sectors, and the Accommodation and Food Services sectors, reflecting the expansion of hotel development in the Study Area over the past 15 years. Employment shrinkage during this period was largely confined to industrial sectors such as Manufacturing, Construction, and Wholesale Trade.

4. Residential Market Context

The Brooklyn-Queens Waterfront has experienced impressive growth in residential market demand. From DUMBO to Long Island City developers have leveraged market interest and the development of new cultural and retail offerings to introduce

[1] "OneNYC: The Plan for a Strong and Just City," page 53.

thousands of mid-rise residential development units at record rent and sales prices. In comparison to other portions of the Study Area, the LIC Waterfront and Court Square/Queens Plaza submarkets are experiencing decreasing vacancy and significant rates of new development. This increase in demand has resulted in a base of 9,000 recently built units and an additional 14,500 units that are anticipated to be delivered by 2025.[2] Little new residential development has taken place elsewhere in the Study Area as a result of current zoning and the limited availability of sites. At Sunnyside Yard's eastern edge, the Dutch Kills/South Astoria and Sunnyside submarkets – which represent three-quarters of the Study Area population – have experienced almost no new residential development and even a slight contraction in total housing units.

Recent Development - ACS/Census Data Analysis

Analysis of ACS/Census data finds a total of 52,300 housing units in the Study Area as of 2013. Sunnyside alone has more housing units than the LIC Waterfront, Court Square/Queens Plaza, Ravenswood, and the LIC Industrial Core submarkets combined. Since 2000, new development has been concentrated in the LIC Waterfront and Court Square/Queens Plaza submarkets leading to large increases in total units (148% and 87%, respectively).

Analysis of data from the Long Island City Partnership and CoStar, a proprietary real estate database, suggests that higher levels of residential development have taken place at Sunnyside Yard's western edge than are reflected in ACS/Census estimates. This alternate analysis indicates that approximately 8,000 units were constructed in the LIC Waterfront and Court Square/Queens Plaza submarkets between 1999 and 2013, approximately 75% higher than ACS/Census estimates of 4,500 units of construction between 2000 and 2013.

Current Rents and Sale Prices

In line with market momentum, residential rents at Sunnyside Yard's western edge range from $40 to $71 per square foot (PSF), higher than rents and sales prices in the submarkets to the east and northwest, which range from $23 to $40 PSF. Rents within the Court Square/Queens Plaza submarket are high compared with the rest of the Study Area but are lower than those observed along the Brooklyn waterfront. LIC Waterfront condo price indicators are comparable to values in Downtown Brooklyn, but are lower than waterfront property in Greenpoint and Williamsburg. (Figure 2.4)

Within the LIC Waterfront and Court Square/Queens Plaza submarkets, a per-building analysis finds that rental units on upper floors with distinctive views can command a price premium of 5% to 10%.

Development Pipeline

The development pipeline of the LIC Waterfront and Court Square/Queens Plaza submarkets generally correlates with strongly performing markets along the Brooklyn-Queens waterfront.

FIGURE 2.4: CURRENT AVERAGE RESIDENTIAL SALES AND RENTAL PRICES PSF (2015-2016)

Adjacent Submarket	Condo Price PSF	Residential Rents PSF
LIC Waterfront (A)	$1,200	$50 - $71
Court Square/Queens Plaza (B)	$1,100	$40 - $65
Ravenswood (C)	n/a	$23 - $31
Dutch Kills/South Astoria (D)	$767	$26 - $36
Sunnyside (E)	n/a	$29 - $40
LIC Industrial Core (F)	n/a	$27 - $36
Study Area Total	$934	$29 - $39
Greenpoint	$1,342	$51 - $69
Williamsburg	$1,440	$54 - $71
DUMBO	$1,007	$48 - $66
Downtown Brooklyn	$1,255	$42 - $68

Source: Streeteasy; CoStar, CBRE

FIGURE 2.5: COMPARISON OF RESIDENTIAL DEVELOPMENT PIPELINE

Adjacent Submarket	Residential Development Pipeline
LIC Waterfront (A)	5,120 units
Court Square/Queens Plaza (B)	6,490 units
Ravenswood (C)	0 units
Dutch Kills/South Astoria (D)	400 units
Sunnyside (E)	20 units
LIC Industrial Core (F)	0 units
Study Area Total	12,040 units
Greenpoint	3,010 units
Williamsburg	4,340 units
DUMBO	190 units
Downtown Brooklyn	6,430 units

Source: Long Island City Partnership; CoStar; CityRealty

[2] Based on Project Team analysis of LIC Partnership pipeline data. "Recently-built" represents projects completed between 1999 and 2014. Estimated development between 2015-2025 includes projects slated for completion in 2015 as well as the development pipeline for 2016 onwards.

FIGURE 2.6: INDUSTRIAL AND COMMERCIAL PROPERTY BY SUBMARKET (2015)

Adjacent Submarket	Industrial SF	Industrial SF (%)	Office SF (A/B/C)	Office SF (%)
LIC Waterfront (A)	4,200,000	17%	600,000	5%
Court Square/Queens Plaza (B)	4,530,000	18%	4,990,000	45%
Ravenswood (C)	2,150,000	9%	180,000	2%
Dutch Kills/South Astoria (D)	3,380,000	13%	2,620,000	24%
Sunnyside (E)	725,000	3%	250,000	2%
LIC Industrial Core (F)	10,200,000	41%	2,380,000	22%
Study Area Total	25,185,000	100%	11,020,000	100%

Source: CoStar

FIGURE 2.7: CLASS A OFFICE RENTS AND TOTAL RBA (2015)

Adjacent Submarket	Class A Office Rents (Asking) PSF	Class A Office Total RBA
LIC Waterfront (A)	n/a	0
Court Square/Queens Plaza (B)	$42	3,870,000
Ravenswood (C)	n/a	0
Dutch Kills/South Astoria (D)	$35	390,000
Sunnyside (E)	n/a	0
LIC Industrial Core (F)	n/a	0
Study Area Total	$41 (average)	4,260,000
Downtown Brooklyn	$68	10,599,000
Lower Manhattan	$52	84,313,000
Midtown	$67	193,871,000
Midtown – Plaza District	$72	136,014,000

Source: HR&A Analysis, CoStar

Figure 2.5 contextualizes the Study Area development pipeline with those of Greenpoint, Williamsburg, and DUMBO. It is forecasted that residential development in the LIC Waterfront and Court Square/Queens Plaza submarkets will exceed the combined residential development in the pipeline for Williamsburg and Greenpoint.

Affordable Housing

The Study Area has a limited, but increasing, supply of affordable housing. The previous 421-a program's "Geographic Exclusion Areas" (GEA) required new residential development to provide on-site affordable housing in exchange for an extended property tax abatement. The GEA typically applied to the city's strongest, highest-rent markets. In 2006 and 2007 the GEA was expanded to include portions of LIC Core, spurring the inclusion of affordable units in construction of new residential development and increasing what was previously a small stock of affordable units.

Even with the limited GEA footprint, based on an evaluation of NYU Furman Center data, within the Study Area there are approximately 8,200 units in buildings that receive some form of subsidy for affordable housing. The majority of these units are part of the 421-a Tax Incentive Program, Mitchell-Lama, Multi-Family rental or State Financing programs. The supply of affordable housing will increase as a number of recently completed and anticipated projects deliver additional affordable units in LIC. Hunter's Point South, a city-led mixed-use development project at the LIC waterfront, will deliver approximately 3,000 affordable units for low and moderate income families. LIC's 22-44 Jackson Avenue, the mixed-use, high-rise development at the former 5 Pointz art exhibition space site, will include 223 affordable units and is expected to be complete in 2017.

The submarkets to the north and east of the Yard are located outside of the 421-a GEA and as a result have supported a very small number of affordable units in recent years. In the future, focused city policies and development goals will bring more affordable units to LIC and Western Queens. In March 2016, the New York City Council adopted the Mandatory Inclusionary Housing (MIH) program, requiring developers of large scale residential development in rezoned areas to provide a 20% to 30% affordable unit set-aside onsite or offsite within the same locale.[3] The rezoning of the Long Island City core presently contemplated by DCP is expected to deliver additional affordable housing, as it will be required to comply with MIH.

5. Commercial Market Context

Long Island City supports a substantial proportion of the City's industrial economy. The 715-acre LICIBZ – one of the city's largest by area – spans much of the area to the west and south of Sunnyside Yard, comprising 18% of total IBZ employment and 35% of total Queens' IBZ employment. Industrial properties comprise two-thirds of total commercial property in the Study

[3] Department of City Planning 2016

FIGURE 2.8: CREATIVE OFFICE RENTS (2015-2016)

Adjacent Submarket	Creative Office Rents (Asking) PSF
LIC Waterfront (A)	$20
Court Square/Queens Plaza (B)	$26
Ravenswood (C)	n/a
Dutch Kills/South Astoria (D)	$39
Sunnyside (E)	$30
LIC Industrial Core (F)	$38
Study Area Total	$26
Downtown Brooklyn	$41
Lower Manhattan	$51
Midtown	$53
Midtown – Plaza District	$63

Source: HR&A Analysis, CoStar

FIGURE 2.9: RETAIL RENTS (2015-2016)

Adjacent Submarket	Retail Rents (Asking) PSF	Total RBA [4]
LIC Waterfront (A)	$63 - $87	438,400
Court Square/Queens Plaza (B)	$25 - $66	685,400
Ravenswood (C)	n/a	864,500
Dutch Kills/South Astoria (D)	$30 - $40	2,383,500
Sunnyside (E)	$27 - $37	995,600
LIC Industrial Core (F)	$32 - $44	396,500
Study Area Total	$32 - $44	5,763,900
Greenpoint	$82 - $112	4,277,000
Williamsburg	$58 - $350	4,178,000
DUMBO [5]	n/a	268,000
Downtown Brooklyn	$63 - $85	2,653,000

Source: HR&A Analysis, CoStar

Area as a whole, and comprise the majority of commercial property in all submarkets except for Court Square/Queens Plaza. (Figure 2.6)

Approximately 4.8 million square feet (SF) of Class A Office can be found in the Study Area. Over 40% of Class A Office space (2.1 million SF) has been developed in the Court Square/Queens Plaza submarket over the past 15 years. These projects have relied upon additional, per-project "discretionary" City subsidies in a variety of forms.

Creative office space, defined as distinctive Class B/C office space in formerly industrial loft buildings with large floor plates, comprises much of the Study Area's commercial office space. Some of the Class A and much of the creative office and industrial property in the Study Area has benefited from a number of "as-of-right" City subsidy programs, such as the Relocation Employee Assistance Program (REAP), the Industrial and Commercial Abatement Program (ICAP), or the Commercial Expansion Program.[6] Integral to attracting prospective tenants to the Study Area, these programs have supported the growth of adaptive reuse strategies for a number of existing industrial properties in the Study Area, delivering an office product that is in high demand from tech and innovation economy tenants in the Information, Finance and Insurance, and Professional Services sectors.

Class A Office

Most of the Class A office property in the Study Area can be found in the Court Square/Queens Plaza submarket, with 2.1 million SF of new construction projects built in the last 15 years. These projects include the 800,000 SF JetBlue Airways Headquarters and the 600,000 SF Gotham Center project. Class A rents in the Study Area range from $35 to $42 PSF, a price level that is 20% to 50% lower than comparable Class A property in Downtown Brooklyn, Lower Manhattan, and Midtown and Midtown's Plaza District. (Figure 2.7) While rents are lower than other markets, vacancy rates are also extremely low because of the limited supply of Class A office. In 2015, Class A vacancy in Court Square/Queens Plaza was only 3.1% compared to 6.5% in Downtown Brooklyn, 13.3% in Lower Manhattan and 8.9% in Midtown.[4]

Creative Office

Creative Office rents in the Study Area range between $20 to $39 PSF. Adaptive reuse projects in the LIC Industrial Core and Dutch Kills/South Astoria submarkets – such as the Falchi Building, the Factory Building, the Center Building, and the Standard Motor Products Building – appear to be likely contributors to increased market momentum, as rents in these submarkets are among the strongest in the Study Area. Creative office rents in the Study Area are 30% to 60% lower than comparable creative office rents in Downtown Brooklyn, Lower Manhattan, and Midtown. (Figure 2.8) Vacancy rates for creative office space varies by submarket. Total creative office vacancy in the LIC Waterfront is 0.6%, while creative office vacancy rates in Dutch Kills/Astoria, LIC Industrial Core and Court Square/Queens Plaza are 5.4%, 6.3% and 11.7% respectively.[7]

[4] CoStar estimates of retail square footage are known to be imprecise, as CoStar cannot differentiate between land uses in a single-occupancy structure. The figures shown here are intended to illustrate the relative prevalence and concentration of retail throughout the Study Area and should not be considered as definitive.
[5] CoStar data analysis finds no retail property is available for rent in DUMBO
[6] Long Island City Partnership, http://licpartnership.org/tax-credit-and-incentives.
[7] CoStar.

FIGURE 2.10: INDUSTRIAL RENTS (2015)

Adjacent Submarket	Asking Industrial Rents	Total RBA
LIC Waterfront (A)	$19 PSF	4,200,000
Court Square/Queens Plaza (B)	n/a[8]	4,530,000
Ravenswood (C)	$21 PSF	2,150,000
Dutch Kills/South Astoria (D)	n/a[9]	3,380,000
Sunnyside (E)	$22 PSF	725,000
LIC Industrial Core (F)	$11 PSF	10,200,000
Study Area Total	**$15 PSF (average)**	**25,185,000**
Brooklyn Navy Yard[10]	$23 PSF	2,439,000
Brooklyn Army Terminal[11]	$13 PSF	1,294,000
Queens	$16 PSF	76,753,000
New York City	$17 PSF	206,596,000

Source: HR&A Analysis, CoStar

Retail

Retail market conditions near Sunnyside Yard vary greatly. While neighborhood-serving retail can be found along Queens and Vernon Boulevards, other submarkets such as the LIC Industrial Core are essentially devoid of retail. Given the significant growth and anticipated continued expansion of the residential market, the proportion and concentration of retail is insufficient. A survey of residential developers showed widespread agreement that retail development in the western submarkets (LIC Waterfront, Court Square/Queens Plaza) has failed to keep pace with the dramatic expansion of residential and hotel uses in the area, to the detriment of residents, workers, and visitors.[12] Compounding the limited supply of neighborhood-serving retail, both the Study Area and Western Queens also lack large-format shopping districts expected for the size of their population. Queens' major shopping districts are found in its central and eastern areas, stretching in an arc from Elmhurst to Flushing. This geographic separation results in leakage of local spending to retailers located outside the Study Area and potentially outside of New York City. [13] Western Queens lacks large-scale urban shopping districts. The nearest projects, including Queens Center Mall, Rego Park Center, and Sky View Center, are located in central and eastern Queens. Sunnyside Yard could capitalize on the transformation of retail districts and support a mixed-use shopping district to draw upon a large catchment area of residents extending throughout Western Queens, North Brooklyn, and the Brooklyn-Queens waterfront.

Retail rents have increased particularly quickly in the submarkets that have experienced residential, office, and hotel development. In the high-value LIC Waterfront submarket, retail rents per square foot average $63 to $87, yet retail rents yield one-third that amount in the Ravenswood and Dutch Kills/South Astoria submarkets. Except for the LIC Waterfront submarket retail rents in the Study Area underperform in comparison to high-value residential real estate markets located elsewhere along the Brooklyn-Queens Waterfront. (Figure 2.9) In 2015, retail vacancy on average was below 5% across the Study Area. This vacancy rate is on-par with the City average of 4.3% over the same time period.[14]

Contributing to the retail market conditions is a transformation in the format of shopping districts across the country, with traditional neighborhood-serving retailers, such as grocers and drug stores being collocated with traditional "destination" retailers such as apparel and electronic shops. As of 2014, the net delivery rate of new space for modern mixed-use shopping dropped to its lowest level in 40 years; while the enduring appeal of the in-store shopping experience contributed to strong monthly shopping-center sales approaching pre-recession peaks of approximately $212 billion. This combination of rising sales, constrained new space, and a preference for new retail experiences, suggests the potential opportunity for development of mixed-use urban shopping districts, similar to SoHo or Dumbo – where neighborhood and destination retailers are intermixed and located in close proximity to residential and office uses. These new mixed-use urban shopping districts draw upon a distinctive architectural approach characterized by enhanced pedestrian connectivity – often aesthetically sheltered or positioned along street grid – that guides shoppers and diners through a walkable and diverse mixed-use district.

Industrial

Industrial property near Sunnyside Yard is of a uniformly older, large-scale character, with a substantial concentration in the LIC Industrial Core, a principally industrial area located to the south and west of Sunnyside Yard. Over 97% of the overall industrial building stock was built before 2000, with average build years ranging from 1942 to 1952. When compared to the other submarkets, areas of former or current industrial use that principally comprise the LICIBZ, such as the LIC Industrial Core, contain three times the amount of industrial space. Industrial rents in the Study Area range from $11 to $36 PSF. In line with recent trends, industrial property built since 2000 is 2% of total rentable building area, and there are no known new industrial projects in the development pipeline for the Study Area. (Figure 2.10) Since 2010, over 1.7 million SF of total rentable building area has been removed from the industrial stock. While vacancy rates have declined for industrial properties across the Study Area – including the LIC Industrial Core experiencing a decline from 8.6% in 2010 to 5.9% in 2015. This decline is more a result of decreased relocation supply than of improved market conditions.

[8] According to CoStar, no industrial properties are currently on the rental market.
[9] According to CoStar, no industrial properties are currently on the rental market.
[10] Industrial rent information for Brooklyn Navy Yard is derived from a "buffered" geography that includes the Navy Yard itself and adjacent industrial properties.
[11] Industrial rent information for Brooklyn Army Terminal is derived from a "buffered" geography that includes BAT and adjacent industrial properties.
[12] "Long Island City faces a shopping drought." The Real Deal, May 1st 2015. http://therealdeal.com/issues_articles/long-island-city-faces-a-shopping-drought/
[13] "Shopping Centers: America's First and Foremost Marketplace." ICSC, 2014.
[14] CoStar

Hotel

Since 2000, submarkets near Sunnyside Yard have experienced a significant amount of new hotel development. Approximately 30 new hotels have been brought to market, an addition of approximately 3,000 new rooms. A contributing factor to this development has been the inclusion of hotels as a permitted commercial use under zoning for manufacturing uses, the predominant classification for much of the industrial property in the Study Area. From 2011 to 2015, the Average Daily Rate ("ADR") for hotels in Queens grew by 3% on an annual basis from $124 to $151; in comparison, the ADR for hotels in Brooklyn grew by 2% on an annual basis from $169 to $183 during the same period.

6. Market Assumptions

Residential Land Uses

Over the past 15 years, the emergence of high-performing real estate submarkets along the Brooklyn-Queens waterfront has transformed an underutilized industrial waterfront into one of the City's most promising growth corridors. This transformation is evident in western submarkets where development activity is taking place – in those areas rents outperform the rest of the Study Area by 30% to 60%. However, the western submarkets still trail comparable Brooklyn-Queens waterfront submarkets by 5% to 20%.

Residential rents and sale prices for the initial phase of onsite development at Sunnyside Yard were established by the core consultant team with review by NYCEDC. These incorporate the following two assumptions:

- Residential development at Sunnyside Yard will likely be accompanied by distinctive open space, high-quality retail and other amenities, which makes the development more appealing. The initial phase of market-rate residential rental development at Sunnyside Yard could reach current price levels observed in the Court Square/Queens Plaza submarkets. Residential condo sale price is expected to be comparable to LIC waterfront given the level of amenties and finishes expected.
- Residential development would increase in value with each successive phase. Increased rents and sale prices could result in higher residential land values for each phase of residential development. Per an earlier Project Team analysis of value premiums associated with large-scale development, this halo effect could increase adjacent residential property land values by 25% to 35% in the project's initial years, and by 10% to 25% in the project's later years. In addition, the inclusion of specific programmatic elements, such as distinctive open space and improvements to area transportation, could generate additional value premiums that would benefit proximate onsite and offsite residential development. Our conservative assumption has been to not include this premium but that it should be studied and tracked.

To assess the onsite feasibility, rates of $60 PSF for residential rents and $1,200 PSF for condominiums were assumed by the Project Team. The projected values are based on a review of current pricing of Court Square/Queens Plaza and LIC Waterfront submarkets.

Residential Historical and Geographic Context

Over 9,000 residential units have been delivered in the LIC Waterfront and Court Square/Queens Plaza submarkets since 2000, with an additional 12,000 residential units in the development pipeline to be completed in the coming years. While the average annual rate of delivery over the past fifteen years was roughly 600 units, the annualized delivery rate has increased significantly in recent years. From 2011 to 2014, 1,110 units were delivered per year. The pipeline is anticipated to deliver approximately 4,000 units per year in Long Island City between 2015 and 2017.

The New York Metropolitan Transportation Council[16] (NYMTC), the federally recognized planning organization for the New York City metropolitan area, forecasts population growth of nearly 50% for the Study Area, from approximately 126,000 residents in 2015 to 183,000 residents in 2040. These numbers represent an increase of 57,000 residents and 21,800 households. Within the Study Area, a significant amount of population growth is forecasted for areas to the west of Sunnyside Yard, in the LIC Waterfront and Court Square/Queens Plaza submarkets.

An alternative projection for short-term residential development based on a dataset of historical and planned development in Long Island City produced by the Long Island City Partnership (LICP), a local economic development organization, as well as analysis of data from CoStar, was constructed by the Project Team. A Study Area population ranging between 135,000 and 156,000 units by 2020 was estimated by the Project Team's analysis. (Figure 2.12, Figure 2.13)

Residential Absorption Assumptions

Formulating a credible absorption forecast is an important metric when assessing the viability of large-scale urban redevelopment. An absorption estimate seeks to establish the rate at which a particular land use will be leased or sold in a particular market during a given time period. A variety of methods to estimate absorption can be used by practitioners; these include a review of case study precedents, an evaluation of local market conditions, and an analysis of demographic trends.

Absorption is an important factor when assessing the possibility of overbuild redevelopment at Sunnyside Yard, as it will drive the rate at which vertical development can be successfully phased, delivered, and occupied. In this section, residential absorption assumptions based on market trends and observed data from other comparable developments are proposed by the Project Team. The following assumptions for residential delivery have been incorporated into the project's financial modeling, physical design, and phasing plan:

- Average deliveries for market-rate residential development across the build-out of the project are estimated to total 520 units per year. This assumption is 25% higher than the

FIGURE 2.12: COMPARISON OF NYMTC AND DEVELOPMENT PIPELINE POPULATION GROWTH (2015-2020)

Adjacent Submarket	2015 Projected Population (NYMTC)	2020 Projected Population (NYMTC)	NYMTC Projected Growth	Projected Growth from Dev't Pipeline[15]
LIC Waterfront (A)	12,000	15,000	3,000	10,000
Court Square/Queens Plaza (B)	5,000	6,000	1,000	15,000
Ravenswood (C)	21,000	23,000	2,000	
Dutch Kills/South Astoria (D)	28,000	29,000	1,000	
Sunnyside (E)	58,000	60,000	2,000	
LIC Industrial Core (F)	2,000	2,000	0	
Study Area Total	126,000	135,000	9,000	25,000

Source: HR&A analysis of data from NYMTC and the Long Island City Partnership

FIGURE 2.11: ASSUMED NON-RESIDENTIAL RENTS

Use	Assumed Rent PSF
Commercial Office (Class A)	$55
Creative Office (Class B/C)	$45
Neighborhood Retail	$75
Mixed Use Retail	$100
Community Facility	$45

Source: HR&A, CoStar

projected absorption for comparable residential megaprojects, and reflects the particular strength of local market conditions in LIC.

- Affordable housing units can generally be absorbed at any volume; their delivery rate would only be constrained by construction timing and the availability of financing.
- For each of the three test cases, absorption estimates were adjusted by the Project Team to reflect the relative significance of residential land uses within the proposed development program.

Observed Trends at Comparable Large-Scale Developments

The observed and anticipated annualized delivery and absorption rates for comparable large-scale urban development projects were analyzed by the Project Team to inform feasible residential absorption rates for Sunnyside Yard. In addition, recent development trends in Western Queens were considered. As part of this exercise, 12 large-scale completed and planned urban redevelopment projects were identified, and average delivery per year was analyzed.[17] Completed projects have delivered an average of 190 units per year, while planned residential projects are forecasted to deliver an average of 265 units per year and projected residential projects are forecasted to deliver an average of 415 units per year.

FIGURE 2.13: ALTERNATE FORECAST OF POPULATION GROWTH (2015-2020)

Adjacent Submarket	2015 Projected Population (NYMTC)	Project Team Selected Growth Projection	2020 Revised Growth	2020 Growth Percentage
LIC Waterfront (A)	12,000	*(pipeline)* 10,000	22,000	83%
Court Square/Queens Plaza (B)	5,000	*(pipeline)* 15,000	20,000	300%
Ravenswood (C)	21,000	*(NYMTC)* 2,000	23,000	10%
Dutch Kills/South Astoria (D)	28,000	*(NYMTC)* 1,000	29,000	4%
Sunnyside (E)	58,000	*(NYMTC)* 2,000	60,000	3%
LIC Industrial Core (F)	2,000	*(NYMTC)* 0	2,000	0%
Study Area Total	126,000	30,000	156,000	24%

Source: HR&A analysis of data from NYMTC and the Long Island City Partnership

Implications for Forecast Growth

An assumed 25-year residential development program with an annual absorption of 520 units would result in 13,000 total market-rate units of housing at full build-out. This would account for approximately 60% of all residential development forecast by NYMTC for the Study Area, and 41% of all residential development projected in the alternative growth forecast. This suggests that forecast residential absorption would be compatible with a conservative estimate of projected future growth in the Study Area. (Figure 2.13)

Non-Residential Land Uses

Each of the non-residential land uses in the Study Area is governed by a set of unique dynamics that merits consideration in order to project rents for onsite development.

Since 2002, Study Area employment grew by 25%. This job growth is spread across a range of building types, including subsidized, newly-constructed Class A Office space and adaptive reuse, large-floor plate Class B/C creative office space commonly preferred by creative industries. Current rents in the Court Square/Queens Plaza submarket underperform those of other commercial employment hubs, including Downtown Brooklyn. neighborhood retail rents in the LIC Waterfront submarket are generally competitive with other submarkets along the Brooklyn-Queens waterfront.

Non-residential rents and sale prices for the initial phase of onsite development at Sunnyside Yard were established by the Project Team and reflect the following assumptions:

- **Commercial Office (including both Class A Office and Creative Office)** Over the last 15 years, much of the new construction Class A Office property in Long Island City and elsewhere along the Brooklyn-Queens

[15] Implied growth has been calculated by applying Census data on average household size per submarket to pipeline data on residential development provided by the Long Island City Partnership.
[16] NYMTC is the federally-recognized planning organization for the New York City metropolitan area.
[17] Completed projects include Battery Park City, Riverside South, Canary Wharf, Mission Bay, Denver Union Station, and Bunker Hill. Planned projects include London Olympic Park, Barangaroo South, Hudson Yards, Union Station (DC), King's Cross, and Pacific Park.

FIGURE 2.14: FORECAST ABSORPTION FOR NON-RESIDENTIAL LAND USES AT SUNNYSIDE YARD

Class A Office	
2,130,000 SF*	Total recently-built Class A Office space in LIC, 2000-2015
250%*	Capture rate for Sunnyside Yard, reflects very limiting existing development
355,000 SF	Forecast annual absorption of Class A Office space
Creative Office	
7,800,000 SF	Forecast aggregate citywide absorption of Class B/C office space, 2013-2025
650,000 SF	Annual citywide absorption of Class B/C office space, 2013-2025
15%	Capture rate for Sunnyside Yard
100,000	Forecast annual absorption of Creative Office (Class B/C office) commercial property at Sunnyside Yard
Neighborhood Retail	
3.5% of overall residential development program	Estimated Neighborhood Retail program for Sunnyside Yard
Mixed Use Retail	
1,000,000 SF**	Estimated Mixed Use retail program for Sunnyside Yard
Hotel	
n/a	Scale of hotel program dependent on test case composition

Source: HR&A Analysis, CoStar

*Test Case 2 only

** Test Case 3 only; Test Case 1 and Test Case 2 have between 1,100 SF and 300,000 SF of mixed-use

waterfront has required assistance from the City to support construction and occupancy. More recently, private investors have begun to advance market-supported Class A Office projects in Downtown Brooklyn, a more mature commercial office district. Assuming that the redevelopment of Sunnyside Yard as an amenity-rich office district could improve conditions for market-supported, new-construction commercial development, substantially discounted Downtown Brooklyn Class A rents were applied.

- **Creative Office** The current market demand for office space in formerly industrial loft buildings throughout Long Island City is recognized by the Project Team. It is assumed that new-construction creative office property at Sunnyside Yard could reflect rents slightly greater than LIC Industrial Core and Dutch Kills submarkets. These reflect fit-out, amenities, and services similar to those of formerly industrial properties such as the Falchi Building, the Factory Building, and the Standard Motors Building.
- **Neighborhood Retail** rents comparable to LIC Waterfront and Court Square/Queens Plaza submarkets were applied.
- **Mixed-use Retail** Rents are structured differently than those for neighborhood retail. In addition to a minimum rent PSF to be paid each month, shopping district tenants frequently enter into participation agreements with a master leaseholder. Rents and participation rates for recently built shopping district facilities within the New York City metropolitan area were assumed by the Project Team.

Projected non-residential rents for the first phase of onsite development at Sunnyside Yard, are shown in Figure 2.11.

Non-Residential Historical and Geographic Context

Forecast data produced by NYMTC was utilized by the Project Team. NYMTC forecasts employment growth of nearly 20% for the Study Area, growing from approximately 97,000 workers in 2015 to 115,000 workers in 2040.[18] Unlike residential growth projections, forecast employment growth in the Study Area is nearly identical to growth rates for the borough of Queens overall and even slightly lower than those for the City as a whole, suggesting that NYMTC does not expect Western Queens to emerge as an area of particular employment growth in the coming decades. While the Project Team believes that this is the appropriate conservative estimate for the study, LIC – catalyzed by the opening of the Cornell Tech Campus and new efforts led by the City – may continue to grow more quickly as a jobs center.

Absorption Assumptions for Commercial Office (Class A Office)

Annual absorption levels are estimated to equal 250% of recent Long Island City market conditions. This assumption is based on the delivery of 2.1 million SF of Class A Office Space in Long Island City over the past 15 years, all of which required public support. The absorption rate is misleadingly high due to the very small amount of SF area absorbed over the last 15 years.

Absorption Assumptions for Creative Office (Class B/C Office)

The following assumptions for creative office have been incorporated into the project's financial modeling, physical design, and phasing plan:

- Over the past 15 years, approximately 800,000 SF of Class B/C adaptive reuse commercial office development has been successfully repositioned in the Study Area.
- According to a 2013 study commissioned by NYCEDC,[19] demand from growth-stage tech tenants absorbed 1.6 million SF of the City's stock of Class B/C office space between 2000 and 2012. This demand is expected to grow, with an additional 7.8 million SF forecast for citywide absorption between 2013 and 2025.
- Under an assumption that the redevelopment of Sunnyside Yard would offer the City an opportunity to expand its stock of creative office property through new development, absorption at Sunnyside Yard was estimated to be equivalent to 15% of the citywide annual forecast demand between 2013 and 2025.

[18] NYMTC 2015 forecast employment of 97,000 for the Study Area is approximately 7% higher than the 90,400 estimate of 2013 Study Area employment produced through analysis of LODES Census data. This discrepancy can be attributed to significant methodological differences between LODES Census data and NYMTC.
[19] Commercial Real Estate Competitiveness Study. Alvarez & Marsal on behalf of NYCEDC, December 2013

Absorption Assumptions for Retail

Neighborhood-serving retail is a supporting programmatic element that can contribute to the creation of an appealing street-level experience and establish district identity. The amount of neighborhood-serving retail is based on the anticipated demand for housing at Sunnyside Yard. Most, if not all of this retail would be developed as ground-floor space in residential and office buildings located across the site. The Project Team estimated absorption for this type of retail to correspond to a ratio of 3.5% to the cumulative square footage of planned residential and commercial development in a given year. This approach aligns the total amount of neighborhood-serving retail with the corresponding amount of large-scale residential and commercial development that it would serve.

In Test Case 3, the Project Team assumed that a mixed-use urban shopping district would contain approximately 1 million SF and could be delivered as a single facility. Absorption would be based on the prescribed lease-up period from the master developer, which could range from 6 to 24 months depending on the relationship between project construction schedule and project marketing efforts.

C. Urban Design Context

Sunnyside Yard is located in Western Queens between Long Island City, Astoria, and Sunnyside. The Study Area represents a wide range of uses, scales, and neighborhood character. The most fundamental urban design elements are described below.

1. Design and Density Considerations

Block Patterns and Grid

Three significant areas with consistent block and street grid patterns are shown in Figure 2.15. The first of these three areas is north of Sunnyside Yard, where the block pattern extends south from Astoria into Long Island City; the second is in the area west of the site where the grid extends to the East River waterfront; the third major block grid pattern is found south of Sunnyside Yard extending to Newtown Creek. The area at the west end of Sunnyside Yard contains a minor, independent grid that is interrupted by the railyard, extending for only for one block on either side of the railyard.

Several major roads interrupt the block and grid pattern. These include Jackson Avenue/Northern Boulevard north of Sunnyside Yard and Greenpoint Avenue, at the southern edge of the Study Area.

Queens Boulevard, although it follows the grid through Long Island City and Sunnyside, should be noted for its physical form and significance as an identifying landmark. It is one of four roadways that bridge Sunnyside Yard.

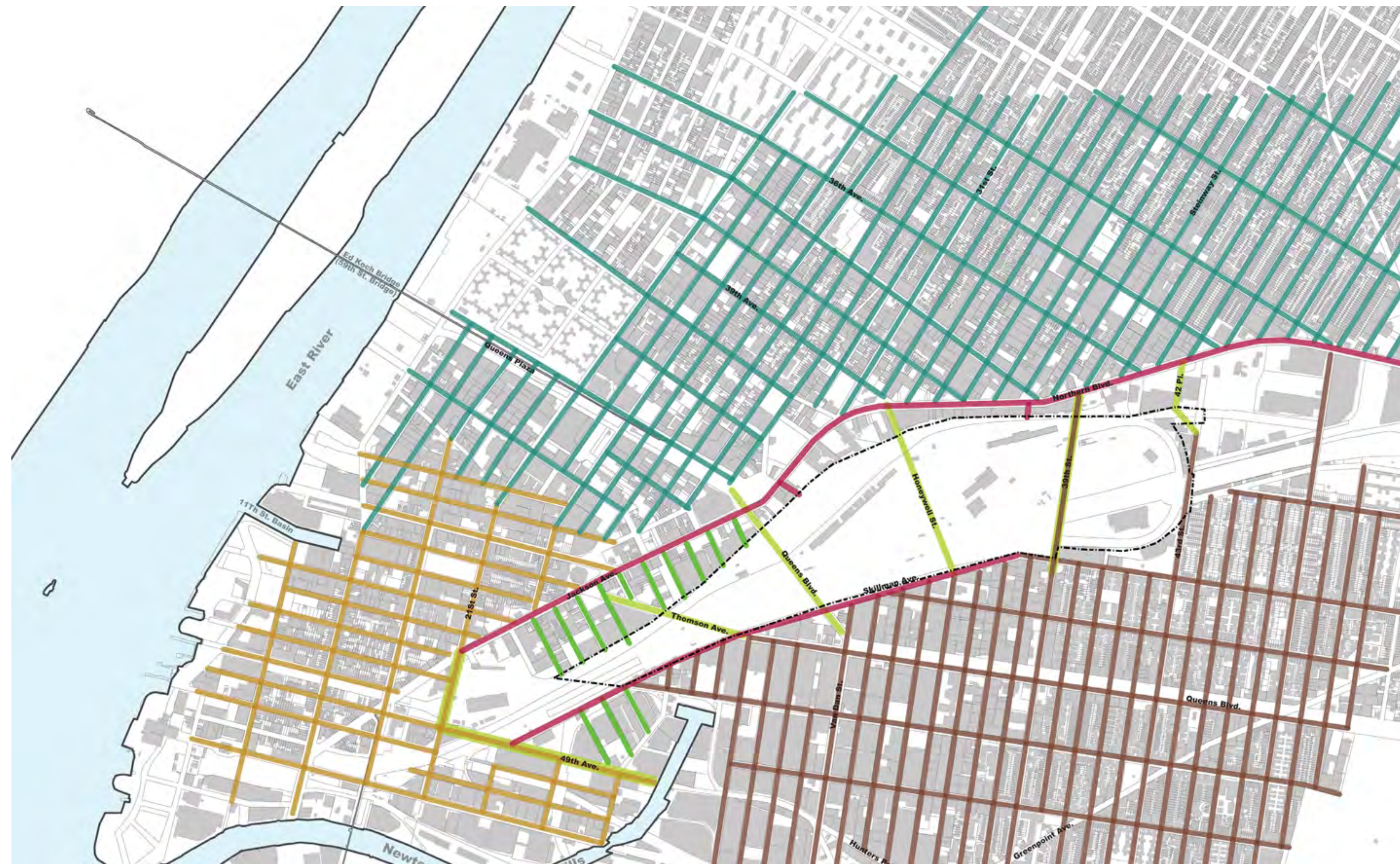


FIGURE 2.15: BLOCK PATTERNS AND GRID

2. Land Use Patterns

The Study Area surrounding Sunnyside Yard includes a wide range of land use patterns and neighborhood types. These include single-story industrial uses and multi-story commercial loft buildings to the north and south, traditional office uses clustered around Queens Plaza, and in many parts of the Study Area, tracts of low-rise, one- to three-family row houses. The neighborhoods to the west and northwest of Sunnyside Yard are in transition, with a large number of new residential buildings under construction or in planning. Much of this new development is in high-rise towers that are changing the character of the area. The area north of Sunnyside Yard is being studied by the Department of City Planning (DCP), as part of the LIC Core Neighborhood Planning Study, to identify a wide range of strategies and investments for Long Island City. (Figure 2.16)

Long Island City Waterfront

The LIC Waterfront has seen significant changes in the last 20 years with the creation of Queens West and Hunters Point South, both large-scale, government-led, primarily residential mixed-use developments. Queens West is now an established neighborhood. Hunters Point South is still under construction. Other areas of the LIC Waterfront are still mostly low-rise single and multi-family residential structures interspersed with clusters of low-rise light industrial/commercial uses. Vernon Boulevard has become a “restaurant row” for the area. The northern portion of the waterfront is part of the Long Island City Industrial Business Zone (LICIBZ) and comprises almost exclusively industrial/commercial uses. (Figure 2.17)

Court Square / Queens Plaza

Court Square/Queens Plaza has a mix of commercial, educational, and cultural uses with more recent residential development of both mid- and high-rise structures. Queens Plaza is anchored by JetBlue’s headquarters, housed in a repurposed loft building, and offices of New York City Department of Health, in a new building. The Department of Health is part of 2 Gotham Center, the first phase of a 1.5 million SF, mixed-use development. The area is also home to civic and cultural institutions including One Court Square (Citigroup), the Long Island City Courthouse, and CUNY School of Law, all clustered near Court Plaza. MoMa PS1 is also located here. The western area is primarily industrial/commercial uses and includes part of the LICIBZ. Silvercup Studios, the largest film and television production facility in the City, is located in this area. (Figure 2.18)

Dutch Kills / South Astoria

The Dutch Kills/South Astoria area has industrial loft buildings that abut Sunnyside Yard along the railyard’s northern edge. Several of these loft buildings, including the Standard Motor Products building, have been converted to house creative office users. Dutch Kills/South Astoria has two significant concentrations of industrial/commercial uses. The first is the western end of the area past Crescent Street. The second is north of the 39th Street Bridge and west of Steinway Street, home to Kaufman Astoria Studios. Both of these areas overlap with areas designated as part of the LICIBZ. Further east of Sunnyside Yard are a large cluster of big-box retailers and car dealerships. North of the Yard the neighborhood becomes primarily low-rise residential. Steinway Street and Broadway, at the northern edges of the area, are retail corridors. (Figure 2.19)

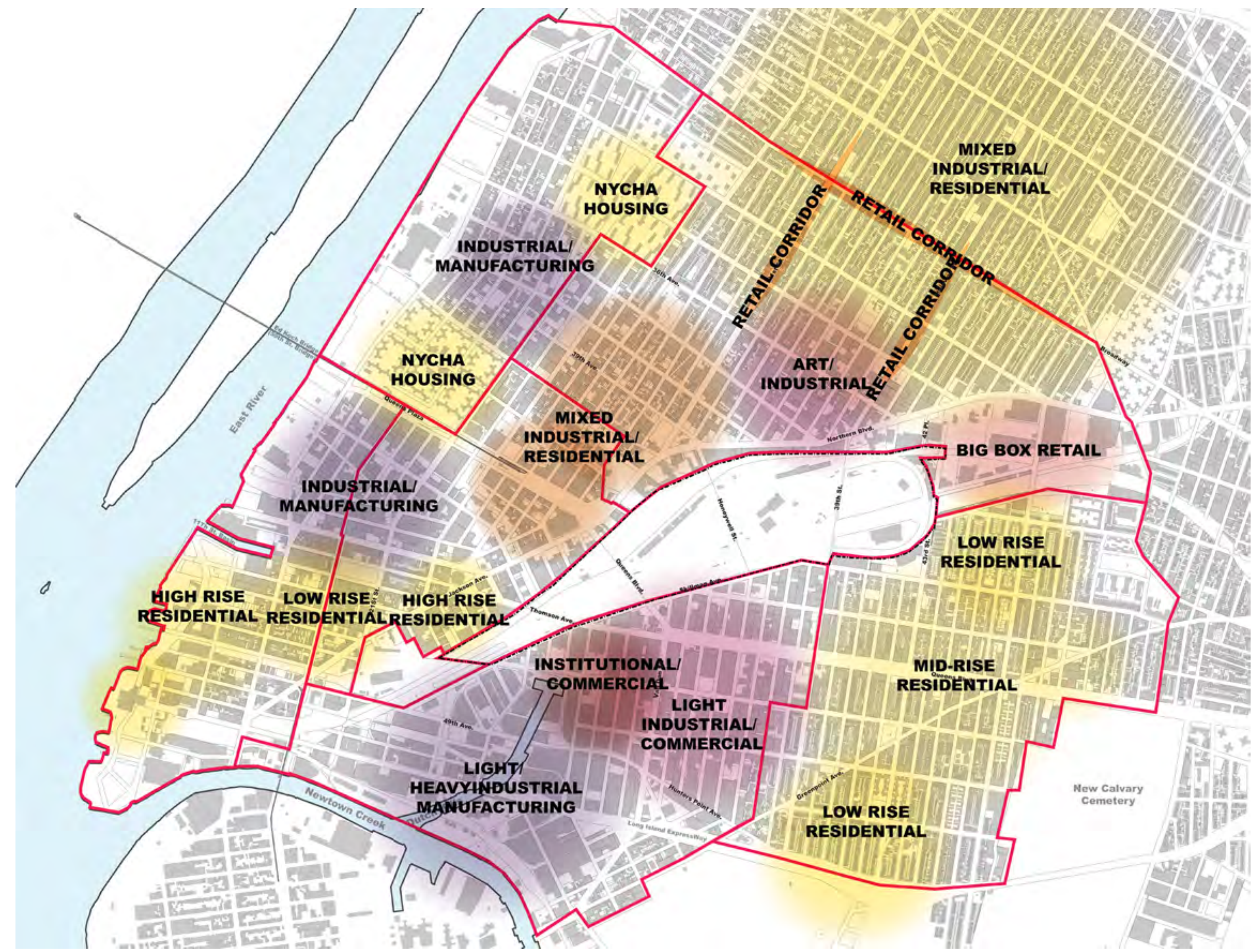


FIGURE 2.16: NEIGHBORHOOD CHARACTER

- Residential
- Mixed-Use
- Industrial/Manufacturing
- Institutional/Commercial
- Retail Corridor
- Study Areas

Sunnyside

Sunnyside, from a land use perspective, is the most homogeneous of the submarkets. The area is overwhelmingly residential, composed of mostly one- and two-family dwellings with a mix of multi-family dwellings. The area also includes the Sunnyside Gardens Historic District, one of the first planned communities in the United States. Retail corridors in this area include Queens Boulevard, Greenpoint Avenue, and clusters of retail along 43rd and Skillman Avenues. (Figure 2.20, Figure 2.21)

Long Island City Industrial Core

The LIC Industrial Core is located immediately south of Sunnyside Yard and generally west of 39th Street. The Dutch Kills tributary of Newtown Creek divides the area. Almost all of this area is part of the LICIBZ. Land uses are almost exclusively industrial/commercial. The area also includes government agencies and several educational facilities, including LaGuardia Community College, Aviation High School, and Queens Vocational and Technical High School. Several loft-style former industrial buildings, such as the Falchi Building, have been adapted to accommodate creative office users. (Figure 2.22)

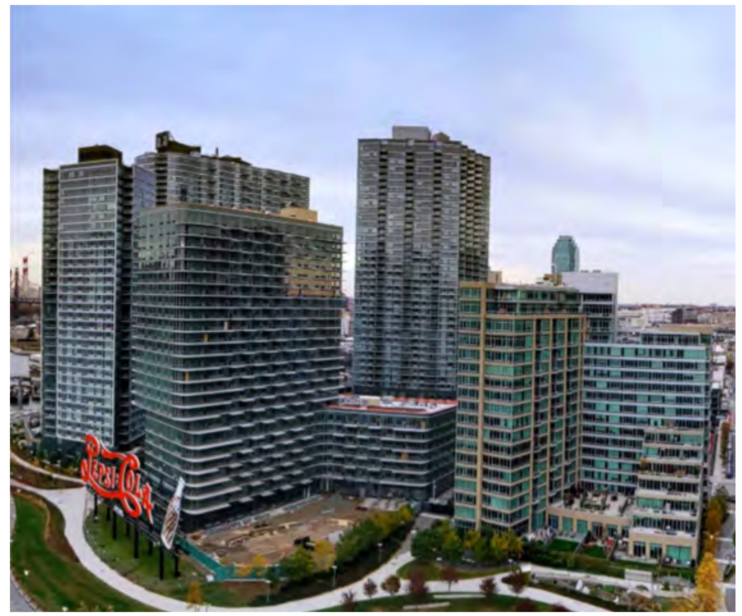


FIGURE 2.17: LONG ISLAND CITY WATERFRONT

FIGURE 2.18: COURT SQUARE/QUEENS PLAZA

FIGURE 2.19: DUTCH KILLS/SOUTH ASTORIA

FIGURE 2.20: SUNNYSIDE

FIGURE 2.21: SUNNYSIDE GARDENS

FIGURE 2.22: LONG ISLAND CITY IBZ

Infrastructure

Infrastructure plays a role in shaping urban form in the Study Area: fostering neighborhood identity; forming boundaries, and impacting the pedestrian experience. Rail tracks including the Main Line, the Northeast Corridor, and the now-abandoned Montauk Spur traverse the Study Area. Highways have been cut through the area and now define neighborhood boundaries. The elevated approach roads to the Queensboro Bridge wind through Long Island City. Elevated subway lines run through the area and have a disproportionate impact on the pedestrian experience below, including a viaduct for the No. 7 train that runs between the east- and westbound lanes of Queens Boulevard. This viaduct is substantial and forms both a visual and physical barrier. In other areas the No. 7, N, and Q trains run in viaducts directly above the roadway. Abandoned infrastructure has also influenced the built form and urban design context. Along the waterfront, former railroad-related operations have been abandoned and the waterfront is being redeveloped as a new mixed-use residential neighborhood. Remnants of the former rail operations can be seen in the historic gantries and past rail corridors to the waterfront that have been repurposed. (Figure 2.23, Figure 2.24)

FIGURE 2.23: HISTORIC IMAGE OF THE ED KOCH QUEENSBORO BRIDGE

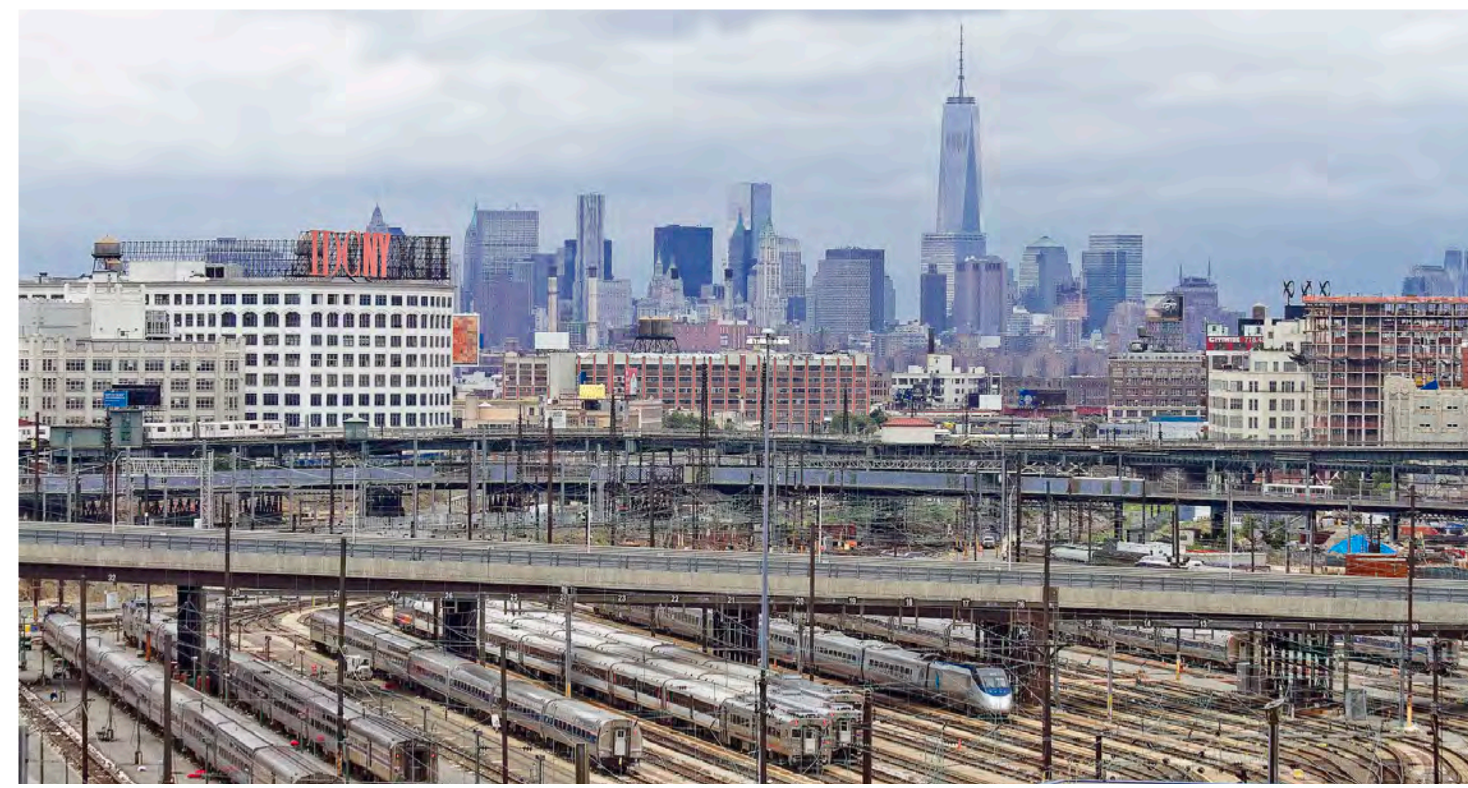


FIGURE 2.24: RAIL TRACKS TRAVERSING THE STUDY AREA

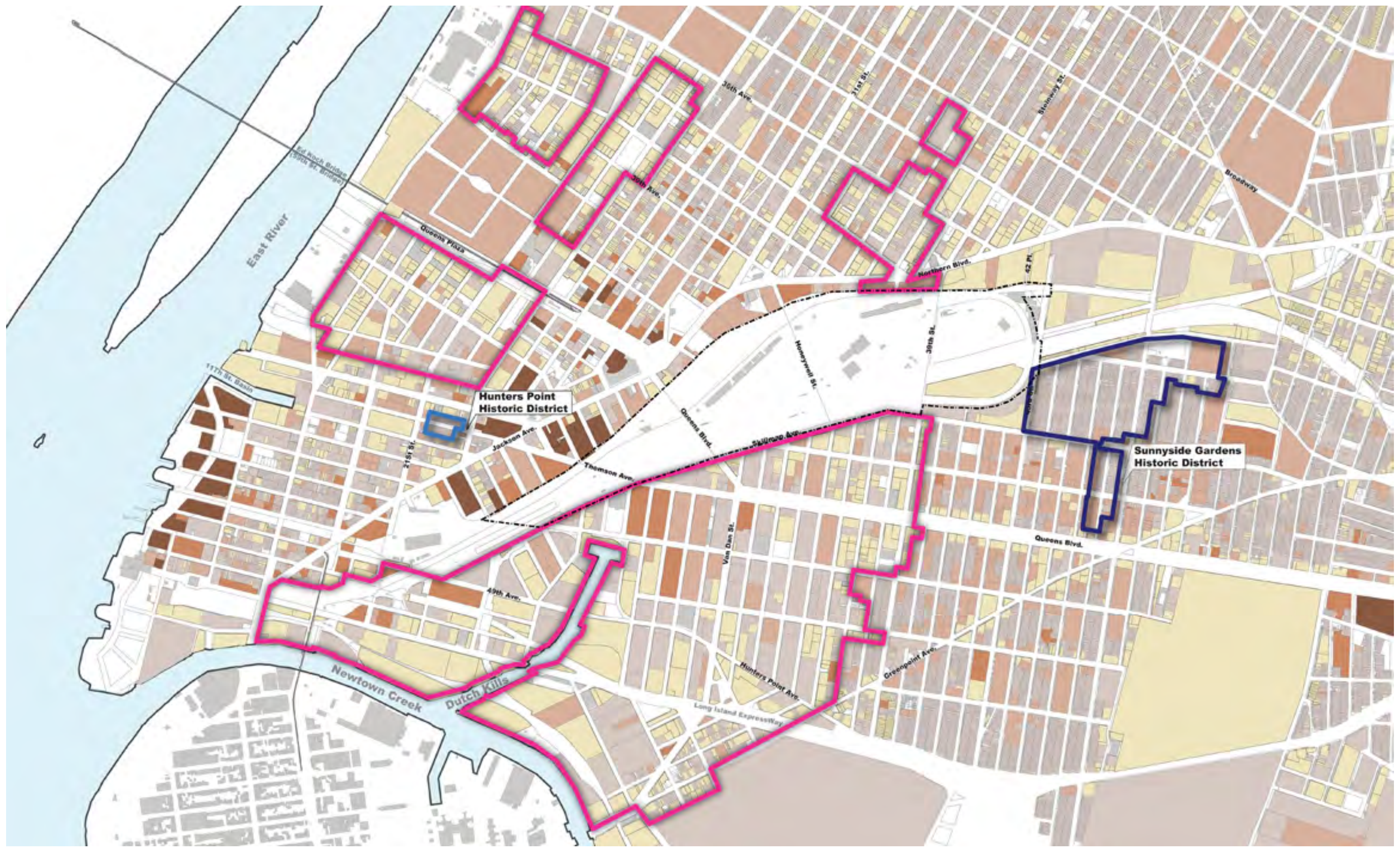


FIGURE 2.25: HEIGHT CONTEXT

- Less than 2 stories
- 3-6 stories
- 7-14 stories
- Over 15 stories
- Long Island IBZ
- Sunnyside Gardens Historic District
- Hunters Point Historic District

3. Height Context

While the Study Area has historically been home to mostly low- rise buildings, typically six stories or less, this context is rapidly changing with new construction occurring to the west of Sunnyside Yard. Towers are clustered along the East River in the Queens West and Hunters Point South developments. Similar large-scale development is planned further north along the waterfront south of the Queensboro Bridge. The tallest towers are being built further east, nearer to Jackson Avenue and Queens Plaza, with some planned to top out at over 80 stories. (Figure 2.25)

The areas zoned for industrial uses north and south of Queens Plaza and the Queensboro Bridge have seen an influx of new mid-rise hotel towers. These new hotels tend to be taller than the existing industrial/commercial context. Development to the north of Sunnyside Yard has been limited, and the scattered buildings and hotels there do not reach the heights of the high-rise buildings to the west of the railyard.

4. Historic Districts and Industrial Business Zone

The LICIBZ and the historic districts affect the character of a significant portion of the Study Area. Much of the area is covered by the LICIBZ. The Study Area contains two historic districts. (Figure 2.26)

Industrial Business Zone

The most concentrated clusters of industrial and commercial uses roughly correspond with areas designated as part of the LICIBZ. Six discontinuous areas are designated as part of the LICIBZ within the Study Area, with the largest area south of the railyard. The LICIBZ contains a full range of industrial/commercial uses and is the largest IBZ in the City in terms of area.

Manufacturing uses have been under increasing pressure from other types of development for limited space, such as in Long Island City. Industrial Business Zones are intended to support and bolster the City's manufacturing sector.

Historic Districts

The Study Area includes two historic districts: The Hunters Point Historic District in the Court Square/ Queens Plaza Submarket west of Sunnyside Yard; and the Sunnyside Gardens Historic District in the Sunnyside Submarket southeast of the railyard.

The Hunters Point Historic District was designated on May 15, 1968, and features a row of 47 townhouses on 45th Avenue built between 1871 and 1890. The Sunnyside Gardens Historic District was designated in June 2007. The district was built between 1924 and 1928 and features private, shared gardens. Sunnyside Gardens is considered an early example of the Garden City movement in the United States which, attempted to combine city living with open space.

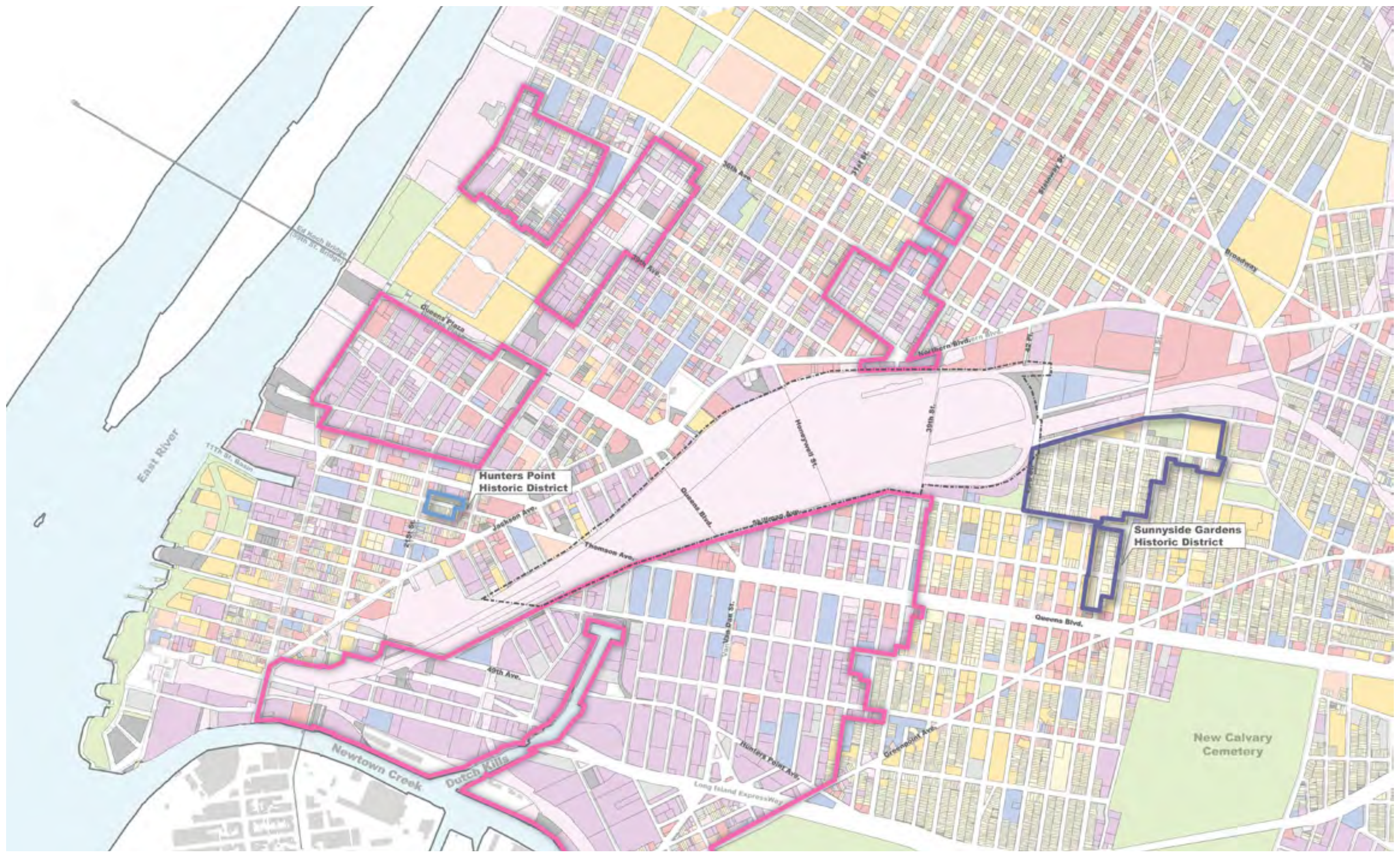


FIGURE 2.26: HISTORIC DISTRICTS AND LICIBZ

- One & Two Family Res.
- Multi Family Res (Walk up)
- Multi Family Res. (Elevator)
- Mixed Res. & Commercial
- Commercial Use
- Industrial / Manufacturing
- Transportation / Utility
- Public Facilities & Institutions
- Open Space & Recreation
- Parking
- Vacant Land
- Long Island IBZ
- Sunnyside Gardens Historic District
- Hunters Point Historic District

5. Public Amenities

Cultural Amenities

The Study Area includes the City's largest cluster of art institutions and museums outside of Manhattan and is home to a range of venues. Examples of the cultural amenities and civic landmarks are described below.

- **The Museum of the Moving Image** is dedicated to film, television, and digital media. It opened in 1988 in a building within the former Astoria Studios complex. Listed on the National Register of Historic Places, Astoria Studios was the site of silent and early sound-era film productions.
- **The Noguchi Museum** opened in 1985 and is housed in multiple galleries and gardens within a converted factory. It displays the works of Japanese-American artist and sculptor Isamu Noguchi (1904–1988).
- **MoMA PS1** is an exhibition space devoted to the display of experimental art. It opened in 1976 and is housed in a former public school.
- **LaGuardia Performing Arts Center** is part of LaGuardia Community College, and has two theaters: a 220-seat multipurpose theater and the 740-seat Main Stage.
- **The Long Island City Courthouse** is home to the civil division of the Queens County Supreme Court. The 1874 courthouse was remodeled and enlarged in 1904 after a fire. It is listed on the National Register of Historic Places and is designated a New York City landmark. The Courthouse fronts on, and prominently anchors, Court Square Park.

Parks and Open Space

The area is generally lacking in parks and open space. Only 11 acres of parks exist within a 10-minute walk from the center of the site. While most of the parks and open-space assets are located west of Sunnyside Yard, the area has seen significant population growth, which is expected to continue. Highlights of some of the significant parks in the study are summarized below. (Figure 2.27)

- **Gantry Plaza State Park** (12 acres) is located west of Sunnyside Yard on the East River in the LIC Waterfront. The park includes historic gantries once used to load and unload rail cars, four piers, gardens, and a mist fountain. Recreational facilities include basketball courts, playgrounds, handball courts, and a fishing pier.
- **Hunters Point South Park** (10 acres) is located just south of Gantry State Park. This park includes a central green, a playground, a dog run, a bikeway, a waterside promenade, a basketball court, and a 13,000 SF pavilion with comfort stations, concessions, and an elevated cafe plaza.
- **John F. Murray Park** (2.5 acres) is located to the west of railyard in Court Square/Queens Plaza. Facilities include synthetic turf fields, handball courts, spray showers, and dog-friendly areas.
- **Court Square Park** (0.49 acres) is located just west of the railyard in Court Square/Queens Plaza. The formal plaza is the front door to the Long Island City Courthouse Complex and features a central fountain.

- **Dutch Kills Green** (1.5 acres) is located at the eastern end of Queens Plaza in Court Square/Queens Plaza. This former commuter parking lot features wetlands, native plantings, artist-designed benches, and walkways. It is a gateway to the Ed Koch Queensboro Bridge.
- **Queensbridge Park** (20 acres) is located on the East River just north of the Queensboro Bridge and west of Queensbridge Houses in Ravenswood. The park includes baseball and soccer-football fields, basketball, volleyball and handball courts, a playground, a wading pool, picnic areas, and walkways.
- **Dutch Kills Playground** (2.4 acres) is located to the north of Sunnyside Yard and adjacent to Dutch Kills School in Dutch Kills/ Astoria. The Department of Education and Parks jointly operate it. In addition to the playground, its facilities include handball courts and spray showers.
- **Laurence Virgilio Playground and Doughboy Plaza** (approximately 4.7 acres) are located to the east of the railyard in Sunnyside. Facilities include sport courts, fitness equipment, outdoor pools, running tracks, spray showers, and playgrounds. Doughboy Plaza includes a Doughboy Monument and a children's playground.
- **Torsney Playground** (just over 2 acres) is located near to the loop tracks at the southwest corner of the railyard in Sunnyside. Besides the playground, facilities include handball courts, spray showers, and dog-friendly area.
- **Lance Corporal Thomas P. Noonan Playground** (just over 1 acre) is located southwest of Sunnyside Yard in Sunnyside. Facilities include playgrounds, handball courts, and spray showers.

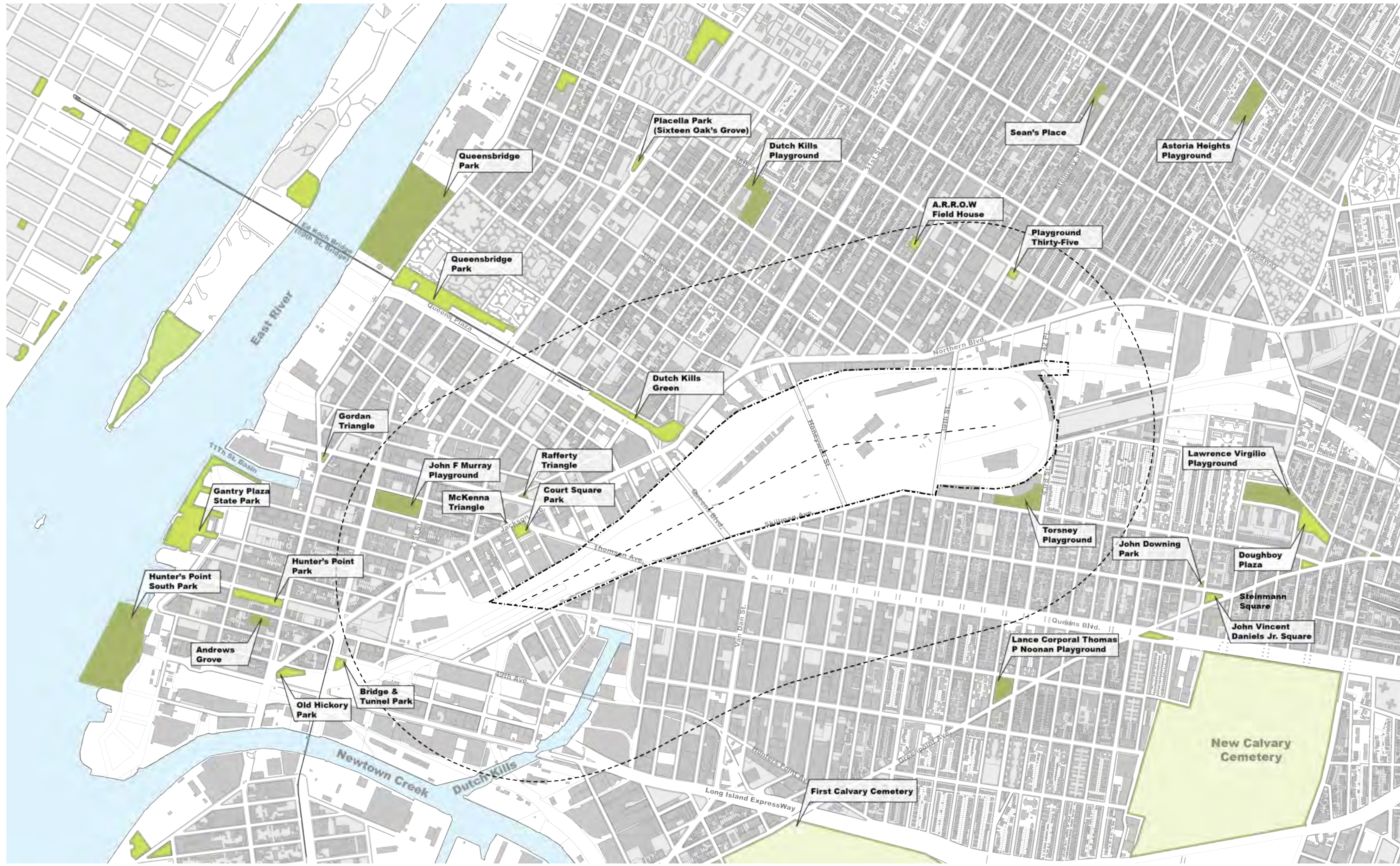


FIGURE 2.27: PARKS AND OPEN SPACE

- - - - 1/2 Mile Radius

6. Schools

The Study Area is served by public, charter, and private schools. (Figure 2.28) Significant residential development on formerly low-rise or industrial sites is creating new demand for schools in these submarkets. As outlined previously, the growth in the population of public school children in these submarkets may not have plateaued.

The Study Area is also home to two schools of higher education, both part of The City University of New York: CUNY School of Law and LaGuardia Community College.

CUNY School of Law is a public interest law school, with a mission of training lawyers to serve the underprivileged and disempowered. The school moved to 2 Court Square in May 2012. Total enrollment in the fall of 2015 was 361 full and part-time students.

LaGuardia Community College is housed in a former Ford Instrument Company factory on Thomson Avenue. In 1980 the college expanded and leased portions of the former Loose-Wiles Sunshine Biscuit Factory building located on 30th Street. Total enrollment in the fall of 2015 was 19,582 full and part-time students.

Technical schools are well represented in the area, and include Aviation High School, Academy for Careers in Television and Film, and Apex Technical School.

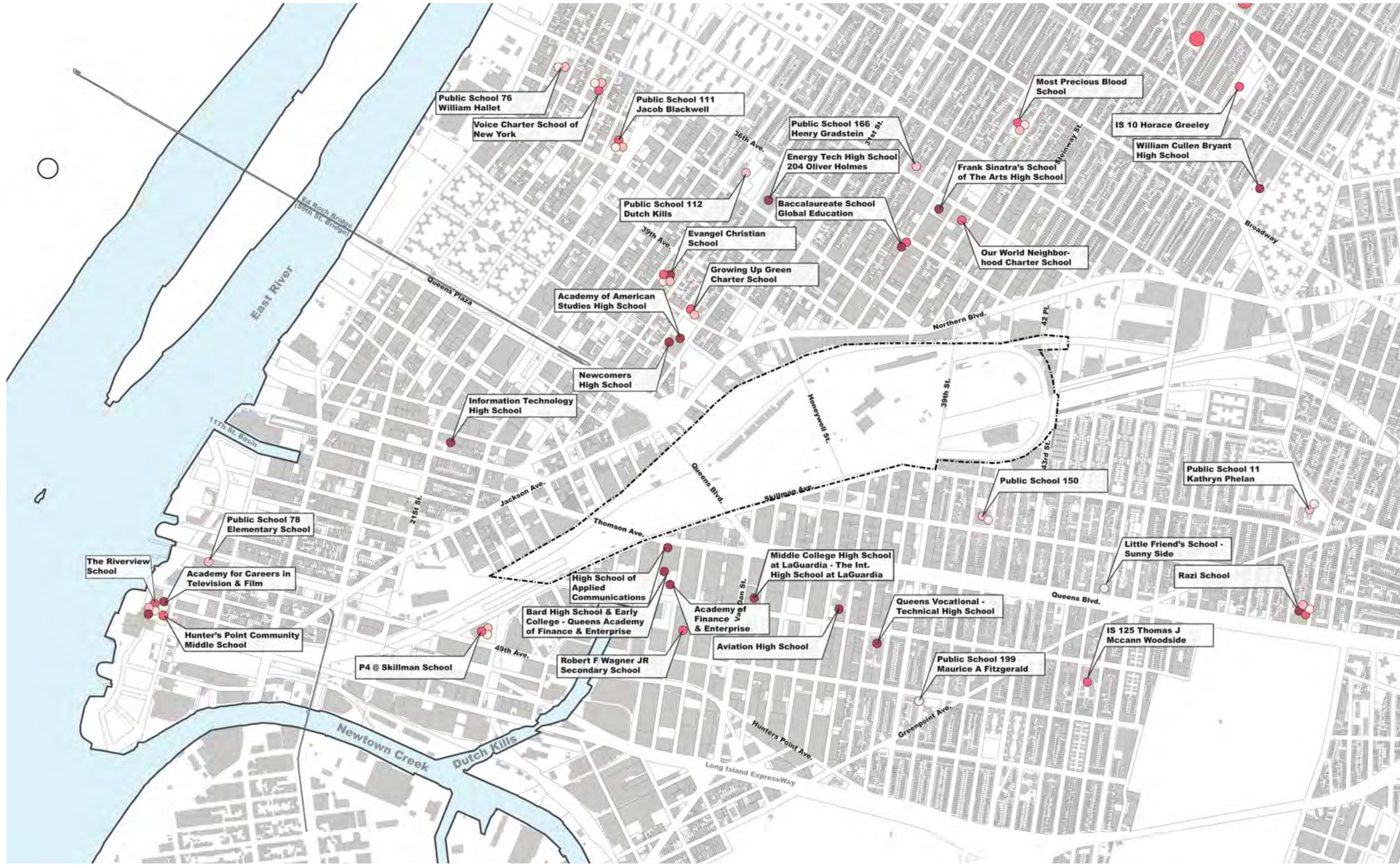


FIGURE 2.28: SCHOOLS

7. Implications for Sunnyside Yard

The area surrounding Sunnyside Yard is a microcosm of the City exhibiting a diverse range of scale and character. The areas to the north and southeast, Astoria and Sunnyside, reflect the middle class neighborhoods that are common throughout Queens. The area includes a fine example of a "garden city" in the Sunnyside Gardens Historic District. While broad generalizations can be made about land use, often these uses come together in close proximity, block by block, and lot by lot. The result is that in many areas of Western Queens, the urban fabric is more of a patchwork quilt.

The pace of development varies greatly throughout the Study Area. Development is occurring at a rapid pace west of Sunnyside Yard. In the industrial areas, new development has been more limited and has been focused on hotels and commercial office. (Figure 2.29, Figure 2.31) Other neighborhoods, especially residential areas of Astoria and Sunnyside, have seen little new development. Where development is taking place in Long Island City and the LIC Waterfront, the built environment and urban experience is being altered by the addition of high-rise towers, and the land use mix is tilting toward primarily residential uses. (Figure 2.30) This is resulting in new pressures for the amenities that go with residential neighborhoods: from the need for parks and schools, to the shortage of retail amenities, to pressures on the transportation system.

A development at Sunnyside Yard could build on the changing nature of Long Island City and its shift from an industrial district, to a primarily residential or mixed-use neighborhood and could connect neighborhoods across the Yard.

FIGURE 2.29: NEW HOTELS SINCE THE YEAR 2000

FIGURE 2.30: NEW RESIDENTIAL BUILDINGS SINCE THE YEAR 2000

FIGURE 2.31: NEW COMMERCIAL BUILDINGS SINCE THE YEAR 2000

D. Infrastructure Context

1. Transportation Capacity

This section provides a summary of existing transportation conditions around Sunnyside Yard. An understanding of the existing transportation conditions in and around Sunnyside Yard will play a large role in the process of identifying opportunities and issues that will impact the feasibility of future development scenarios.

The analyses performed are based partially on information received from multiple City and State agencies. Each agency plays a role in the transportation network within the Study Area, including the New York City Department of Transportation (NYCDOT) and the New York Metropolitan Transportation Agency (MTA). To support and update this information, field data was collected specifically for this project. A tailored data collection program was developed that included traffic counts, parking surveys, and critical field observations.

The Transportation Study Area, illustrated in Figure 2.33, was defined to include transportation facilities and services most likely to be affected by the potential new trips generated to and from the proposed development scenarios. The Transportation Study Area is roughly defined as a ¼- to ½-mile radius covering these transportation elements, including major roadway corridors to and from major highway access points, critical intersections, major parking facilities, the subway/commuter rail stations and bus stops in close proximity to the project site, and the major pedestrian pathways to and from those transportation elements.

Roadway Network

Major roadways around and crossing Sunnyside Yard are as follows:

- **Jackson Avenue** runs parallel to the northern edge of the western half of the project site.
- **Northern Boulevard** is a two-way arterial road that runs parallel to the northern edge of the eastern half of the project site. (Figure 2.34)
- **Skillman Avenue** is a local roadway located adjacent to the southern edge of the project site.
- **Thomson Avenue** is a short local roadway that bridges across Sunnyside Yard to the west of the project site.
- **Queens Boulevard** is a major arterial that runs in an east-west direction beginning from Queens Plaza and stretching eastward into Queens. This roadway also bridges across Sunnyside Yard.
- **Honeywell Street** and 39th Street both bridge across Sunnyside Yard near the center of the proposed overbuild development. (Figure 2.35)

For the purposes of the baseline studies, ten intersections were selected as representative of the most critical locations analyzed for vehicular traffic along the major roadways described above. A detailed traffic analysis of existing conditions was conducted for the intersections shown in Figure 2.32.

FIGURE 2.32: INTERSECTION LEVEL OF SERVICE CRITERIA

Level of Service	Average Delay per Vehicle (seconds)	
	Signalized Intersec-tions	Unsignalized Intersections
A	≤ 10	0 – 10
B	> 10 – 20	> 10 – 15
C	> 20 – 35	> 15 – 25
D	> 35 – 55	> 25 – 35
E	> 55 – 80	> 35 – 50
F	> 80	> 50

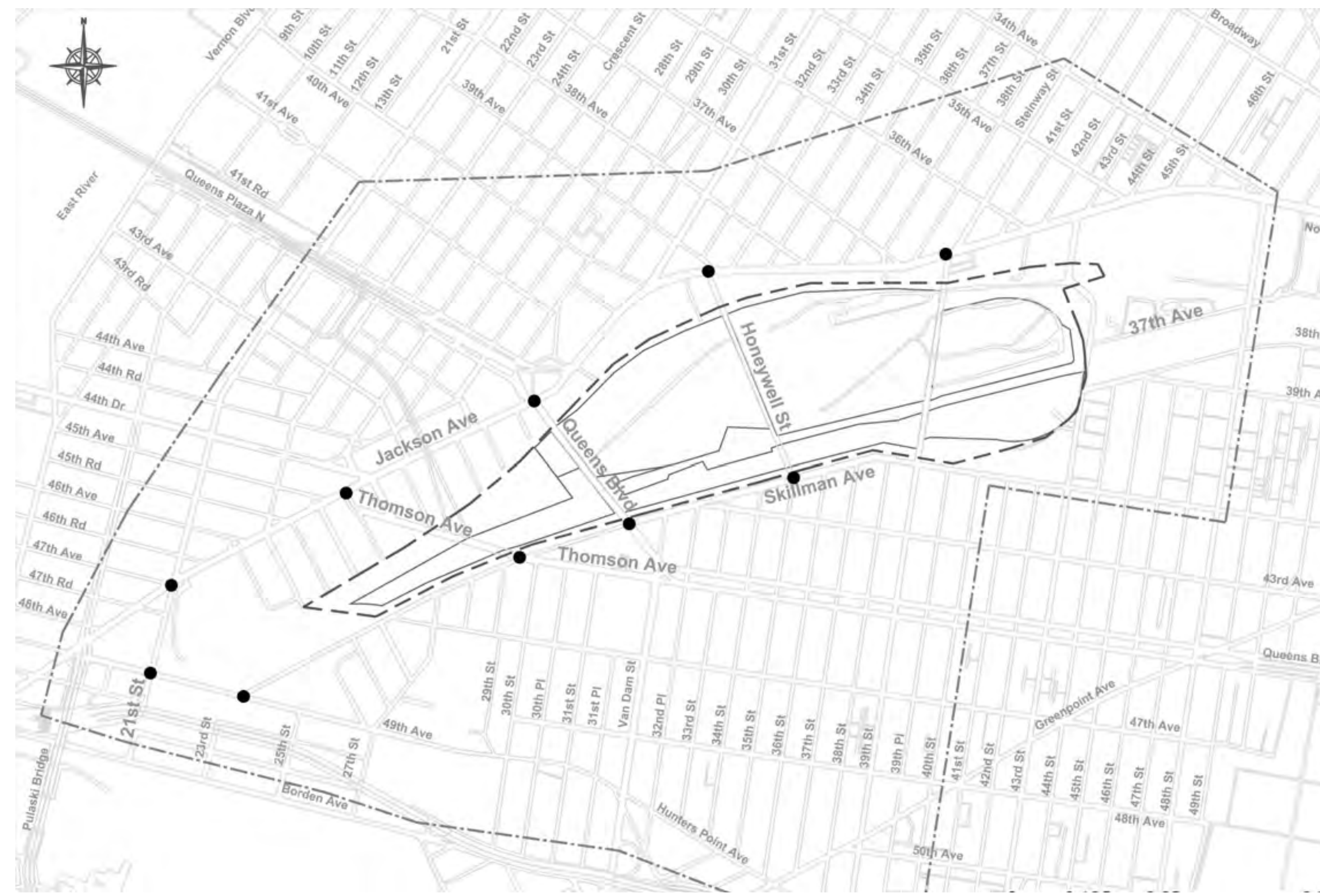


FIGURE 2.33: TRANSPORTATION STUDY AREA

● Analyzed Intersection

FIGURE 2.34: NORTHERN BOULEVARD AT QUEENS PLAZA STATION

FIG. 2.35: HONEYWELL STREET AND SKILLMAN AVENUE

Traffic Conditions

Existing traffic volumes at the analysis intersections were determined based on field counts conducted in Fall 2015, as well as archive traffic count surveys conducted by the NYCDOT in Spring 2015. Field data was supplemented with data collected from field inventories of roadway geometry, traffic control features, and parking regulations/activities. Peak hours were determined using the available 24-hour data collected by NYCDOT using Automatic Traffic Recorders (ATR). Based on this data, traffic volumes are highest during the traditional commuter peak hours for most roadways within the Transportation Study Area, specifically from 7:45 a.m. to 8:45 a.m. in the morning and from 4:15 p.m. to 5:15 p.m. in the evening.

Capacity Analysis

The capacity analysis performed for the Transportation Study Area intersections used the methodology presented in the 2000 Highway Capacity Manual (HCM). The HCM methodology calculates a volume-to-capacity (v/c) ratio for each approach or lane group of a signalized intersection.

Figure 2.32 shows the Level of Service (LOS)/delay relationship for signalized and un-signalized intersections using the HCM methodology. Levels of service A, B, and C generally represent conditions that are extremely favorable for traffic flow; at LOS D, the influence of congestion becomes noticeable; LOS E is considered to be the limit of acceptable delay; and LOS F is considered to be unacceptable to most drivers.

For the traffic analysis conducted, each intersection's overall intersection delay, approach delay and, where appropriate, lane-group or movement delay (e.g., through, left turn, right turn, and de facto turn, if a lane is not exclusively designated for turns) were evaluated.

Five of the analyzed intersections contain at least one congested movement during the morning peak hour while six of the analyzed intersections contain at least one congested movement during the evening peak hour. Typically, the most congested intersections are located to the west of the project site, close to the Long Island City submarket and access to I-495. Congested movements also appear at the northeast corner of the project site, where there is limited capacity available for vehicles traveling between the major east-west corridors and the Astoria neighborhood. In fact, the vast majority of congested movements within the Transportation Study Area are on approaches that generally travel in the north or south directions, illustrating the lack of major north-south corridors through the area, particularly across the project site.

Parking

Within the Transportation Study Area, alternate side of the street parking regulations apply on most streets, as much of the area encompasses a residential neighborhood. Metered parking is available primarily along the major corridors.

Observations of on-street parking within a 1/4-mile radius of the project site were conducted in Fall 2015 during both the morning and evening peak periods. Based on these observations, the average overall weekday utilization for on-street parking appeared to be very high (close to 100%) during both time periods.

Within the Transportation Study Area boundaries, there are a large number of off-street parking facilities, primarily located to the west of the project site. The size of these facilities varies greatly, but none were identified as having a capacity of more than 300 vehicles. A sampling was made of the most critical parking facilities based on capacity, proximity to the project site, and potential to cater to any development that could occur in the future. Overall, the average weekday utilization rate during the morning peak period is 96%. During the evening peak period, overall off-street parking utilization decreases to 84%.

Public Transit

A combination of subways, commuter rail, and transit buses are available relatively close to all sections of the project site, with the most convenient access provided at the western half of Sunnyside Yard.

Rail Transit

As shown in Figure 2.36, eight Metropolitan Transportation Authority (MTA) subway lines serving approximately 13 subway stations or complexes are located within the Transportation study Area and walking distance to the project site. LIRR also provides service to the area via one station, Hunterspoint Avenue, located on to the

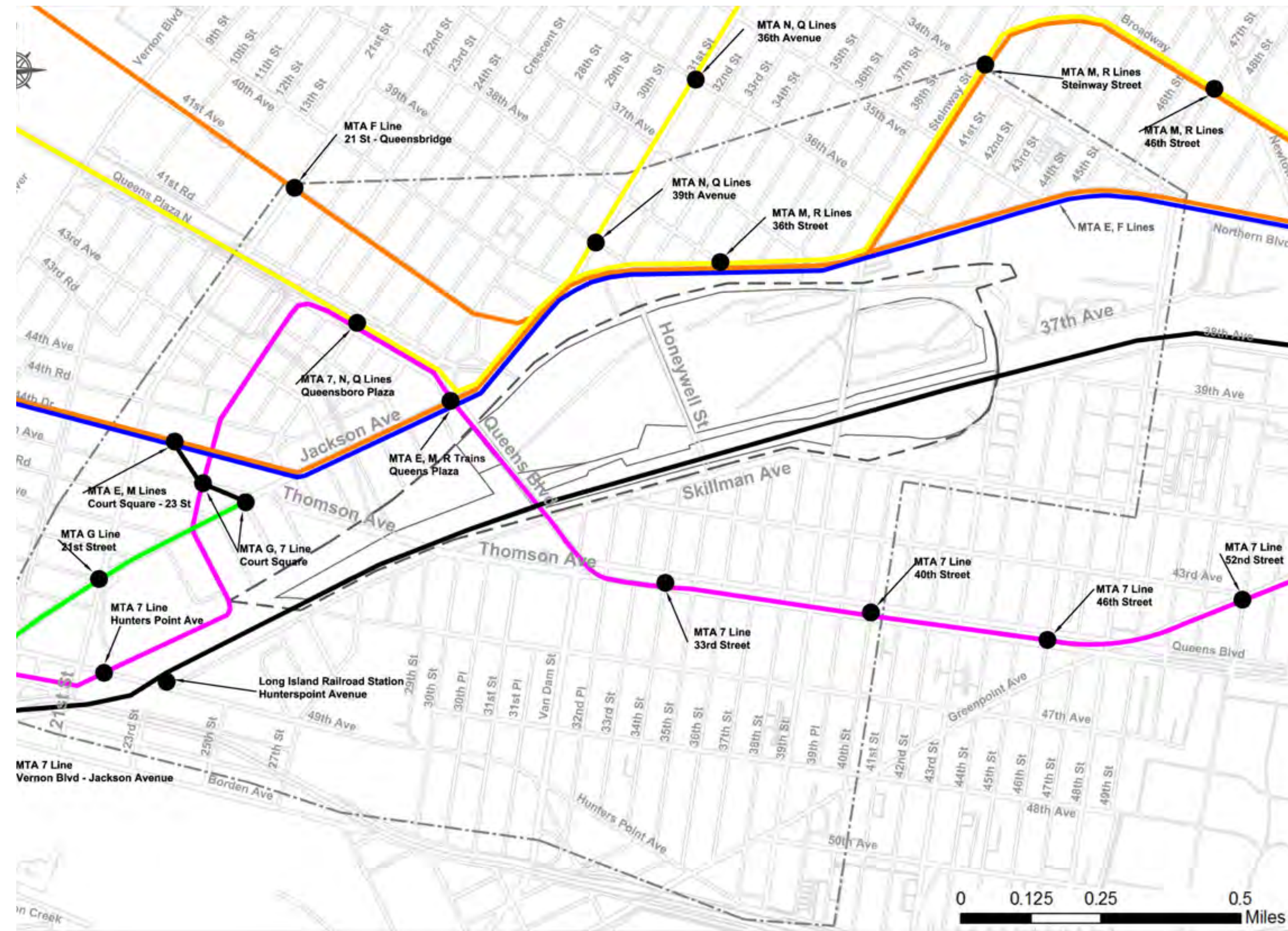


FIGURE 2.36: RAIL TRANSIT ROUTES IN VICINITY OF PROJECT SITE

Train Station
Subway Line
LIRR Route
Project Site

west of the project site. The following stations are most likely to be used for traveling to and from future development within Sunnyside Yard.

- **21st Street (G)** on the IND Brooklyn – Queens Crosstown Line, is located approximately 3/4-mile from the project site.
- **Court Square Complex (E, G, M, 7)** is a transit facility consisting of two separate stations; the Court Square – 23rd Street station serviced by the IND Queens Boulevard Line, and the Court Square station serviced by the IRT Flushing and IND Brooklyn–Queens Crosstown Lines. Court Square is the terminus of the G train.
- **21st Street – Queensbridge (F)** is located approximately 1/2-mile from the project site. The station is the only stop along the F Line within the Study Area, which provides service between Coney Island in Brooklyn and Jamaica (179th Street) in Queens.
- **Queens Plaza (E, M, R)** on the IND Queens Boulevard Line, is located at Queens Boulevard and Jackson Avenue/Northern Boulevard, a few feet away from the project site boundary. The station has six entrances, with stairway access at four locations on the south side of Jackson Avenue/Northern Boulevard closest to Sunnyside Yard. This is the only station adjacent to Sunnyside Yard that provides full ADA accessibility. (Figure 2.37)
- **Queensboro Plaza (7,N,Q)** on the IRT Flushing and BMT Astoria Lines, is located less than a quarter of a mile from the project site. According to preliminary 2014 subway line haul volume and capacity information received from the MTA, the N and Q lines are operating at capacity at this location during the morning peak hour, considered by the MTA as the time period that generally experiences the heaviest subway ridership throughout the day.
- **39th Avenue (N, Q)** on the BMT Astoria Line, is an elevated station located 600' north of Sunnyside Yard. Both the N and Q trains operate between Coney Island in Brooklyn and Astoria (Ditmars Boulevard) in Queens. (Figure 2.38)
- **36th Street (M, R)** on the IND Queens Boulevard Line, is located on Northern Boulevard, adjacent to the project site. The station has five entrances, with stairway access at two locations on the south side of Northern Boulevard closest to Sunnyside Yard. (Figure 2.39)
- **40th Street (7)** on the IRT Flushing Line, is located at the intersection of Queens Boulevard and 40th Street. The station has four entrances within the Queens Boulevard median, less than a quarter of a mile of the project site boundary. (Figure 2.40)
- **Hunters Point Avenue (7)** on the IRT Flushing Line, is located just east of the intersection of 49th Avenue and 21st Street, approximately one mile west of the project site.
- **33rd Street (7)** on the IRT Flushing Line, is located on Queens Boulevard. The station has six entrances within the median. The station is less than ¼ of a mile from the project site.
- **LIRR Hunterspoint Avenue station** entrance is located on 49th Avenue, adjacent to the Hunters Point Avenue subway station. Various lines provide limited service at this station.

The most recent average weekday ridership information available for each of these stations is provided in Figure 2.41. All of the stations that will most likely be used by transit users traveling to and from future development within Sunnyside Yard have had ridership increases

FIGURE 2.37: QUEENS PLAZA (E, M, R)

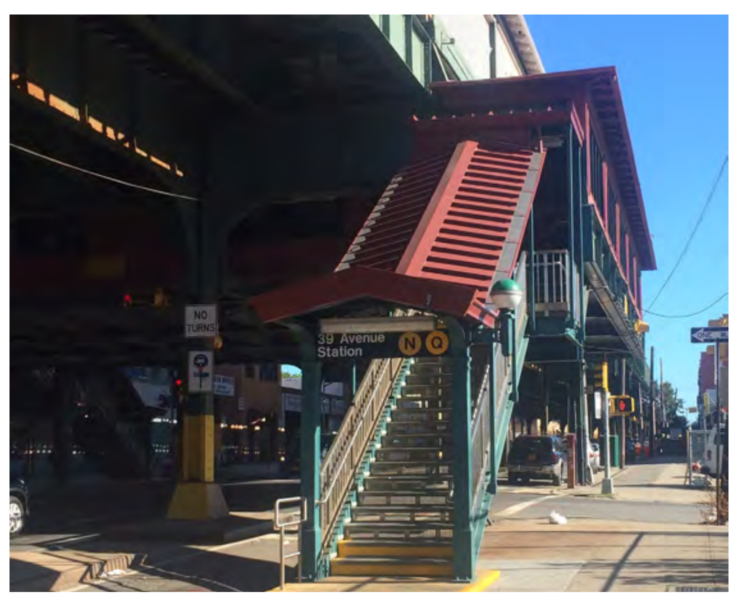


FIGURE 2.38: 39TH AVENUE (N, Q)

FIGURE 2.39: 36TH STREET (M, R)

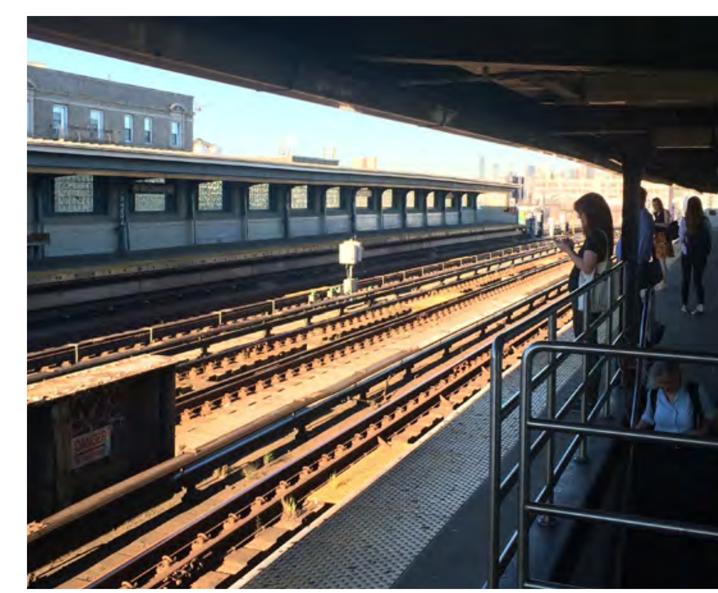


FIGURE 2.40: 40TH STREET (7)

in the past 5 years, with the exception of Court Square. MTA's ongoing signal upgrades to support Communications Based Train Control (CBTC) on the No. 7 line are scheduled to be completed in 2017. According to information provided by the MTA, the new system will reduce headways and result in additional service approximating 2 additional trains in the peak hour.

These reduced headways will result in an increase in capacity of approximately 7% during the peak hour. According to MTA's Overview of MTA Conditions in LIC Core (2015), Court Square is one of the agency's highest priorities for ADA upgrades given the high number of transfers that occur between platforms at this complex. MTA's 2014 Annual Report noted a LIRR system-wide increase in ridership of 3% in the past year and the third consecutive year of growth.

Bus Transit

A large number of MTA bus routes either stop or pass through the Study Area as illustrated in Figure 2.43. Of these, 11 bus routes provide stop-service within 1/2-mile of the project site. (Figure 2.41) The following bus routes are most likely to be used by transit users traveling to and from future development within Sunnyside Yard.

- **Q32 –** This bus route serves the Queens Boulevard corridor within the study area and crosses the project site itself. Service is provided between Penn Station in Manhattan and Jackson Heights in Queens.
- **Q60 –** Also serving the Queens Boulevard corridor, this bus route operates between East Midtown in Manhattan and South Jamaica in Queens, with alternating buses terminating at

FIGURE 2.41: AVG. WEEKDAY RAIL TRANSIT RIDERSHIP

Station	2014	5 Year Change (2010-2014)	
21 St (G)	1,265	+215	+20.5%
21 St-Queensbridge (F)	8,914	+549	+6.6%
33 St-Rawson St (7)	14,256	+596	+4.4%
36 St (M, R)	4,597	+594	+14.8%
39 Av (N,Q)	3,504	+671	+23.7%
40 St-Lowery St (7)	11,211	+591	+5.6%
Court Sq (E, G, M, 7)	22,433	-2,415	-9.7%
Hunters Point Av (7)	6,666	+643	+10.7%
Queens Plaza (E, M, R)	10,125	+1,755	+21.0%
Queensboro Plaza (N, Q, 7)	11,554	+2,638	+29.6%
LIRR Hunterspoint Avenue	5,224	N/A	N/A

Source: MTA NYCT

FIGURE 2.42: 40TH STREET BUS STOP

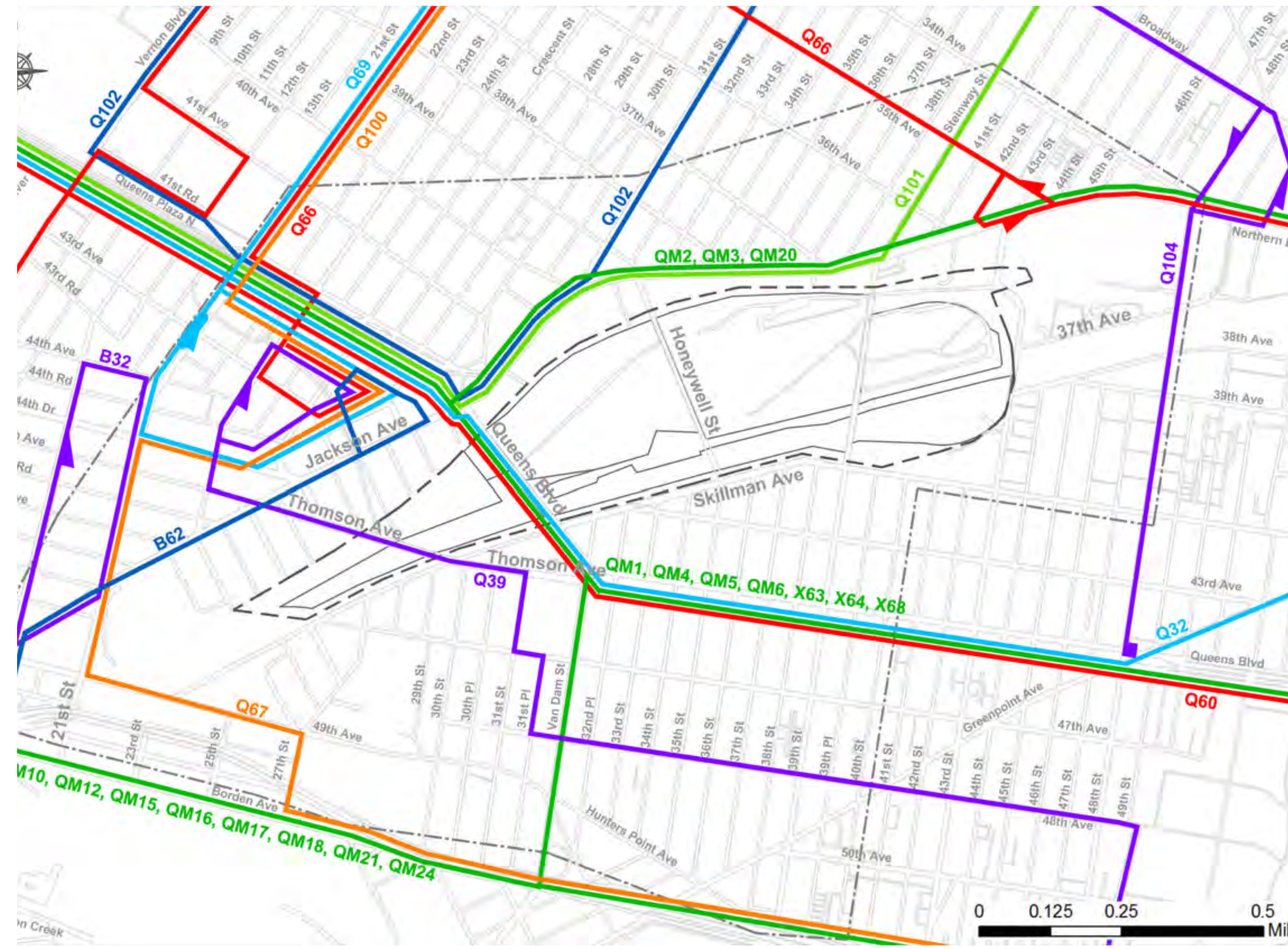


FIGURE 2.43: BUS ROUTES IN VICINITY OF PROJECT SITE

QM00 Bus Number
Bus Line
Project Site

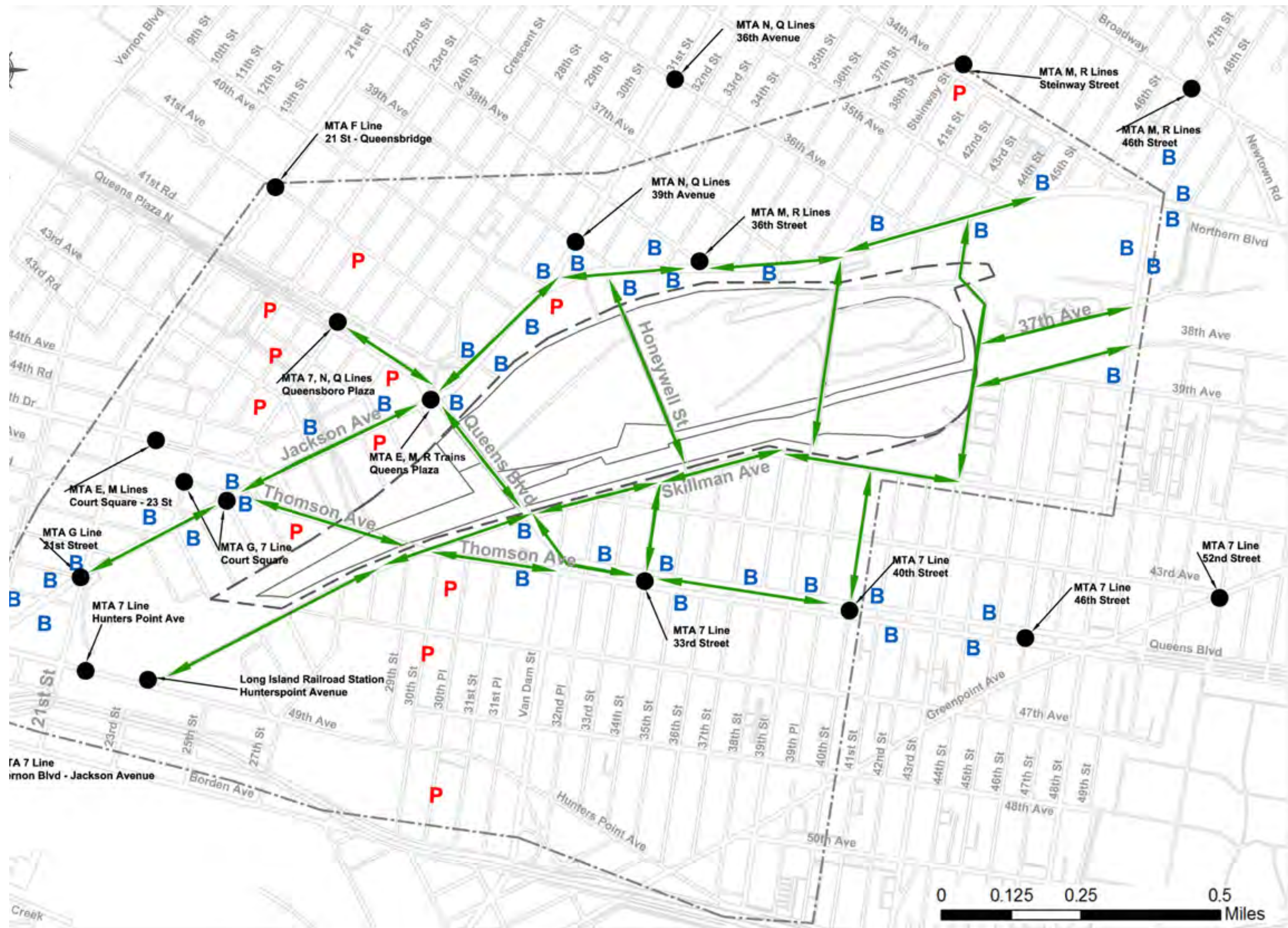


FIGURE 2.44: CRITICAL PEDESTRIAN PATHWAYS

- Subway and LIRR Station
- P Critical Off-Street Parking
- B Bus Stop Near Project Site
- Critical Pedestrian Pathway
- Project Site

the Jamaica, Queens LIRR station during the day.

- **Q66, Q67, Q69 Q100 –** These bus route provide service to Queensboro Plaza subway station within the study area.
- **Q101 –** Providing service within the study area along Queens Plaza, portions of Northern Boulevard adjacent to the project site, and Steinway Street, this bus route operates between East Midtown in Manhattan and Astoria, Queens. Weekday service frequency is every 14 minutes during both the morning and evening rush hours.
- **Q102 –** This bus route provides service between Astoria, Queens and the Roosevelt Island Tram Station, Roosevelt Island.
- Within the study area, bus stops are located along Queens Plaza, a portion of Northern Boulevard adjacent to the project site, and 31st Street

Overall, bus ridership appears to have declined within the Study Area in recent years according to the most recently available historical ridership data. The largest drops in ridership occurred on the Q39 and Q69 bus routes.

Pedestrians

The analysis of baseline pedestrian-flow conditions focused on crosswalks at the critical intersections chosen for traffic analysis. The critical intersections are located in the immediate vicinity of the project site and would be expected to be used by pedestrians accessing future development. Critical pedestrian pathways are shown on Figure 2.44.

Pedestrian-flow conditions were analyzed using Highway Capacity Manual methodology and considered conditions during the peak 15-minute period in the morning and evening peak hours. The evaluation of crosswalks is based on the average time required for a pedestrian to cross the street at an assumed walking speed, and is calculated using the width of the street. This analysis also accounts for the movement of vehicles traversing the crosswalk.

All of the analyzed pedestrian elements currently operate under good conditions. Since the completion of NYCEDC's Pedestrian and Bicycle Improvement project in the spring of 2012, the pedestrian safety has improved and number of crashes involving pedestrians has decreased. The project improved the flow of traffic and enhanced the pedestrian environment with new sidewalks, curbs, plantings, landscaped traffic medians, and improved lighting at multiple areas along Queens Plaza, including at the intersection with Jackson Avenue/Northern Boulevard.

FIGURE 2.45 BIKE PATH / ED KOTCH QUEENSBOROUGH BRIDGE

Bicyclists

The bicycle network within the Study Area is generally well connected, though there are a few critical gaps along Jackson Avenue, as well as along additional local north-south streets. The majority of the bicycle routes are shared lanes, which require bicyclists and motorists to share the same roadway space. Queens Plaza provides a protected pathway leading to and from the Queensboro Bridge, providing a convenient and safe link between Manhattan and the project site. (Figure 2.45)

There are bike racks located throughout the Study Area, most concentrated around the Queens Plaza and Court Square areas. No significant bike parking facilities are available near the project site, nor are there any shared bike docking stations. Figure 2.46 illustrates the bicycle routes within the Transportation Study Area.

Summary

Under current conditions, public transportation in and around the Sunnyside Yard study area is generally under or at-capacity and available within close proximity of the Yard. The main exceptions to these findings are issues associated with subway lines operating at capacity and decreased parking availability. Capacity analyses of the levels of service for vehicular traffic found that the levels are generally acceptable.

2. Offsite Utilities

The existing utility networks outside Sunnyside Yard include electricity and gas (Con Edison), water and sewer/treatment (provided by the New York City Department of Environmental Protection - NYCDEP), combined sanitary and stormwater sewers (provided by NYCDEP and New York State Department of Environmental Conservation - NYSDEC), telecommunications (operated by Verizon and other service providers). A vital fuel-oil transmission pipe line (owned and operated by Buckeye Partners LP), that supplies jet fuel to LaGuardia Airport and heating oil to depots in Queens, runs along the southern and eastern limits of the Yard and would need to be protected during future construction.

Existing utility infrastructure is well developed and is generally adequate for current land uses and the level of development in areas surrounding Sunnyside Yard. However, some of the infrastructure, particularly sewers and water mains, is aging and may have inadequate capacity to meet future demands.

As other new developments occurs to the north and west of Sunnyside Yard, it is anticipated that various private and public utility lines may be incrementally upgraded locally to accommodate the demand requirements within the local street frontage for these various developments; however, these upgrades may not be adequate to comprehensively address issues of aging infrastructure, piecemeal redevelopment of the surrounding neighborhoods, as well as demands of Sunnyside Yard overbuild.

The majority of water mains in the streets surrounding Sunnyside Yard are aging (most are 50 years old or older) and they may not be large enough to support the major increase in demand that will be imposed by the overbuild development. In order to meet those demands, improvements to the water distribution network would be warranted. These improvements may include new, larger distribution mains to replace old pipes along Jackson/Northern Blvd and Skillman Avenue. The existing sewers are generally adequately sized to handle dry weather sanitary flows from the overbuild. To accommodate the increased sanitary flows, existing storm flows from Sunnyside Yard and adjacent City streets woul need to be diverted from the combined sewer system to a new separate storm-only sewer that would run along Skillman Ave and outfall to the Dutch Kill.

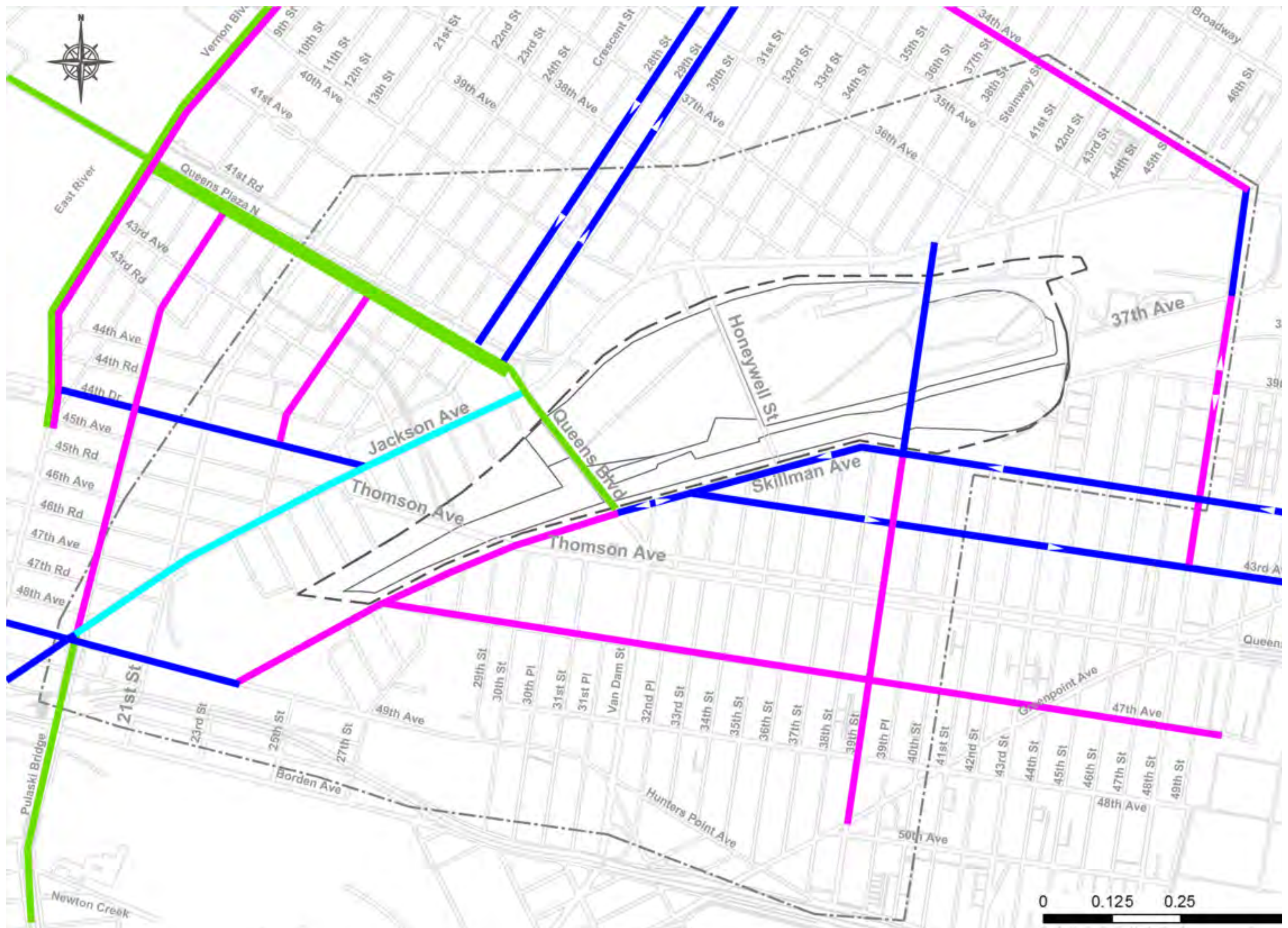


FIGURE 2.46: BICYCLE PATHS

- Bicycle Lane
- Shared Lane
- Potential Bicycle Path Access Point
- Protected Bicycle Path with Access Point
- Project Site

E. Conclusion

The area surrounding Sunnyside Yard exhibits a diverse range of urban scale and character, complemented by economic conditions that support the continued development of housing, office space and amenities. Today, the area in the western submarkets is characterized by a change in demographic composition as a result of a substantial amount of new residential development in the LIC Waterfront and Court Square/Queens Plaza submarkets. In the eastern submarkets there is a shortage of residential supply as a result of decreasing residential vacancy and limited new development. While the area has experienced increased residential development, unmet demand continues to exist, especially for low and middle income residents.

The Study Area is the largest employment hub in Western Queens and includes a substantial proportion of the City's industrial economy. While nearly two-thirds of total commercial property in the Study Area is comprised of industrial uses, new Class A office spaces have been developed in Long Island City. While the employment base is growing, this study assumes that some form of public support will be necessary for construction of new Class A or creative office to be feasible.

A combination of subways, commuter rail, and transit buses are available relatively close to all sections of the project site. The most convenient access is provided at the western half of Sunnyside Yard, and a large number of MTA bus routes either stop or pass through the Study Area. Under current conditions, transportation in and around Sunnyside Yard Study Area is generally under or at capacity, accessible, and levels of service for vehicular traffic are generally acceptable. All of the analyzed pedestrian elements currently operate under good conditions and the bicycle network is generally well connected. Increases in residential and commercial development will increase transportation demand, which may necessitate an increase in transportation capacity. It is anticipated that the increased demand on transportation infrastructure projected after an overbuild would exceed the capacity of the existing transportation infrastructure.

Existing utility infrastructure is well developed and is generally adequate for current land uses and level of development in areas surrounding Sunnyside Yard; however, some of the infrastructure, particularly sewers and water mains, are aging and may have inadequate capacity to meet future demands.

Chapter 3: Onsite Conditions

Table of Contents

A. CHAPTER OVERVIEW

This chapter addresses one of the most basic questions of this study: is it technically feasible to construct an overbuild project, given the complexity of the railroad infrastructure in Sunnyside Yard and the requirement to keep Sunnyside Yard operational during construction? To understand the challenges of a Sunnyside Yard overbuild, this chapter examines site attributes, including railroad infrastructure, geotechnical conditions, and contamination. Future conditions and railroad operations are then assessed by looking at planned projects, including Amtrak's Master Plan for Sunnyside Yard and the MTA's East Side Access project. Within this framework, engineering parameters and structural considerations for an overbuild development are identified. These topics include foundations, support walls and columns, trusses, and mega transfer trusses to support towers. Construction methods are identified that would minimize impacts to railroad operations. The interaction of the overbuild development with railroad systems is considered, along with fire-safety and ventilation requirements.

While portions are found to be technically feasible, overbuild development at Sunnyside Yard would require close coordination between the railroads and developers to solve challenges related to railroad operations and engineering.

B. Site Attributes

1. Railroad Infrastructure

An important step in determining the feasibility of an overbuild project at Sunnyside Yard is understanding existing conditions. The existing railroad infrastructure, which is composed of tracks and traction power systems for trains, as well as buildings and other elements, is one of the most important components in assessing feasibility. This infrastructure is critical to the operation of the railroad, and is described below.

Sunnyside Yard is a key train storage yard and maintenance hub for Amtrak's Northeast Corridor operations, as well as for New Jersey Transit (NJT). Long Island Rail Road (LIRR) is developing storage tracks and maintenance facilities within Sunnyside Yard. Harold Interlocking, a major railroad interlocking, which routes trains from Pennsylvania Station to either the Northeast Corridor or the LIRR Main Line, is located within the site boundary. (Figure 3.1, Appendix A)

Sunnyside Yard was opened in 1910 by the Pennsylvania Railroad and now covers almost 200 acres. It is over 8,000' long from east to west, and varies in width from 400' to 1,500'. Most of Sunnyside Yard is owned by Amtrak, with the MTA owning the northern and western parcels. Air rights above the MTA-owned properties along the northern border of project site are primarily owned by the City. The facility owned by General Motors within the Yard has also been included in the site area.

MTA Capital Construction (MTACC), a subsidiary of the MTA, is overseeing construction in Sunnyside Yard associated with the East Side Access project. As discussed later in this chapter, the project will allow LIRR services to access Grand Central Terminal, which involves significant construction within Sunnyside Yard.

The Sunnyside Yard complex currently has 32 active storage tracks. NJT uses Sunnyside Yard primarily as a midday lay-up area for storing trains between the morning and evening rush hours. Amtrak stores and services its trains that use the Northeast Corridor, including long-distance trains, at Sunnyside Yard. Trains typically approach Sunnyside Yard from Pennsylvania Station, and follow the loop tracks that wrap around the south and east sides of Sunnyside Yard. The trains then enter the storage tracks from the east, and ultimately depart Sunnyside Yard traveling to the west, toward Pennsylvania Station. Amtrak operates a high-speed rail (HSR) maintenance facility for their Acela service at Sunnyside Yard, as well as a commissary building for preparing onboard food and beverages.

Most storage tracks and Main Line tracks have overhead catenary power. In general, this system is comprised of tall support poles, with support wires (cross-catenary and body-span) spanning between, below which the catenary support wires and contact wires are suspended along each track. Amtrak and NJT trains draw electric power from the contact wire. Future operations by Metro North would also draw power from the catenary system. The catenary system above the main storage yard is characterized by support poles up to 75' tall. Support wires span from pole to pole, crossing the entire railyard perpendicular to the tracks. (Figure 3.2)

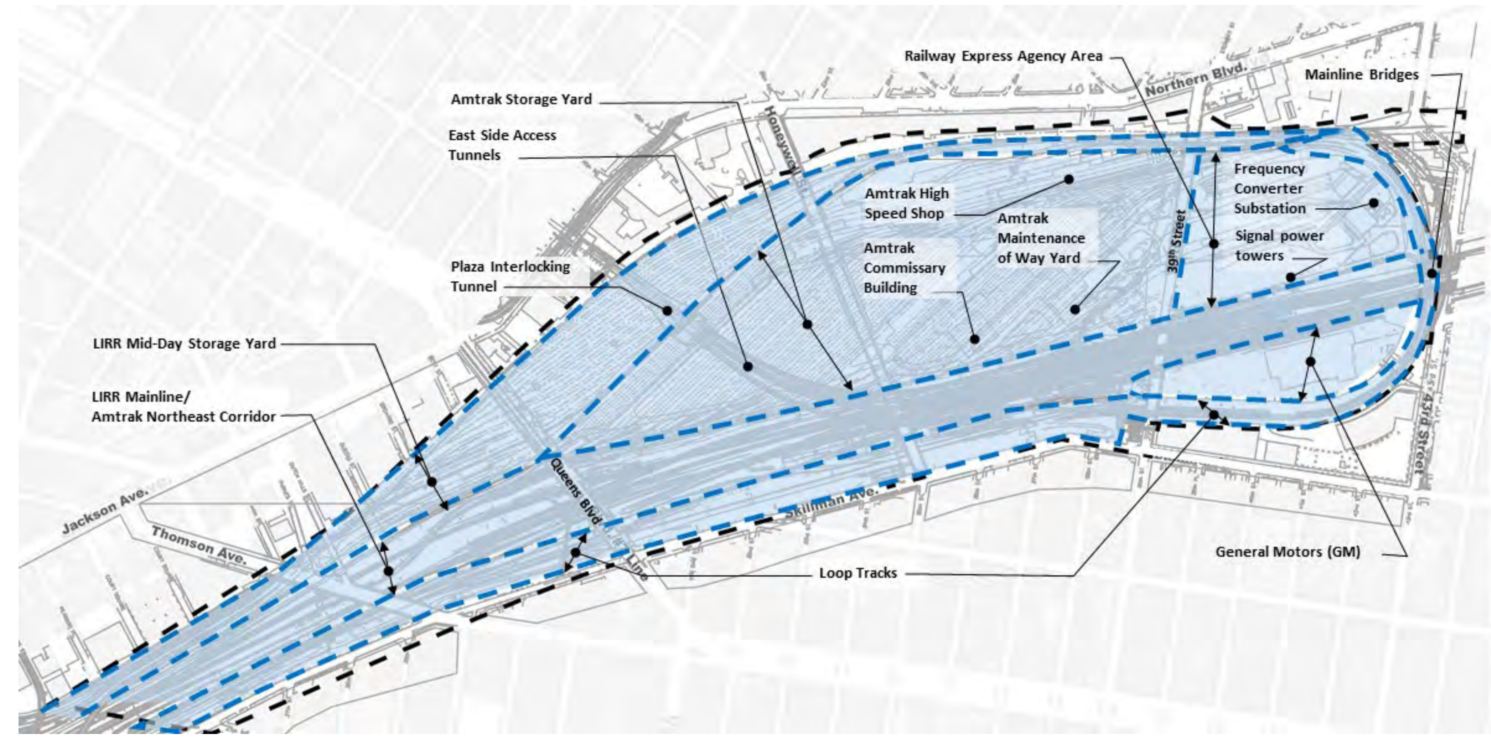


FIGURE 3.1: KEY FEATURES OF SUNNYSIDE YARD

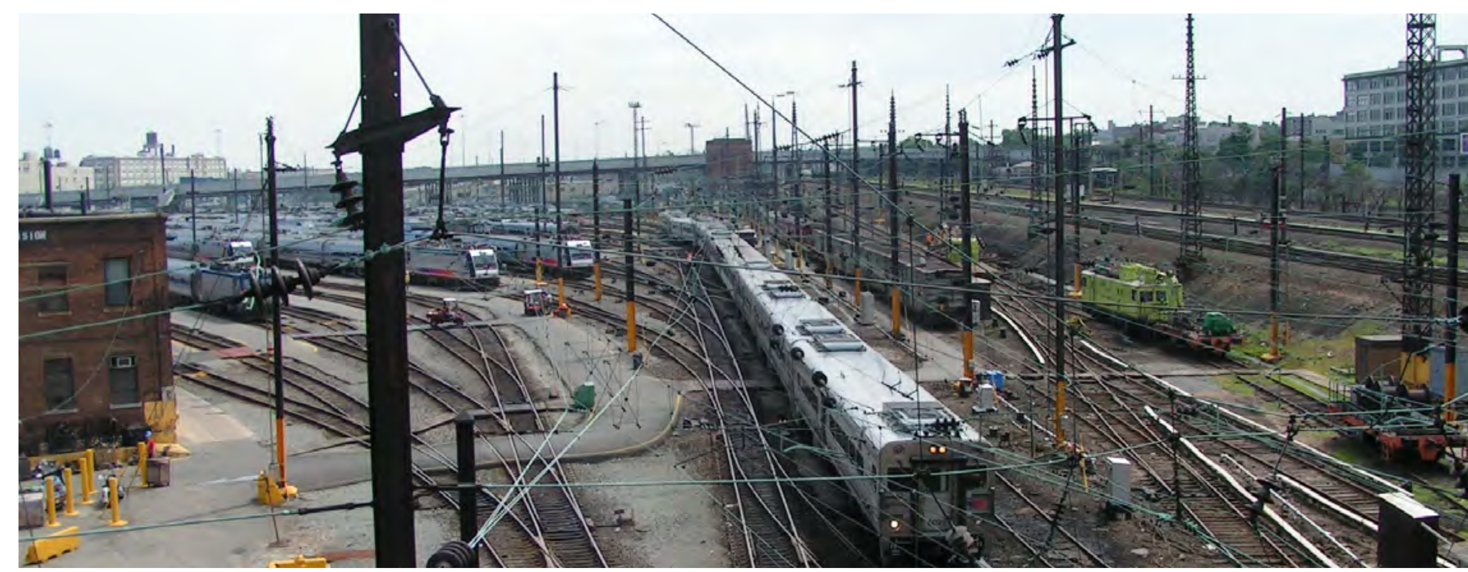


FIGURE 3.2: SUPPORT WIRES SPANNING SUNNYSIDE YARD

Most of the Main Line tracks also have a catenary power supply. Generally, the Main Line track catenary system operates independently from the catenary system above the storage tracks, but is similar in design and character. Much of the catenary system is being replaced by the East Side Access project and many of the support poles have been replaced with portal frames that span the Main Line tracks. (Figure 3.3) The catenary system for the loop tracks is a combination of original pole structures and new portal structures that were installed by the East Side Access project. As discussed later in this report, overbuild decks are likely to require the replacement of catenary systems.

Most Main Line tracks, and a few of the yard tracks, also have third rail power. (Figure 3.4) LIRR trains draw power from the third rail. The third rail system poses minimal constraints for overbuild construction because it is mounted on the track ties and can be de-energized and re-energized quickly. Most of the tracks in the LIRR Mid-Day Storage Yard will only use third-rail power. The No. 7 train also uses a third-rail system where it crosses over Sunnyside Yard on viaducts.

Tightly spaced tracks, power systems, and other infrastructure in Sunnyside Yard present a challenge for overbuild development. However, as described in subsequent sections, Amtrak and LIRR plan to reconfigure much of Sunnyside Yard. As a result, while some of the existing railroad infrastructure will need to be accommodated below an overbuild development, a significant amount will be replaced, potentially reducing some existing physical constraints.

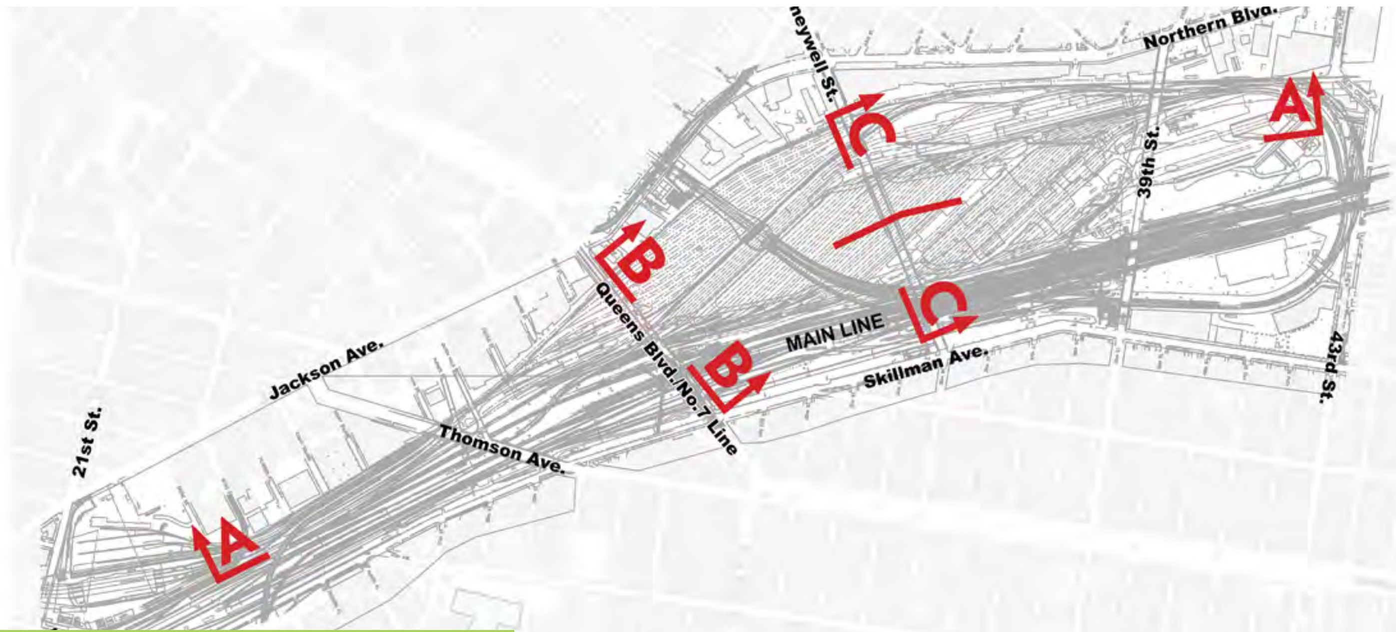
2. Geology

It is anticipated that a development over Sunnyside Yard would include multiple high-rise buildings. The considerable weight of such structures would typically require deep foundations that extend into competent soils or into rock capable of supporting the structure. The nature of the soils and rock below Sunnyside Yard is described below. As structure for a deck and taller buildings will need to be anchored in suitable soils or rock, the location, depth, and other

FIGURE 3.3: CATENARY PORTAL SYSTEM

FIGURE 3.4: THIRD RAIL WITHIN SUNNYSIDE YARD

FIGURE 3.5: SOIL-BORING RIG



3.6: LOCATION OF GEOLOGICAL PROFILES

characteristics of the geology have a direct impact on costs and feasibility. This information will inform discussions in subsequent sections regarding the evaluation of suitable foundation types.

The description of the subsurface conditions provided in this section are based on available records and data collected from subsurface investigations within Sunnyside Yard. The information presented should be supplemented by additional subsurface investigations and geotechnical engineering evaluations if the project advances.

The ground surface within Sunnyside Yard varies between approximately 8' and 60' above mean sea level. Elevations in this report are stated relative to the NAVD88 datum, which is within 1' of mean sea level near the project site.

Sources of Subsurface Information

The geology of Western Queens is well documented (References 10-15). In addition, numerous subsurface investigations have been performed for existing facilities and structures within Sunnyside Yard. (Figure 3.5) Records of subsurface investigations are provided in the references to this report, and include the following:

- Geotechnical reports for the Queens Segment of the East Side Access project prepared for the MTACC, which were the primary source of data for subsurface conditions within Sunnyside Yard, and included the logs of probes from New York City Department of Design and Construction (NYCDDC) and logs of borings for an investigation of the Queens Boulevard Bridge. (Reference 16-17)
- A geotechnical report prepared for the investigation of Honeywell Street Bridge for the New York City Department of Transportation (NYCDOT). (Reference 18)
- A geotechnical report prepared for an existing high-speed trainset maintenance and inspection structure for Amtrak. (Reference 19)

The accuracy of data provided in the reports prepared for NYCDOT and Amtrak is less certain than the corresponding data shown on logs of borings performed for the more recent investigations performed for MTACC, particularly the depth of bedrock.

Regional Geology

The Sunnyside Yard project site is underlain by Ordovician/Cambrian Age metamorphic bedrock. Regionally, the bedrock surface dips southeastward at approximately 80' per mile. On a local scale, the surface is characteristically irregular and undulating. Exposure of the rock surface over a long period of geologic time, prior to deposition of younger deposits, resulted in severe weathering of the upper part of the rock profile. Weathering penetrated the rock mass to depths greater than 100' in some areas of Long Island. In the project area, much of the softer, weathered material appears to have been removed by subsequent glacial scour.

The bedrock is overlain by varying depths of Cretaceous sand and clay deposits, and Pleistocene Age deposits consisting of a mixture of glacial, interglacial, and post-glacial materials.

The last glacial advance into the New York metropolitan area is the source of most of the soil deposits in the region when a terminal moraine was created to the south of the Sunnyside Yard site. North of the moraine, the bed load deposited by the glaciers (referred to as till or ground moraine) is composed of an unsorted mixture of sand, gravel, clay, cobbles, and boulders. Glacial lake deposits of silty fine sand, silt, and clay were later deposited.

Geological layering is generally complex, and significant variations in the thickness and location of the individual strata are common. In many cases boundaries between strata are not clearly defined and considerable interlayering of the glacial materials, particularly the mixed glacial deposits, is observed. Therefore, comprehensive subsurface investigation will need to be performed throughout the site prior to the foundation design.

Symbol	Stratum	Description
	Fill	Heterogeneous mixture of soils. A loose to dense mixture of coarse to fine sand, silt, gravel, and miscellaneous debris. Debris includes cinders, fragments of bricks, wood (timber ties), concrete and metal (rails, spikes). The fill varies in composition, thickness, and density.
	Organic Deposits	Black to gray, very soft to medium stiff organic silt or brown fibrous peat with organic silts and clays. Sands, gravels and fibers were also encountered. The USCS group symbols are generally PT, OH, OL, CL and CH.
	Mixed Glacial Deposits	Gray, brown, soft to very stiff non- plastic to low plasticity silts and clays. This stratum is predominantly varved with fine micaceous sands and fine gravel. Gravel, cobbles and boulders are also present. The USCS group symbols are generally CL, ML, and SM.
	Glacial Till/Outwash Deposits	Brown, gray medium dense to very dense fine to coarse sand, gravel, silt and clay. Cobbles and boulders are common within this stratum. The USCS group symbols are generally SM, GM, SW and SM-ML.
	Coastal Plain Sediments	Interbedded strata of clay, sand and gravel. Clay strata are stiff to hard in consistency. Sands and gravels are medium dense to dense in compactness. The USCS group symbols are generally CL, ML, and SM.
	Decomposed Rock	Green, black and mottled white very dense silty sand to sandy silt exhibiting relict structures of the parent rock. USCS symbols are generally SM.
	Bedrock	Bedrock is typically hard to very hard gneiss or schistose gneiss.

SUBSURFACE SOIL STRATA SUMMARY

Subsurface Conditions

Most of the western portion of the site lies within the former Dutch Kills Creek and swamp area. Highly compressible organic deposits, including peat and organic silt and clay, are typically present below a superficial layer of man-made fill. This creek and the swamp were filled using materials excavated during the construction of Sunnyside Yard. The eastern portion of the site was generally at a much higher elevation than the western portion of the site, and the soils in the eastern portion do not include the relatively shallow organic deposits.

The subsurface soils beneath Sunnyside Yard can generally be described by two typical geologic profiles, recognizing that there are some variations from these typical strata and that there are areas where the two typical profiles transition. Geologic profiles have been prepared to illustrate the subsurface conditions. The vertical scale used for the profiles is based on NAVD 1988; the horizontal scale is as shown and is approximate. The ground surface shown reflects the ground surface off the Main Line rail embankments. The locations of the profiles are shown in Figure 3.6. Figure 3.7 presents subsurface conditions, oriented west to east, across all of Sunnyside Yard. Figure 3.8 presents a geologic profile, oriented north to

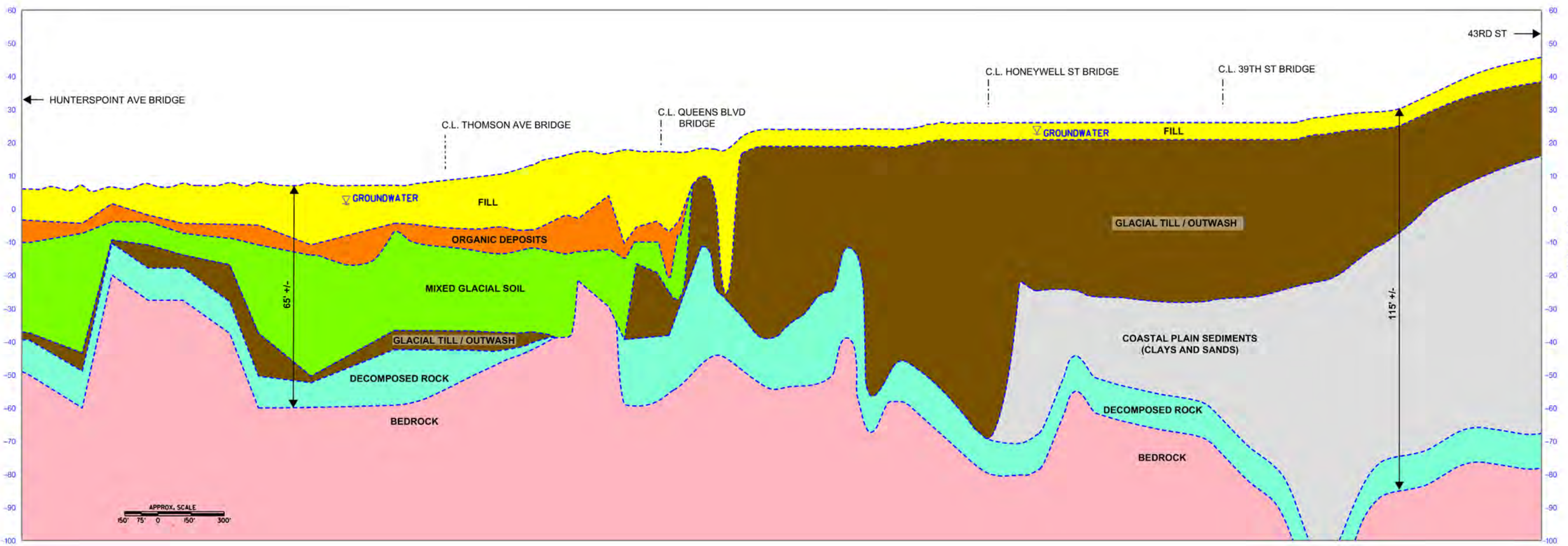
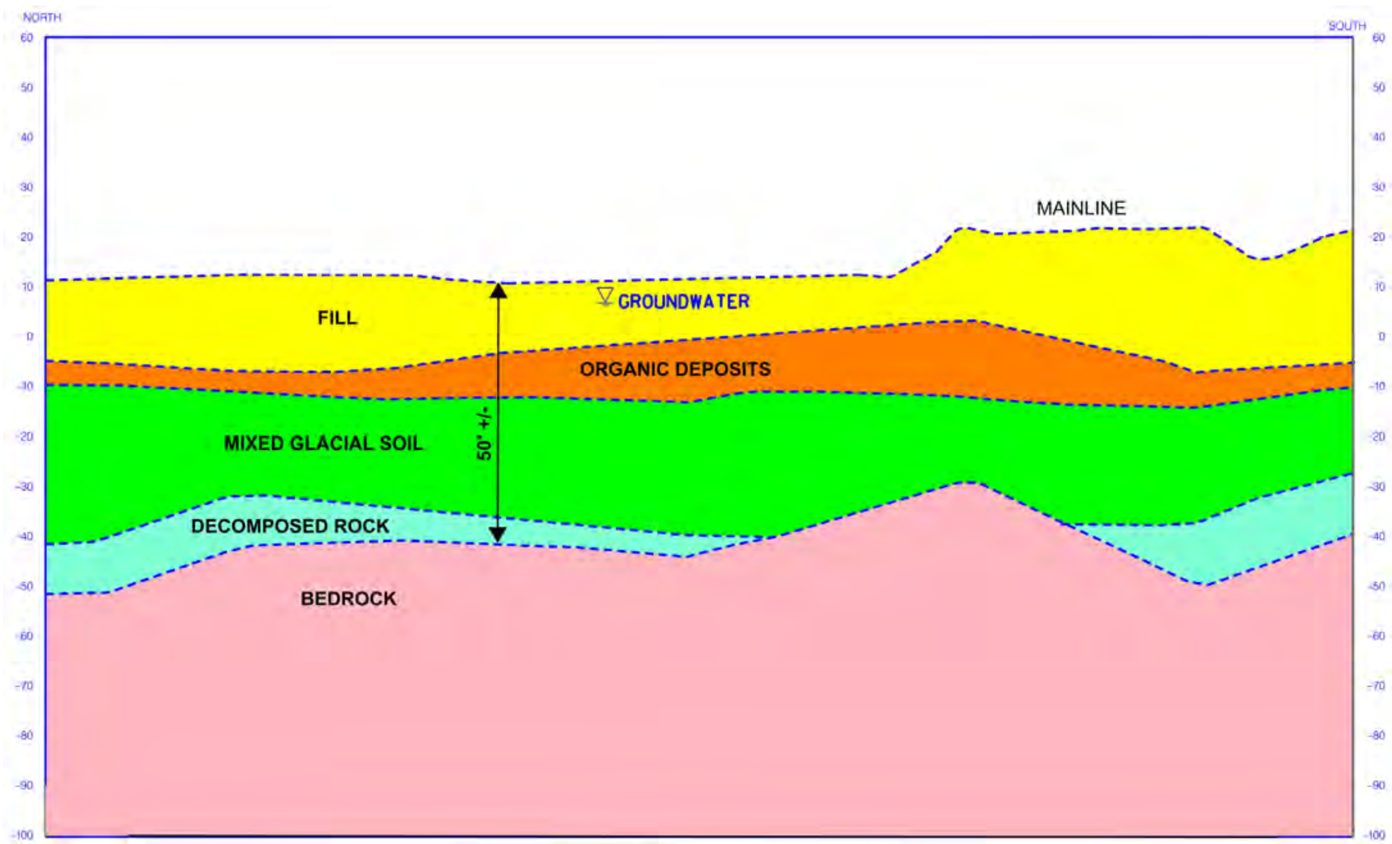
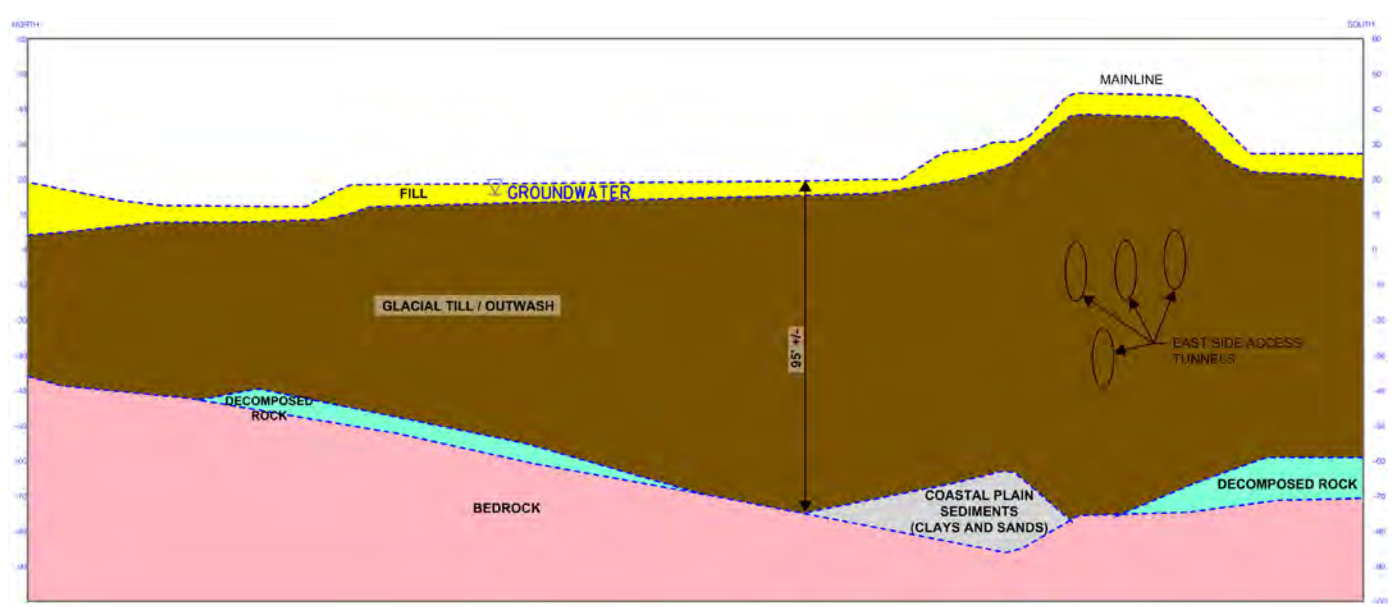


FIGURE 3.7: GEOLOGIC PROFILE A



3.8: GEOLOGIC PROFILE LOOKING EAST FROM QUEENS BOULEVARD BRIDGE



3.9: GEOLOGIC PROFILE LOOKING EAST FROM HONEYWELL STREET

south, representing typical conditions beneath the west portion of the site. In Figure 3.9, a geologic profile, oriented north to south, presents typical conditions beneath the east portion of the site.

The subsurface conditions beneath the west portion of the site typically include soil strata with the following thicknesses:

- Fill: 5' to 25'.
- Organic Deposits: Not present to 15'.
- Mixed Glacial Deposits: Less than 5' to 35'.
- Decomposed Rock: Less than 5' to 10'.
- Bedrock: The depth of the top of bedrock ranges from about 15' to 60'.

The subsurface conditions beneath the east portion of the site typically include soil strata with the following thicknesses:

- Fill: 5' to 10'.
- Glacial Till/Outwash Deposits: 20' to 80'.
- Coastal Plan Sediments: Not present to 80'.
- Decomposed Rock: Less than 5' to 25'.
- Bedrock: The depth of the top of bedrock ranges from about 60' to more than 120'; one boring near 43rd Street reached El. -100' (more than 150' below the ground surface at that location) and did not encounter bedrock.

In the lower lying portions of Sunnyside Yard, such as west of the Queens Boulevard Bridge and the northern portion of Sunnyside Yard, groundwater is typically within 5' to 10' of the ground surface. Along the Main Line embankments and the eastern portion of Sunnyside Yard, groundwater surface typically ranges from 15' to 40' below the ground surface.

Numerous geotechnical investigations have been performed in Sunnyside Yard, providing good information on ground conditions. Soils are predominantly dense glacial sands and gravels, which could support low-rise structures and potentially taller structures. The soils are underlain by bedrock at a variable depth of 15' to over 100'. Foundations extending to bedrock would be capable of supporting high-rise towers. Depth of the foundations will vary with the variable profile of the bedrock.

Contamination

Sunnyside Yard has been used as a train yard for over 100 years, resulting in spilled oil, fuel, and other products. In combination with water-borne compounds that have migrated into Sunnyside Yard from off-site sources, contamination has affected several areas of the site. The contamination that is known to exist in Sunnyside Yard is described below, and the potential consequences for construction are considered.

In December 1986, the New York State Department of Environmental Conservation (NYSDEC) listed approximately 133 acres of Sunnyside Yard as a Class 2 Site in the Registry of Inactive Hazardous Waste Disposal Sites in New York, also known as the State Superfund Site registry. (The extent of the Class 2 site is shown by the colored shading in Figure 3.10.) A Class 2 Site is a site at which hazardous waste presents a significant threat to the public health or the environment and action is required.

Since Sunnyside Yard opened in 1910, releases of contaminants associated with fueling operations of trains and vehicles, maintenance activities, train-mounted transformers, cinder and coal ash from coal-fired locomotives and coal fired boilers, and peeling lead-based paint from the four bridges that span Sunnyside Yard, have resulted in the presence of hazardous wastes at the site, including polychlorinated biphenyls (PCBs), semi-volatile organic compounds (SVOCs), polycyclic aromatic hydrocarbons considered, as subset of SVOCs, to be carcinogenic (cPAHs), and lead.

The Sunnyside Yard complex includes areas outside the 133 acres classified by NYSDEC as a Class 2 site. These include all the property owned by the MTA (such as the LIRR Mid-Day Storage Yard, Arch Street Yard, and Hunterspoint Avenue LIRR station), the General Motors facility, and Amtrak property to the west of Thomson Avenue. Fewer investigations have been performed in these areas, but being outside the Class 2 area, they are considered to have generally lower levels of contamination. Nevertheless, they have operated as railroad yards and facilities for more than 100 years and various types and concentrations of contamination can be anticipated.

FIGURE 3.10: OPERATING UNIT LAYOUT PLAN

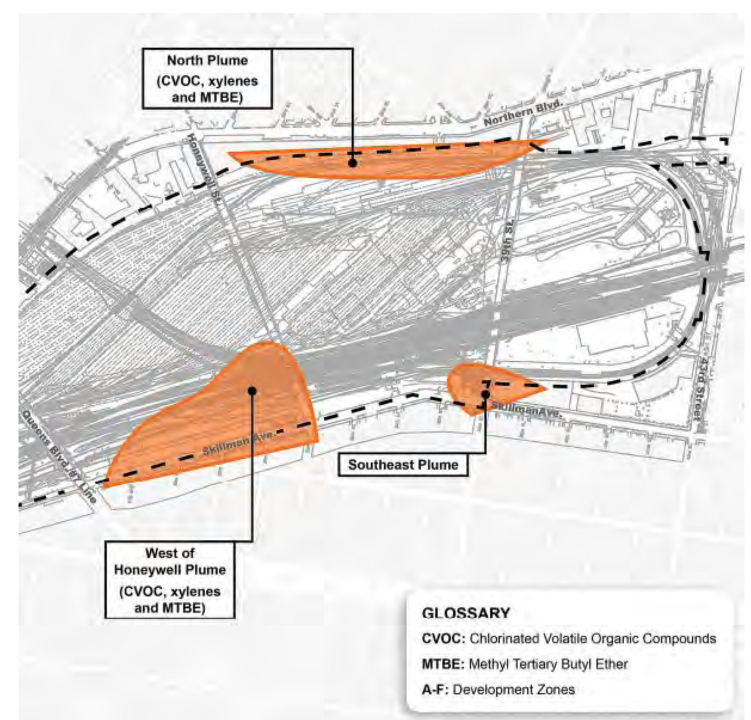


FIGURE 3.11: CONTAMINATION PLUMES

Known Contamination

According to the NYSDEC, PCBs, SVOCs, and lead have contaminated the unsaturated soil at the Superfund Site and have resulted in a significant threat to human health associated with potential exposure to soil impacted with those contaminants. A significant environmental threat is also associated with the potential impacts of these contaminants to the groundwater. Contaminated groundwater plumes are shown in Figure 3.11.

In February 1997, the NYSDEC identified three compounds of concern (COC) for the Superfund Site: PCBs, cPAHs, and lead. The NYSDEC issued the following site specific cleanup levels for compounds of concern at Sunnyside Yard:

- Total PCBs: 25 milligrams per kilogram (mg/kg).
- Total cPAHs: 25 mg/kg. and
- Lead: 1,000 mg/kg.

The Superfund Site specific clean up levels were established based on the fact that the site would remain a railyard and all future use of Sunnyside Yard would be regulated through institutional controls.

FIGURE 3.12: SOIL TESTING

FIGURE 3.13: GROUNDWATER TESTING

In 1997, New York State determined that the Superfund Site was too large to effectively manage as a single area, and therefore divided it into six sub-areas known as “operable units” or “OU”, each of which would have a separate remediation plan. A description of each OU and the associated remediation plans are included in Appendix C.

East Side Access Areas

The East Side Access project is under construction, including excavation and dewatering within the Class 2 site. The project is discussed later in this chapter. Four bored tunnels beneath the Amtrak storage tracks and five open-cut structures along the Main Line lie within the NYSDEC Class 2 Site. Other structures and facilities will be located outside of the NYSDEC Class 2 Site, such as the LIRR Mid-Day Storage Yard, the cut-and-cover structure below that yard, and miscellaneous work west of Thomson Avenue. Several Environmental Site Investigations (ESIs) were conducted in the East Side Access project areas to characterize soil (Figure 3.12) and groundwater (Figure 3.13) in order to assess construction worker safety and disposal options for soil and groundwater, characterize groundwater plumes, confirm the presence or absence of on-site sources of VOCs in the groundwater, and identify lead-based paint or asbestos-containing materials during demolition of structures on the Superfund Site. (Reference 20-24)

The subsurface investigations identified a number of locations where soil disturbance and excavation will require NYSDEC-approved procedures for testing, handling, and disposal of contaminated materials. The soil sampling confirmed the presence of areas of soil contamination identified in previous studies, and also identified new areas. VOCs, cPAHs, PCBs, and lead were detected in the soil samples collected within the work area.

Investigations for contaminated groundwater were also performed, the results of which were consistent with those found within the NYSDEC Class 2 Site (discussed in Appendix C for Operable Unit 6). Construction protocols were implemented for groundwater cut-off walls and limits of drawdown during dewatering in order to minimize adverse movement of contamination plumes.

Many of the buildings and other facilities in Sunnyside Yard were found to contain lead-based paint and asbestos. Asbestos-cement (“transite”) conduits were discovered in areas around the Main Line, and may exist elsewhere in Sunnyside Yard. Asbestos products require special handling to prevent release of harmful particles. Safe removal of such items, where required for construction, can significantly extend the schedule.

Prior to construction activities, a site-specific Construction Contaminant Management Plan (CCMP) was developed to outline the proper testing, handling, stockpiling, and disposal protocols required for construction. (Reference 24)

Consideration of Potential Contamination in Other Areas

It is possible that additional contamination that has not yet been identified, or that has been released from adjacent properties, exists on the Superfund Site. Properties directly adjacent to Sunnyside Yard may have caused direct impacts to the soils and groundwater from hazardous materials and/or petroleum-based products due to spills, improper handling and storage of wastes, or manufacturing/commercial use of chemicals. Properties that are not directly adjacent to Sunnyside Yard may not have direct impacts to the soils; however, if the hazardous material/petroleum release is hydraulically up-gradient of the site, then Sunnyside Yard may be impacted by contaminated groundwater or soil vapor issues. Releases impacting groundwater on cross-gradient or down-gradient properties may also impact the Superfund Site depending on the hydrogeology of the area. A detailed investigation of adjacent properties was not conducted as part of this study, but light industry exists all around the site and spills have been reported. Groundwater generally flows east to west through Sunnyside Yard, which is consistent with the general direction of plume migration. The Superfund Site is located on the former Dutch Kills Creek, therefore groundwater also flows from the south and north towards the site.

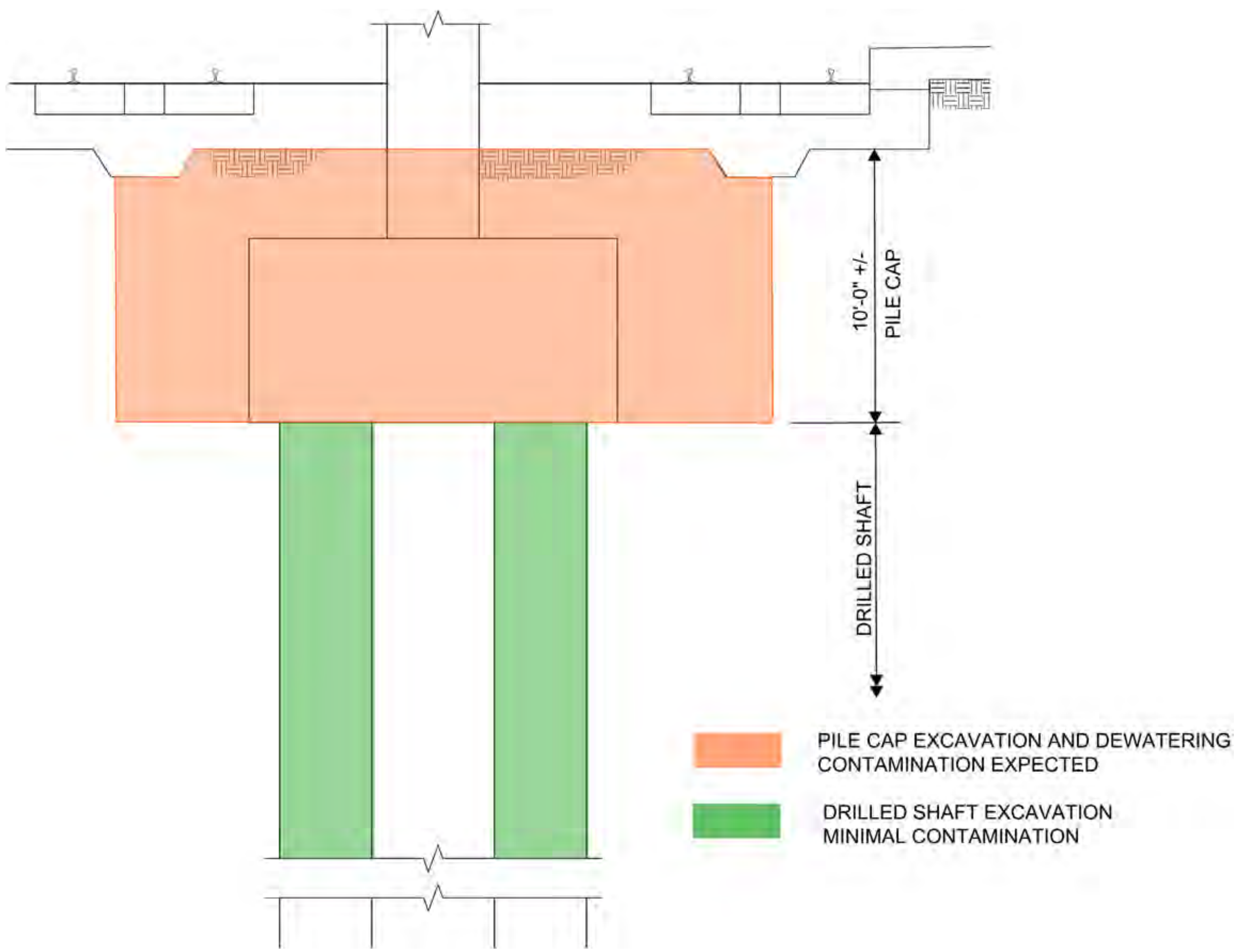


FIGURE 3.14: CONTAMINATION DEPTH AND CONSTRUCTION RELATIONSHIP

Implications of Contamination on Construction

Although much of the contamination previously present on the Superfund Site has been identified and remediated, the site has a long history of potential contamination from railroad maintenance operations, and remains classified as a Class 2 Superfund Site. It is therefore probable that any major development project, such as Amtrak's Master Plan railyard expansion project or an overbuild development project, would encounter contaminated ground or groundwater.

Potential pathways of exposure would need to be identified and mitigation plans developed to eliminate risk to the public, construction workers, and the larger environment. Such measures would include subsurface investigations to determine the nature and extent of contamination, and prescribed construction measures to manage contaminated materials prior to and/or during construction. These measures would be presented in site-specific Sampling and Remedial Work Plans, and Health and Safety Plans.

During construction, it is anticipated that foundations, consisting of drilled shafts and pile caps, would be constructed beneath the existing track bed. Soils in the projected areas of excavation would need to be tested either in-situ or post-excavation in order to ensure the proper management of waste. In the northern part of Sunnyside Yard, the ground water elevation is located approximately 5' below ground surface. Therefore, dewatering for pile cap excavation would be required. All groundwater should be collected, sampled, treated, and disposed of in accordance with the groundwater management plan. NYSDEC may require the effect of dewatering on groundwater plumes to be modeled, and to be verified by groundwater sampling around the Superfund Site.

Typical procedures employed to properly manage contaminated or hazardous materials include:

- Screening of soils during all excavations.
- Development of a community air monitoring plan for soil disturbance activities.
- Stockpile management plan for management of excavated soils.
- Waste disposal plan for offsite disposal of soil in accordance with Federal, State, and local regulations.
- Groundwater management plan and onsite re-use plan for use of excavated soil on the Superfund Site.

Given the limited laydown space in Sunnyside Yard, the ability to stockpile soils for testing is limited. Additionally, stockpiling of soils inevitably leads to double-handling. These two factors may result in it being more economical to automatically classify soil from certain areas as being contaminated, and to immediately dispose of it accordingly offsite.

In general, it is anticipated that the upper layers of soil will be more contaminated. Figure 3.14 shows the expected relationship of soil and ground water contamination to depth of construction.

Implications of Contamination on Design of Final Structures

If the entire structure is constructed on an elevated deck, then adverse impacts from contaminated soils and groundwater of the site would not be anticipated, but emissions from diesel-powered locomotives may be a potential hazard. Developing a site with known contamination requires that the potential pathways of exposure are identified and mitigation plans are implemented to eliminate this risk to users. For instance, if any occupied basements or grade-level rooms are to be constructed directly on the soils of the Superfund Site, and if elevated levels of VOCs remain at the site in the soil gas, then the building design may need to incorporate measures such as vapor barriers and/or venting systems to eliminate the potential for soil vapor exposure. Identifying potential exposure pathways during the design process would ensure that the required mitigation measures are implemented and that future redevelopment proceeds in a manner protective of public health.

Due to the nature of hazardous contaminants located at the site, it is not anticipated that these contaminants would have a corrosive effect on the foundation shafts and pile caps to be installed at the site. However, the intent of testing performed at the site was to identify and delineate areas of soil and groundwater contamination. Additional soil and groundwater testing should be performed to determine whether corrosive constituents are present at the site in the locations where the proposed foundation shafts are to be installed.

Implications of Overbuild on Long-Term Cleanup Operations

After implementation of Amtrak's Master Plan for Sunnyside Yard, overbuild development projects, and any associated contaminant cleanup operations, there should be no remaining or anticipated human exposure pathways. Therefore, subsequent cleanup operations should be unnecessary.

It is unlikely that future large-scale construction under the deck would be required. Therefore, the potential for excavation or other work that could disturb contaminants is limited. Should such work be needed, any associated cleanup operations would need to consider special conditions created by the deck, such as headroom restrictions for equipment and the need for ventilation.

At this time, it is not anticipated that overbuild construction activities would have any significant impact on any future cleanup operations.

Conclusion

Most of Sunnyside Yard is identified as a Class 2 Inactive Hazardous Waste Disposal Site. Numerous subsurface investigations over several years have identified PCBs, SVOCs, and lead as compounds of concern at Sunnyside Yard, especially between the Queens Boulevard Bridge and the 39th Street Bridge. (Figure 3.15) According to the NYSDEC and reports reviewed, these wastes have contaminated the unsaturated soil at the Superfund Site and have resulted in a significant threat to human health associated with potential exposure to soil impacted with PCBs, cPAHs, SVOCs, and lead, and a significant environmental threat associated with the potential impacts of contaminants to groundwater. Prior to any construction activity at the Superfund Site, a Construction Contaminant Management Plan should be implemented to provide procedures and requirements to manage contaminated or hazardous materials that may be encountered during construction.

The implications of site contamination on the construction of the elevated platform and final structure appear to be minimal. Contaminated soil and groundwater can be safely managed during the construction process; structures built on the elevated decking would not be adversely affected by the existing site contamination. Conversely, the completion of an elevated platform and overhead structures may have some negative impact if any future remedial operations need to be performed at the site, however, these impacts can be mitigated with proper planning. These impacts may include restricted overhead clearance for drilling and excavation operations, limitations on excavation near pile caps, and restrictions on groundwater pumping.

Potential costs associated with sampling, handling, and disposing of contaminated materials have been included in the financial evaluation of overbuild development alternatives, as discussed elsewhere in this report.

FIGURE 3.15: MAINTENANCE FACILITIES AND TRACKS

C. Railroad Operations

Several projects within Sunnyside Yard are in construction or planned over the coming decades, including Amtrak's Yard Expansion project, detailed in its Master Plan, and the MTA's East Side Access project. The projects are shown in Appendix A, and are described in subsequent sections. While these projects are underway, opportunities exist for coordination with an overbuild development. This could simplify overbuild construction compared to working around existing conditions in Sunnyside Yard. However, a lack of project coordination could limit the space available for overbuild structures and complicate construction. More trains will use Sunnyside Yard as new railroad projects are completed and as such projects are completed, available work-windows for overbuild construction will be restricted and costs will increase.

1. Planned Projects: Amtrak

Amtrak is planning a major expansion of Sunnyside Yard, so that within twenty years Sunnyside Yard will be able to accommodate approximately double the number of trains that it does today. In addition, Amtrak is planning to rehabilitate the East River Tunnels, which were damaged during Hurricane Sandy. Amtrak also has ongoing state-of-good repair work (maintenance and equipment upgrades) and other miscellaneous projects around Sunnyside Yard.

These are shown in Appendix A, and are described in more detail below.

Amtrak: Master Plan for Sunnyside Yard/ Sunnyside Yard Expansion

In 2014, Amtrak completed a master planning study for the expansion of Sunnyside Yard, which considers how to expand and upgrade Sunnyside Yard to meet Amtrak's needs through 2030 and beyond. (Reference 1) This report was advanced to a 15% Concept Design in March 2016 (Reference 2), and the drawings were made available to the overbuild study team. Unless noted otherwise, details in the section are taken from the Master Plan report.

Sunnyside Yard functions as the main train storage and service point for many trains originating or terminating in Pennsylvania Station. Amtrak crews service and maintain Amtrak High Speed Rail (HSR) and Conventional (Long Distance, Northeast Corridor (NEC), Keystone and Empire) trains as well as NJT's Northeast Corridor, Manhattan Direct, and North Jersey Coast Line trains. Sunnyside Yard also provides commissary service to support the Pennsylvania Station operations along with maintenance of way (MOW) facilities to maintain Pennsylvania Station, Harold Interlocking (a series of tracks and switches between the four East River Tunnel portals and 43rd Street), and the Hell Gate Line.

Sunnyside Yard is currently operating at capacity, with 92 trains using Sunnyside Yard each day. This number is projected to increase to 117 per day by 2020, and to 137 per day by 2030. Currently, 805 employees are based in Sunnyside Yard. The number of employees is projected to grow to 1,163 by 2020, and 1,306 by 2030. Accommodating this growth will require significant infrastructure investment, as outlined in the Master Plan.

Starting in 2020, Amtrak will introduce a Next Generation high-speed train service, at greater frequency compared with the current Acela service. This will increase use of Sunnyside Yard, and will require a new high-speed train maintenance facility. In 2028, Amtrak is scheduled to complete the Gateway Program. The Gateway Program is a major rail infrastructure improvement project, which will substantially increase the capacity of rail service between New York and New Jersey, and improve the capacity of Pennsylvania Station. It will include two new tunnels under the Hudson River and upgrades to the existing infrastructure between Newark, NJ and Penn Station. Many of the trains required for Gateway services will be stored, maintained, and readied for service in Sunnyside Yard.

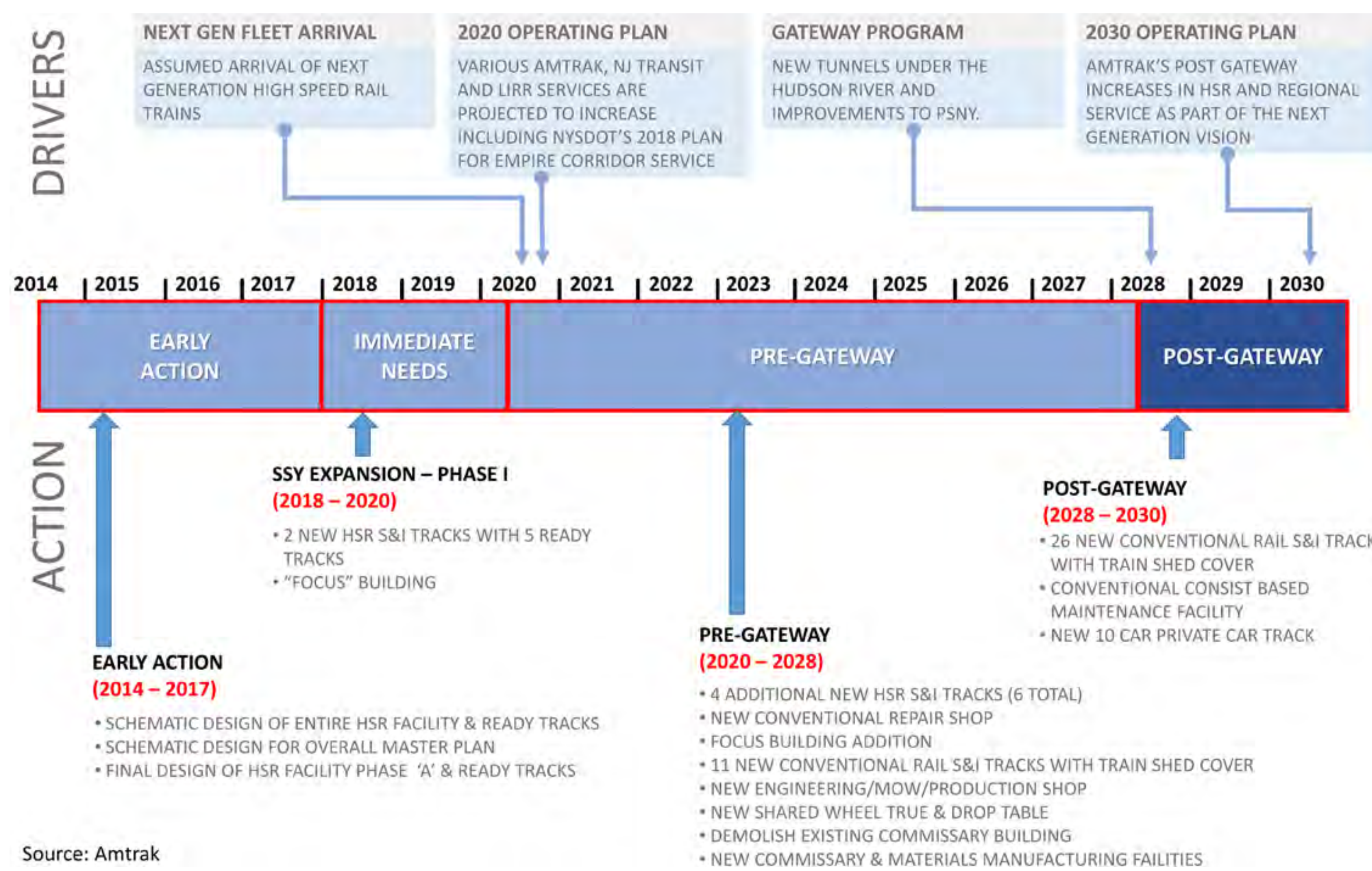


FIGURE 3.16: POSSIBLE MASTER PLAN IMPLEMENTATION SCHEDULE

Investment by Amtrak in new Yard facilities is required not only to accommodate increased train operations, but also to modernize and address aging facilities that are inefficient at meeting the requirements of the railroad. Many of the buildings and systems within Sunnyside Yard are in poor condition and need improvements in order to remain operational. For example, the overhead contact system that supplies electric traction power for Amtrak's locomotives is over 80 years old and is in need of replacement.

Sunnyside Yard Expansion - New Facilities

Amtrak's Master Plan provides a methodical approach for the complete upgrade of Sunnyside Yard, east of Queens Boulevard. In general, the track alignments and building locations foreseen in the full 2030 build-out of the Master Plan will be the baseline for overbuild planning. The design process following from the Master Plan has progressed to a 15% Concept Design. A plan of the full buildout is shown in Appendix A. A plan of the proposed Phase 1 buildout is shown in Appendix A. Renderings of the complete buildout are shown in Appendix A. A potential schedule for implementing the Master Plan is shown in Figure 3.16.

The principal elements to be constructed are as follows:

- **Rebuilt and Expanded High Speed Rail Facility (HSRF)** (Figure 3.17) would be expanded in three phases from two tracks to six. Completion of the first phase (which adds two service and inspection (S&I) tracks to the two existing) is critical for Amtrak to complete before delivery of its new high speed trains, anticipated to arrive at the end of summer 2020. Five "Ready Tracks" (for HSR trains waiting to enter Pennsylvania Station) and one run through track will be constructed in the area formerly occupied by Buildings 1 through 8, adjacent to the MTA Mid-Day Storage Yard. The improved HSR Facility would also house a Sunnyside Yard operations center, HSRF mechanical, and transportation on the upper floor.
- **New Train Shed Over Storage Tracks with Expanded Track Centers** would allow for Service and Inspection (S&I) on the tracks. Eleven tracks would have pits matching the full length of the train consist (a train consist is a lineup of railroad cars and locomotives that comprise a complete train). Similarly, equipment would be provided on the tracks such as potable and non-potable water, gravity toilet dumps, compressed air, and 480 volt standby power, in order to allow for servicing of the trains under the new Train Shed or structure that would be built over the tracks. The Master Plan increases the number of storage tracks from 32 to 38, while providing wider track centers. The Master Plan also proposes a complete replacement

FIGURE 3.17: HIGH SPEED RAIL SHOP (CONCEPTUAL RENDERING)

FIGURE 3.18: CONVENTIONAL REPAIR SHOP (CONCEPTUAL RENDERING)

of the existing catenary system, with a new system enclosed within a roof canopy. The new catenary system would likely be suspended from the roof canopy.

- **New Conventional Repair Shop** (Figure 3.18) would provide four stub-end locomotive repair tracks; four double access car repair tracks; and administration, storage, and back shop space. Conventional Mechanical Welfare facilities would be located on the upper floor of the Conventional Shop. A two-track consist-based maintenance facility is included on the north side of Conventional Repair Shop.
- **New Wheel True/Drop Table Building** would be used by both HSR and Conventional Mechanical Departments and would be constructed in the middle of the Train Shed. This facility would provide wheel true capabilities as well as a drop table and a truck release track. Foreman offices and support facilities for conventional S&I operations within the Train Shed would be included on the upper floor of this building.
- **New Commissary and Materials Management Building** (Figure 3.19) would provide commissary and a centralized warehouse for materials management. Support facilities for commissary, materials management, on-board services, and engineering would be provided on the upper floors. This new building would allow for demolition of the existing commissary building, which would create space for new storage tracks and maintenance shops.
- **Focus Building** would provide a centralized meeting point and provide access to the HSRF, Conventional Shop and Commissary and Materials Management Building. There would be an entrance to the Focus Building from the 39th Street Bridge as well as at ground level. The Focus Building would include employee amenities such as a cafeteria, fitness center, and infirmary. It would also include training and conference rooms. The security department support facilities would also be located in the Focus Building.
- **Relocated Engineering, Production, and Maintenance of Way (MOW) Area** with a new Engineering/Production/MOW Shop would be capable of maintaining track-mounted and highway vehicles, as well as construction equipment.
- **New 10-car Private Car Track** would be constructed with an adjacent access road. Private rail cars are owned by individuals, groups, or companies and are generally coupled with scheduled Amtrak services by prior arrangement with the owner.
- **Enlarged Substation Area** would include space for the existing Frequency Converter Substation, the relocated and expanded 60-cycle substation, and the expanded Substation 44 Main Line and Sunnyside Yard Traction Power substation.
- **Centralized Employee Parking Facilities at the Amityville Yard Site** with pedestrian access to Sunnyside Yard provided by means of a pedestrian bridge over the Loop Tracks.

The conventional rail storage tracks have been planned to accommodate 4’ diameter columns for future overbuild, which presents a good opportunity for overbuild construction. The 15% Concept Design has modified various elements of the Master Plan, such as the High Speed Rail Facility and the Ready Tracks. Such modifications will continue as Amtrak advances in its design process, and any future overbuild development should be coordinated with such changes. To date, no major spatial deviations from the Master Plan have been identified.

Modifications to track alignments and buildings to better accommodate overbuild may be considered by Amtrak, provided that such modifications do not pose a significant detriment to yard operations and efficiency. Certain efficiencies may be available; for example, the primary purpose of the proposed Conventional Train Shed roof will be to provide protection from weather for the servicing of trains. An overbuild deck structure will provide the same function, which will obviate the need for the proposed roof. However, modifications may result in additional costs.

FIGURE 3.19: COMMISSARY AND MATERIALS MANAGEMENT BUILDING (CONCEPTUAL RENDERING)

Master Plan - Phased Implementation

Implementation of the development and construction of the facilities described above is planned in phases. Reasons for this phasing include the availability of funding, the need to maintain operation of Sunnyside Yard during construction, and the fact that service demands are projected to increase incrementally over the next 15 years. Figure 3.16 shows a potential Master Plan construction timeline, based on the operational drivers and actions to address the drivers. It has been modified from the timeline in the Master Plan to reflect the currently anticipated schedules. A key driver of increased train operations and associated new facilities in Sunnyside Yard is the Gateway project, which Amtrak anticipates being complete in late 2028. This date assumes that all required funding for the Gateway project and the construction of the tracks and facilities in the Master Plan will be available when required. If funding is delayed, it would result in the schedule shown on Figure 3.16, and noted below, extending later.

The potential construction schedule for each structure is described as follows:

Sunnyside Yard Expansion Phase I (2018-2020):

- Construct Phase A (two tracks) of a new HSRF to cater to the Next Generation fleet of high speed trains. Construction is anticipated from mid-2018 through mid-2020.
- Construct temporary offices in the former Railway Express Area to allow for demolition of existing Building 8. This will create space to allow for construction of HSR Ready Tracks.
- Construct the Focus Building on 39th Street, which will serve as the main entry point for employees into Sunnyside Yard. If funding is not available, construction would be delayed until after 2020.

The designs of the Focus Building and High Speed Rail S&I Facility are currently at a 15% Concept Design and are being progressed to final design by the end of 2017.

Pre-Gateway Program (2020-2028):

- Construct a new Commissary and Materials Management Building.
- Construct Phase B of the High Speed Rail Facility, adding two more tracks for a total of six tracks, to accommodate continued expansion of HSR service.
- After demolition of the existing Commissary and relocation of Maintenance of Way facilities, new conventional rail maintenance facilities can be constructed without loss of storage tracks.
- Construct Phase C of the High Speed Rail S&I Facility in time for initiation of the Gateway project. This would replace the existing HSRF with a two-track bay that would complete the new HSRF.

Post Gateway (2028 – 2030 and beyond):

- The main construction during this phase is the construction of the new Train Shed over the conventional rail storage tracks.
- As funding becomes available, Amtrak would construct an Engineering/Production/MOW Shop, as well as a Private Car Track.

The laydown area in the former Railway Express Agency (REA) area, currently being used by the East Side Access project, would have competing demands from the Master Plan work, an overbuild development, and many of the other projects planned for Sunnyside Yard. Furthermore, as the expansion of Sunnyside Yard progresses per the Master Plan, the available laydown space would be incrementally reduced by construction of offices, the Commissary Building, and the new Engineering/Production/MOW Shop. Additional off-site or on-deck laydown space would need to be identified.

State of Good Repair Projects

In addition to the Master Plan expansion, Amtrak is advancing various smaller scale state-of-good-repair and upgrade projects in Sunnyside Yard. These include substation rehabilitation and replacement, and heat tracing of certain non-potable water supplies.

As discussed earlier in this chapter, Amtrak is also progressing with remediation of areas within Sunnyside Yard that are contaminated with hazardous materials. Amtrak is working with New York State regarding remediation requirements related to groundwater and soil removal.

Amtrak: East River Tunnel Sandy Repair

Two of the East River Tunnels were flooded with salt water during Hurricane Sandy. All four of the tunnels are in need of repair (Reference 3), and designs are being developed for such work. Repair work may require that one tunnel at a time be taken out of service for an extended period of time from 18 to 24 months. Amtrak anticipates work to run from 2020 through 2025, and operating the railroad with only three tubes in service will require coordination with, and likely completion of, the Amtrak High Speed Grade Separation structures in Harold Interlocking (discussed in the next section). If this timeline overlaps with the overbuild construction it could have the following consequences on an overbuild:

- Closure of a tunnel would reduce the number of routes through Harold Interlocking. A positive effect could be that work adjacent to the track(s) leading into the out-of-service tunnel could potentially occur with fewer restrictions. However, the other tracks in Harold Interlocking would be used more heavily, which may preclude any construction in certain areas of the Main Line.
- Non-revenue service through the tunnels could be reduced, with fewer trains "looping" around Sunnyside Yard or using Sunnyside Yard for storage and maintenance. This could potentially improve the availability of track outages in Sunnyside Yard. This would present all the railroads with operational challenges. For example, displaced trains would need to be serviced and stored in other yards (likely west of the Hudson). Also, fewer looping trains would cause platform capacity issues at Pennsylvania Station.
- East River Tunnel work would require a laydown area for materials and equipment. This could negatively impact the ability of the overbuild project to identify an available laydown area for simultaneous overbuild construction.
- East River Tunnel work would likely require support from railroad personnel (flaggers, Electric Traction (E/T), etc.) which would reduce the availability of personnel to support an overbuild project.

There is likely to be limited overlap between East River Tunnel repairs and an overbuild project. During any overlap there could be both positive impacts arising from fewer train movements, but also negative impacts arising from increased demand for railroad support personnel, as described above. The net impact on an overbuild is likely to be negative given that more construction affecting Sunnyside Yard is likely to complicate coordination and limit available resources.

Conclusion

Amtrak has several projects planned in and around Sunnyside Yard. However, none is more important to the feasibility of an overbuild project than the expansion work outlined in Amtrak's Master Plan for Sunnyside Yard. The anticipated 15-year build-out would involve the replacement and reconfiguration of most of the tracks and overhead wires in Sunnyside Yard. This work presents a unique opportunity for the coordinated design and construction of railroad infrastructure and overbuild development.

2. Planned Projects: MTA

Sunnyside Yard has several ongoing MTA projects, with others planned over the next 15 years and beyond. This section identifies those projects, their anticipated construction schedules, and notes some of potential ways in which those projects could affect overbuild construction.

The following MTA projects are under construction, planned, or envisioned:

- MTACC: East Side Access (under construction)
- MTACC: Sunnyside Station (conceptual design phase)
- LIRR: Flood protection of the East River Tunnel portals (Request for Proposals (RFP) phase)
- Metro North Railroad (MNR): Penn Station Access (planning phase)
- MTACC: Demolition of Montauk Line Cut Off structure (final design phase)
- New York City Transit (NYCT): Queens Super Express (long term vision)

These are located as shown in Appendix A and are described in more detail below.

MTACC: East Side Access Project

The MTA's major ongoing construction project within Sunnyside Yard is the East Side Access project. This project would connect the LIRR Main Line, and points east, to Grand Central Terminal. The plan of "Active and Planned Projects Within Sunnyside Yard" (Appendix A) shows the major elements of this project within the railyards.

The East Side Access project has been in construction since 2004 and is scheduled for completion between 2021 and 2023. Most of the work remaining after 2020 would be systems installation, testing, and commissioning.

The major elements of the East Side Access project in Queens, with analysis of certain challenges of each project and/or site for an overbuild project, are as follows:

- Three cut-and-cover structures are located within Harold Interlocking, which transition Main Line tracks from grade-level down into the bored tunnels. These are currently under construction within the Main Line embankment, near the 39th Street Bridge. Construction is anticipated to continue through 2021. The structures would be constructed in the limited available space between surface Main Line tracks, constraining opportunity for future column touchdown points through this corridor.
- One cut-and-cover structure is located immediately west of 43rd Street, which would permit a bi-directional yard/loop track to transition from grade-level down into a tunnel. This structure is complete (see Figure 3.20) and shares a site with new retaining walls, a substation, and a new access road for Amtrak's High Speed Rail Facility. The footprint of the structures and the surrounding land is owned by MTA. This area potentially provides some limited space for construction on terra firma, or for vehicular connections between Northern Boulevard and the overbuild deck.
- Four bored tunnels, each 22' in external diameter, extend west and northwest from the Main Line transition structures, passing under the Main Line and the core yard storage tracks, to the underground Plaza Interlocking structure. Figure 3.21 shows the tunnels under construction from within the Plaza Interlocking structure, below the Amtrak North Runner bridge. The tunnels are now complete, and present a "no go" zone for piles that would be needed to support an overbuild. Piles and columns must be located outboard of the tunnels, with long-span decks between columns.
- The Plaza Interlocking cut-and-cover structure is approaching completion and is located below the future LIRR Mid-Day Storage Yard. (Figure 3.22) It is approximately 900' long and varies in width from 80' to 160'. For this study it is assumed that the

FIGURE 3.20: CUT-AND-COVER STRUCTURE

FIGURE 3.21: BORED TUNNEL CONSTRUCTION

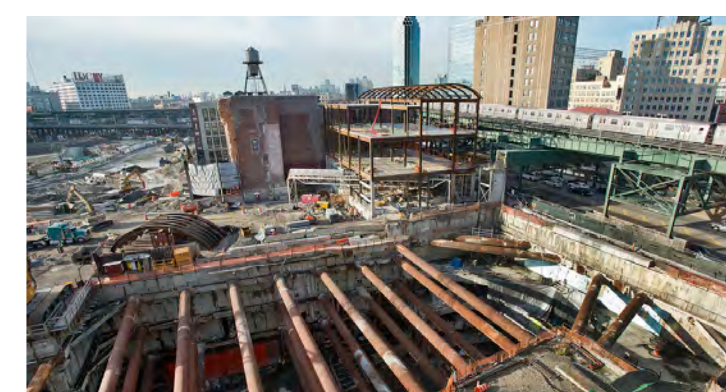


FIGURE 3.22: PLAZA INTERLOCKING STRUCTURE

structure presents a "no go" zone for piles. However, isolated lightly loaded columns could potentially be founded on the structure, but this would involve complex technical and coordination issues, including structural re-analysis, waterproofing, maintenance, etc. On top of the northwestern part of this structure, between Northern Boulevard and the future Mid-Day Storage Yard, various new steel-framed LIRR structures and a parking facility are currently being constructed.

- The LIRR Mid-Day Storage Yard would be constructed on the MTA property to the north of the Amtrak storage tracks. The site is currently used for materials laydown and storage of construction equipment for other elements of the East Side Access project. Construction is anticipated to start in 2017. If overbuild construction occurs after completion of the Mid-Day Storage Yard, overbuild construction costs would increase and the schedule would extend. New yard systems would also need to be reconfigured or replaced. MTA has not provided information on tracks and facilities within the Mid-Day Storage Yard. The track alignments as shown in the Amtrak Master Plan for Sunnyside Yard were assumed as the basis for study. However, the availability of space between tracks for overbuild support walls is unknown. In some areas, that space may be required for vehicular access roads, utility troughs and other purposes.
- Harold Interlocking is being expanded and upgraded to accommodate LIRR service to Grand Central Terminal, in addition to enhanced Amtrak and MNR services. All current work is being performed by MTACC as part of the East Side Access project. This includes almost complete replacement of the tracks, signal systems, communications, third rail, overhead contact system (OCS, or catenary). (Figure 3.23) In addition, signal power towers, central instrument locations (CILs), substations, signal troughs, and associated systems are being constructed. The loop tracks adjacent to Skillman Avenue and west of 39th Street are also being expanded. A replacement Amtrak train-car wash would be constructed in this area in approximately 2021, which would constrain overbuild opportunities. The catenary system and signal power towers are 45' and 70', respectively, above the Main Line tracks, which are approximately 15' above the storage tracks in Sunnyside Yard. The elevation of these existing systems presents a challenge for a potential deck over the Main Line. Options that can be considered include the relocation of the signal power towers elsewhere, routing the signal power wires underground, and reducing the height of the catenary systems.

FIGURE 3.23: OVERHEAD CONTACT SYSTEM

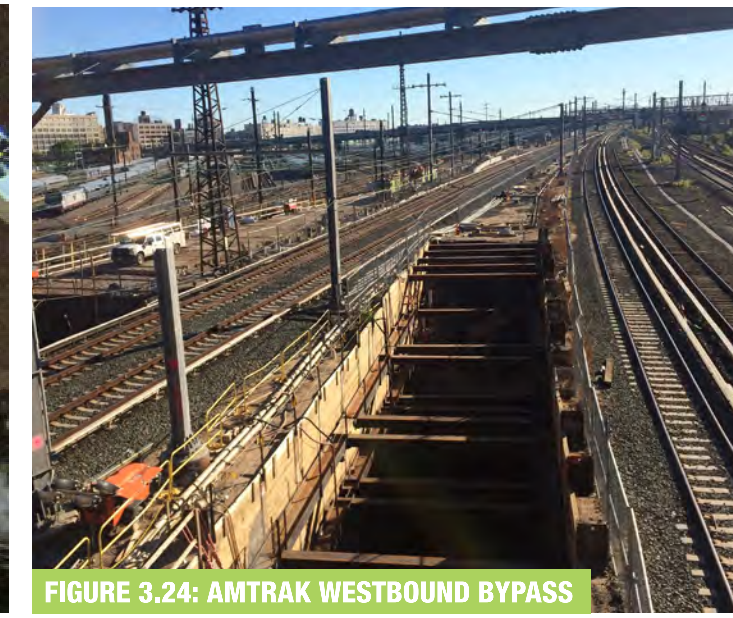


FIGURE 3.24: AMTRAK WESTBOUND BYPASS

- Amtrak High-Speed Grade Separation structures are being constructed within Harold Interlocking between Thomson Avenue and 39th Street. (Figure 3.24) Currently, Amtrak trains to/from Boston are routed at-grade through switches that also serve LIRR commuter trains. The cut-and-cover tunnel structures would allow Amtrak trains to pass under the LIRR tracks without conflict. Construction is being coordinated by MTACC as part of the East Side Access program. The structures would occupy much of the space between tracks in the western part of Harold Interlocking that would otherwise appear to be suitable for column touchdown points.
- The former Railway Express Agency (REA) area, located between the loop tracks and 39th Street, north of the Main Line, is the principal East Side Access laydown area for materials and equipment. This would also be a prime staging area for an overbuild project, the Amtrak Master Plan/Yard Expansion, and other projects described in this report. The space could not accommodate all the projects underway and anticipated, so the priority of uses for area would need to be determined.

Most of the heavy civil construction on the East Side Access project is scheduled to be complete by 2020 and would not overlap with overbuild development.

Sunnyside Station (MTACC)

The concept of Sunnyside Station was developed in the early 2000s and it was included in the Environmental Impact Statement for the East Side Access project. (Reference 4) The proposed station would be located on the Main Line tracks, centered on Queens Boulevard Bridge, with pedestrian access from the bridge and Skillman Avenue. It would have a central island platform with two side platforms, and it would provide a new stop for certain LIRR commuter trains (and potentially Metro North and Amtrak trains) that access Pennsylvania Station. Such a station would benefit an overbuild development by providing access to Manhattan, Long Island, East Bronx, and areas beyond. Although Metro North and Amtrak did not include Sunnyside Station in their future plans, the realized demand for their services at this location could potentially affect their strategy for this area.

As planned, the Sunnyside Station would be located west of where the East Side Access tunnels diverge from the Main Line and therefore, trains to/from Grand Central Terminal could not use Sunnyside Station. It would be located directly below the No. 7 train tracks; however no additional No. 7 train station was proposed as part of the conceptual plans for the Sunnyside Station. A revised design that expands the passenger concourse and other facilities to accommodate residents and users of any overbuild development would likely be required.

Design and construction is partially funded ($76.5 million) in the 2015-2019 MTA Capital Plan, with $10 million allocated to 2017 and $66.5M to 2019. (Reference 1) Construction could occur between 2020-2025.

Construction of station infrastructure between the Main Line tracks would require multiple track outages and weekend possessions to allow tracks, catenary, and systems to be reconfigured, and for footings, platforms, and superstructure to be constructed. This work would need to be coordinated with any overbuild construction, which may have competing demands for track outages and railroad personnel.

The proposed Sunnyside Station location provides an opportunity for enhanced transit access to the surrounding neighborhood and also to an overbuild development. The spacing of tracks and platforms immediately west of Queens Boulevard potentially provides sufficient touchdown points for columns to support significant overbuild structures that could be located above the station platforms. For the purpose of this study, the locations for support walls for an overbuild development were assumed to be located midway between the platform edges of the future station.

Flood Protection of the East River Tunnel Portals (LIRR)

During Hurricane Sandy, two of the East River Tunnels flooded as a result of the storm surge rising above the elevation of the portals and adjoining railyard areas. LIRR's "River to River Rail Resiliency" project proposes to build flood walls to reduce the risk of flood water entering the tunnels from the Manhattan or Queens portals. The flood walls in Sunnyside Yard would be located to the west of Queens Boulevard Bridge at the northern boundary of the project area, and to the west of 27th Street at the southern boundary of the project area. (Figure 3.25) Construction is projected to start in 2018 and be completed by 2020. Coordinating the design and/or construction of the support walls for the overbuild with the flood protection project would avoid any potential conflicts with the flood walls.

Penn Station Access (MNR)

The Penn Station Access project would provide access for Metro North Railroad (MNR) trains into Pennsylvania Station via Amtrak's Hell Gate Line and along the Main Line tracks that pass through Sunnyside Yard. (Figure 3.26) The project anticipates four new stations in the Bronx, with MNR services extending into Connecticut. No major construction is anticipated within Sunnyside Yard, although it is possible that some signal/systems modifications would be required along the Main Line.

MTA expects environmental and federal reviews to be completed by 2017. Design would follow, with construction potentially in the 2020 to 2025 timeframe. Service would start operating after the East Side Access project is in operation.

The project would result in more trains using the Main Line tracks through Harold Interlocking, which would reduce the availability of track outages. However, this increase would be offset by LIRR re-routing some services that currently serve Pennsylvania Station into Grand Central Terminal. The only location in Sunnyside Yard where both Pennsylvania Station and Grand Central services would operate would be on the Main Line between 39th Street and 43rd Street. Introducing a third passenger railroad onto the Main Line would complicate planning for track outages and adjacent construction.

FIGURE 3.25: FLOOD WALL LOCATIONS

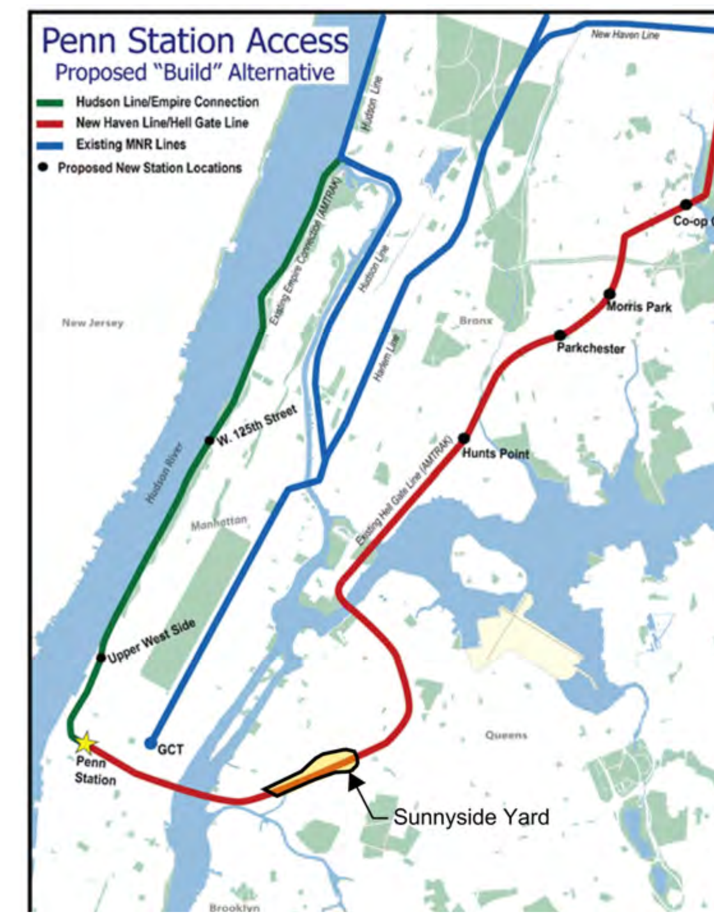


FIGURE 3.26: PENN STATION ACCESS

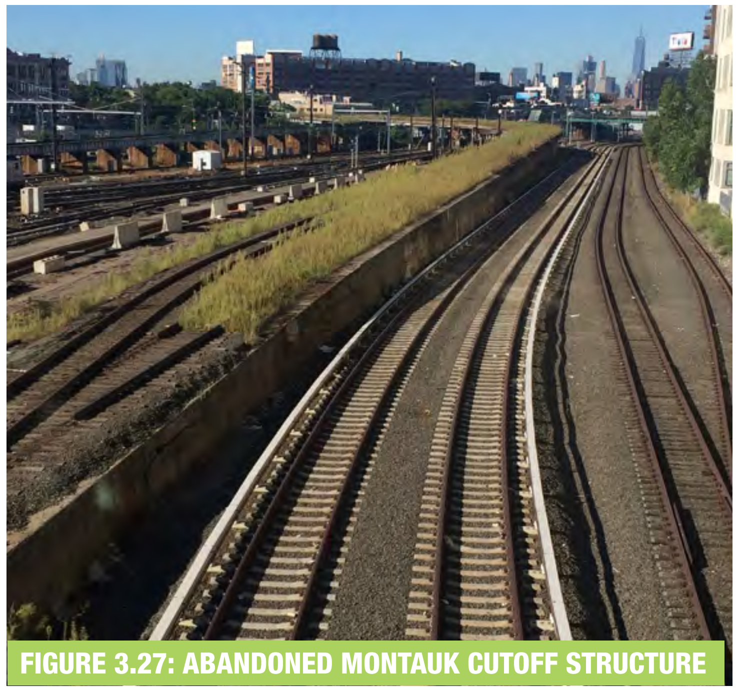


FIGURE 3.27: ABANDONED MONTAUK CUTOFF STRUCTURE

FIGURE 3.28: ADAPTIVE REUSE

Demolition of Montauk Cutoff Structure (MTACC)

The MTA plans to demolish a portion of the Montauk Cutoff, an abandoned railroad viaduct between the overbuild project site and the tunnels to Pennsylvania Station (Reference 5). Removing a portion of the Montauk Cutoff would allow LIRR trains to operate between the LIRR Mid-Day Storage Yard and the Arch Street Facility west of Sunnyside Yard. Figure 3.27 shows the structure, looking west from Thomson Avenue Bridge. Demolition could occur between 2016-2018. (Figure 3.28)

Montauk Cutoff Adaptive Reuse (MTA)

The LIRR is in the process of decommissioning a separate portion of the Montauk Cutoff (Figure 3.28) south of Sunnyside Yard to Borden Avenue and Dutch Kill. In 2015, the MTA issued a Request for Expressions of Interest to identify a range of potential uses. (Reference 6) Potential uses could include a footpath or cycle-way that could be beneficial for an overbuild development of Sunnyside Yard and could be extended into an overbuild development.

Queens Super Express (NYCT)

When the 63rd Street Tunnel Connector Project was constructed in the 1990s, adjacent to the Queens Plaza station, a provision for bifurcations or turn-outs, was included to allow future construction of two new tunnels for a branching subway service. A potential future use identified by NYCT for these turn-outs was to serve a future “Queens Super Express” with two tunnels passing under Sunnyside Yard and turning parallel to the LIRR Main Line, with portals east of 48th Street. Construction of this line is no longer planned by NYCT; however, the East Side Access project has been designed and constructed to not preclude its construction at some point in the future. If the route is constructed, it is likely to occur post-2040, after much of the overbuild development is constructed. A NYCT station could potentially be constructed in Sunnyside Yard on the new route.

An overbuild project would need to be prepared to provide route protection to allow for the future construction of these (or other) tunnels under Sunnyside Yard. After construction, the dense grid of deep columns required to support the overbuild structure could preclude future subway tunnels, unless specific column “clearways” and other provisions are included.

Conclusion

MTA’s projects within Sunnyside Yard are predominantly associated with the East Side Access project. The project has resulted in the construction of four bored tunnels below the Amtrak storage tracks, cut-and-cover tunnels in several locations, and major renewal of infrastructure on the Main Line. These restrict the opportunities for footings and increase the cost of overbuild. Upcoming MTA work would include additional work on the Main Line, build-out of the LIRR Mid-Day Storage Yard, and construction of LIRR’s Sunnyside Station. The feasibility of overbuild within the LIRR Mid-Day Storage Yard would depend on the availability of touchdown points for columns, and also on coordinated construction schedules. LIRR’s Sunnyside Station would provide an important transport node for the overbuild development. Coordination with MTA on its completed and ongoing projects will be necessary in many parts of Sunnyside Yard.

D. Engineering Parameters

1. Structural Requirements

The overbuild structural system, consisting of support walls and deck, would allow development of a new neighborhood composed of streets, parks, residential buildings, schools, offices and other structures. The structural deck and other horizontal load-bearing structures would be supported on columns and walls located throughout Sunnyside Yard.

To identify the optimal structural system to support the overbuild development, the following factors were considered:

- Vertical clearance requirements for railroads.
- Location of touchdown points of walls and columns.
- Distances between touchdown points and the resulting deck spans.
- Structure types and building types to be supported and the associated vertical and horizontal loads.
- Design of foundations.
- Design of columns and support walls.
- Optimal structural deck types for open space and low-rise structures.
- Optimal structural support types for medium-rise and high-rise structures.

The primary goal the engineering evaluation is minimizing the cost of the support structures, while also minimizing the impact on railroad operations.

2. Clearance Requirements for Railroads

Minimum vertical and horizontal clearances between trains and structures dictate the touchdown point locations and support wall design. Appendix A show standard railroad clearances required by Amtrak and LIRR.

The minimum 8'-6" regulatory horizontal clearance from centerline of track to edge of wall/column is applicable to all tangent tracks in Sunnyside Yard. For curving tracks, including those with super-elevations, increased horizontal clearances apply and would need to be considered during post- feasibility design stages. The minimum clearances provide some room for personnel between the train dynamic clearance envelope and the proposed structures, but might not be sufficient for inspection, maintenance, access, cleaning, loading supplies, wayside equipment, and other functions. For this study it has been assumed that space for these functions could be accommodated with localized recesses or openings. This would need to be verified in future design stages.

Vertical train clearance requirements are different in the Amtrak and LIRR portions of Sunnyside Yard. The principle difference is that most Amtrak tracks have an overhead traction power (catenary) system, whereas LIRR does not. According to the requirements for each agency, vertical clearances from top of rail to underside of structural deck or fixtures are 26'-9" and 22'-0" respectively for Amtrak and LIRR. However, these are desired clearances and in practice, railroads can agree to grant a waiver. For example, LIRR agreed to a minimum vertical clearance of 19'-6" in the decked portion of Vanderbilt Yard in Brooklyn. Amtrak has stated that a minimum vertical clearance of 25' is desirable above existing service roads in the Yard.

For structural efficiencies it is desirable to keep the deck as low as possible. Shorter walls are stiffer, reduce sway effects in buildings, and permit taller overbuild structures. From an urban design viewpoint a lower deck promotes connectivity between the new development and surrounding neighborhoods, and improves access to the deck from the four bridges crossing Sunnyside Yard.

For railroad operations and efficiency, it may be necessary or preferable to have more clearance than the technical minimum. Depending on the location in Sunnyside Yard, a higher clearance could increase space for the catenary system, improve accessibility to the top of the trains for inspection and servicing, allow for train-roof servicing platforms, accommodate bridge cranes, allow for toilet servicing equipment, or provide clearance for lights, water, 480V ground power, fans, and other systems. Minimum clearances at each point in Sunnyside Yard would need to be agreed upon with railroads.

For the purposes of this study, structural assessments have been based on a deck that is 24'-3" above top of rail in all areas. Associated support walls are 25' tall. Figure 3.34 shows the minimum clearances used for the feasibility study.

3. Touchdown Points

To determine the potential locations of touchdown points for support walls and columns, both existing conditions and future conditions based on information contained in the Amtrak Master Plan for Sunnyside Yard and information on the East Side Access project provided by MTACC were considered.

The most important factors dictating the location touchdown points for support walls and columns are:

- Areas of terra firma (open/undeveloped ground).
- Track spacing and train car clearance envelopes.
- Location of access roads and pathways.
- Location of existing bridges and tunnels.
- Location of buildings and substations.
- Clearances needed for Amtrak and LIRR service equipment.
- Property boundaries.

Structural design of support walls and columns is discussed in Section 2.7, and potential touchdown points are shown in Appendix A. The modification of existing utilities and traction power systems, as necessary to accommodate overbuild, has been assumed. Spacing of the touchdown points would be a driving factor in determining the building types that can be developed on the deck above.

The availability of touchdown points varies in each area of the Yard based on the factors outlined above.

LIRR Mid-Day Storage Yard

The future LIRR Mid-Day Storage Yard is currently a construction laydown area for the East Side Access Project. The following assumptions and challenges have been considered when evaluating future conditions:

- Track layouts for the LIRR Mid-Day Storage Yard would be as shown in the Amtrak Master Plan for Sunnyside Yard.
- Support walls can be placed between tracks where sufficient space exists for train clearances. In practice, some of this space may be required for vehicular access roads and utility troughs. This could limit the locations of touchdown points, which would increase deck span lengths beyond those currently considered. MTACC has not provided information on the detailed LIRR yard configuration and requirements, and the location of LIRR infrastructure is for the most part unknown.
- Areas near the edge of Sunnyside Yard present challenges for constructing a deck due to limited clearances between tracks and property lines where there is insufficient space for support walls.
- The Amtrak Ready Tracks, immediately adjacent to the Amtrak/MTA property boundary, would have alignments as shown in the Amtrak Master Plan. Amtrak has indicated that these planned alignments are likely to be adjusted, which could reduce space available for touchdown points.

Amtrak Storage Yard

Amtrak plans to completely realign and reconfigure the existing tracks throughout its storage track area, and to replace almost all the buildings. The Amtrak Master Plan has been developed with consideration of the possibility of future development over Sunnyside Yard. Amtrak's proposed track and roadway layout allows for 4'-0"–wide support walls or columns for overbuild to be placed on a grid matching the supports for Amtrak's proposed train shed.

The following assumptions have been made about future conditions:

- Support walls can be located within some future buildings and between storage tracks where minimum clearances permit. Amtrak has not advised as to whether continuous support walls within buildings or between storage tracks are permissible, or how many openings would be required.
- Some support columns can be placed within large paved areas intended for turning vehicles. No assessment of actual truck routes or turning radii has been performed.

Former Railway Express Area

The area north of the Main Line, bounded by the loop tracks and 39th Street, is currently used for miscellaneous materials storage, temporary offices and substations. Under Amtrak's Master Plan, new tracks, buildings, a Maintenance of Way facility, and substations would be constructed. Parts of the existing loop tracks would be modified by the East Side Access project. The following assumptions have been made about future conditions:

- Support walls can be located within future buildings and between storage tracks, where clearances permit.
- Limited support walls can be located within the future Maintenance of Way facility, following preliminary guidance provided by Amtrak's Master Plan team.
- Material storage and handling in the future Maintenance of Way area would use gantry cranes or other low-height methods that can be accommodated below a deck.

Skillman Strand

The strip of sloping unbuilt land between the loop tracks and Skillman Avenue, termed the Skillman Strand in this study, would get narrower in the future condition due to an additional loop track being constructed as part of the East Side Access project. This narrowing would limit the available space for touchdown point locations within this area.

Main Line

Many of the Main Line tracks will be realigned over the coming few years as part of the East Side Access project, and new track switches will be installed. Recently completed tunnels pass under the tracks and new cut-and-cover tunnel structures are under construction. These tracks and structures significantly limit opportunities for touchdown points along the Main Line. However, a limited number of potential column locations have been identified, and it has been assumed that the support walls can be located within future LIRR Sunnyside Station platforms.

4. Spans Between Support Points

The potential touchdown points, described above, generally dictate the spans of the overbuild structures. In areas of terra firma, a deck is generally not required and building columns/footings can be placed on an optimized grid. Some ramp structures are required on terra firma to allow access to the deck.

Appendix A shows where support walls could potentially be located. Spans between walls vary from less than 40' (in some parts of the Railway Express Agency Area) to more than 100' (along most of the Main Line). Spans between support walls were used to determine estimated costs.

E. Engineering Systems

The proposed overbuild is anticipated to include a structural deck with a road level situated between 25' and 40' above the surface level of Sunnyside Yard. Buildings, roadways and parks would be constructed on the deck. The types of buildings being considered for the development include the following:

- Residential towers, ranging from 15 to 69 stories.
- Office towers, ranging 18 to 44 stories.
- Low rise, Residential, Academic, Neighborhood Retail, Destination/ Neighborhood Retail or other support uses such as Parking and Community Facilities up to 60' (about five residential stories).

Residential buildings are assumed to have 10' floor-to floor heights with a 20' ground floor level. Commercial buildings are assumed to have a 15' floor-to-floor height with a 20' ground level. Schools are assumed to have a 15' floor-to-floor height.

1. Foundations

Structural loads from the platform and buildings would be carried by columns and support walls to foundations which would be below the track-bed or ground surface of Sunnyside Yard. Primary considerations for the selection of appropriate foundation types include ground conditions, magnitude and direction of loads, construction constraints, and cost.

The subsurface conditions beneath Sunnyside Yard are described in Section B-2.

Several types of foundations such as spread footings, driven piles, drilled shafts, and secant piles were considered for the feasibility study. Figure 3.30 summarizes the suitability of different foundation types for the overbuild development. Driven piles cannot be used on the east portion of the site due to the very dense compactness of the Glacial Till/Outwash Deposits, and the presence of cobbles and boulders within this stratum. Driven piles might be considered for the western portion of the site, however, drilled shafts can take much the higher loads required to support taller buildings.

To evaluate the feasibility of using drilled shafts, geotechnical analyses were performed to determine the allowable load capacity and size of drilled shafts suitable for supporting the platform and planned structures. Axial loads, horizontal loads and moments were estimated for the various types of structures being considered for the overbuild development. Based on the analyses, drilled shafts ranging from 48" to 72" in diameter, with the bottoms socketed into bedrock, could be used for the support of the platform and structures. The rock sockets would be 6" less in diameter than the drilled shafts and range from 5' to 15' in depth. For the analyses, the center-to-center spacing of the shafts are assumed to be 15', which is 2.5 to 3.75 times the shaft diameter. The closer the spacing of the shafts, the less efficient they become in resisting horizontal loads.

With the 15' spacing, one row of shafts could be used to support buildings up to 18 stories in height; the axial load per shaft would be on the order of 2,000 kips. For the buildings ranging from 19 to 43 stories in height, two rows of shafts are required, with the rows spaced 15' apart and the piles spaced at 15' centers in each row. For the tallest towers, such as residential buildings ranging from 44 to 69 stories, it is anticipated that three rows of drilled shaft foundations would be required below each support wall. The rows would be spaced 10' apart, with a 15' spacing in each row. The axial load per shaft is estimated to range from 3,000 kips to 6,000 kips with the higher loads requiring a deeper rock socket. Figure 3.31 shows the anticipated foundations for each typology, which are shown graphically in Appendix A. The double and triple rows are required to increase the rotational stiffness to reduce the sway of high rise buildings. This increases the cost of the foundations compared with equivalent height buildings constructed on terra firma. The requirements may vary based on exact floor-to-floor height based on use.

For conceptual planning, all shafts are assumed to be socketed into bedrock. Based on final development plans and additional geotechnical investigations, rock sockets may not be necessary for all shafts. Similarly, the need for a third row of footings for the tallest towers would need to be evaluated on a case by case basis, dependent on depth to rock, soil parameters at shallow depth, building height and stiffness, and other parameters.

For the evaluation of feasibility, all the shafts are considered to have a reinforcing steel cage from the top of the shaft to the bottom of the rock socket. For the conceptual analysis, the cross sectional area of the steel was assumed to be about 3% of the gross cross-sectional area of the shaft.

Reinforced concrete caps would be required to transfer loads to each group of shafts. The top of the caps would have to be deep enough to be covered in soil and ballast to avoid interference with tracks and utilities. (Figure 3.29)

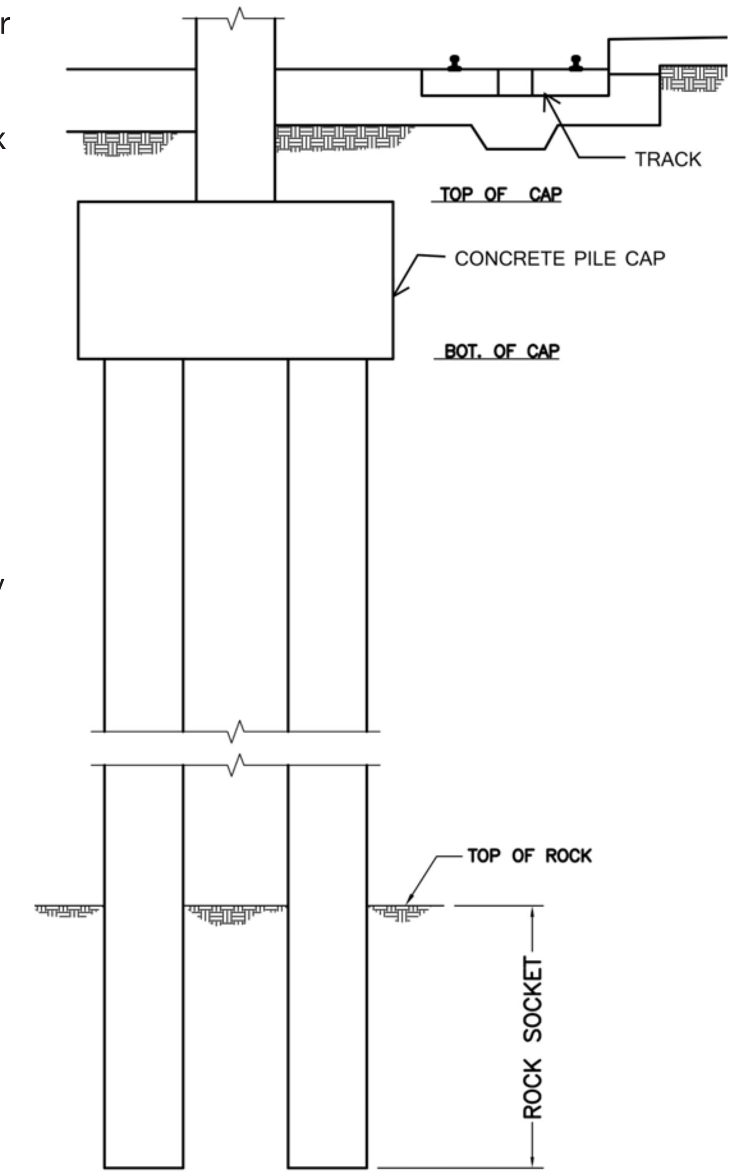


FIGURE 3.29: CONCRETE PILE CAP DETAIL

Foundation Type	Pros	Cons
Spread Footings ✗	• Cost effective if practical	• Low capacity • Sensitive to poor soil conditions. • Subject to settlement – risk of damage to structure • Lateral resistance is limited
Driven Piles ✗	• Less expensive than drilled shafts • Eliminate drill spoil	• Require large equipment • Vibrations and noise affect nearby structures & residents • Not suitable where cobbles and boulders are present within soil stratum • Not cost efficient for high loads
Drilled Shafts ✓	• Suitable for high axial and horizontal loads. • Suitable for large depth to bedrock and through soils with low stiffness	• Expensive • Difficult to install – requires large equipment • Require Special Inspections • Drill spoil
Secant Piles ✓	• Suitable for high axial and horizontal loads. • Suitable for large depth to bedrock and through soils with low stiffness • Suitable adjacent to active tracks	• Expensive • Difficult to install – requires large equipment • Require Special Inspections • Drill spoil

FIGURE 3.30: FOUNDATION TYPES FOR OVERBUILD

BUILDING TYPE		FOUNDATION TYPE				
			Drilled Shaft Size			
Typology	No. of Stories	Drilled Shaft Configuration	Diameter in Soil (in)	Diameter in Rock (in)	Length in Soil (ft)	Length in Rock (ft)
West						
Residential 1	15	1 row, 15 ft spacing	72	66	50	10
Residential 2 & 2.5	43	2 rows, 15 ft spacing	72	66	50	15
Residential 3	69	3 rows, 15 ft spacing	72	66	50	15
Office 1	18	1 row, 15 ft spacing	72	66	50	10
Office 2	33	2 rows, 15 ft spacing	72	66	50	10
Office 3	44	3 rows, 15 ft spacing	72	66	50	10
Road/Open Space Light 5-Story	5 (max)	Single shaft, 20 ft spacing	48	42	50	10
East						
Residential 1	15	1 row, 15 ft spacing	60	54	110	10
Residential 2 & 2.5	43	2 rows, 15 ft spacing	72	66	110	15
Residential 3	69	3 rows, 15 ft spacing	72	66	110	15
Office 1	18	1 row, 15 ft spacing	60	54	110	10
Office 2	33	2 rows, 15 ft spacing	60	54	110	10
Office 3	44	3 rows, 15 ft spacing	72	66	110	10
Road/Open Space Light 5-Story	5 (max)	Single shaft, 20 ft spacing	48	42	110	10

FIGURE 3.31: FOUNDATION TYPES PER BUILDING TYPOLOGY

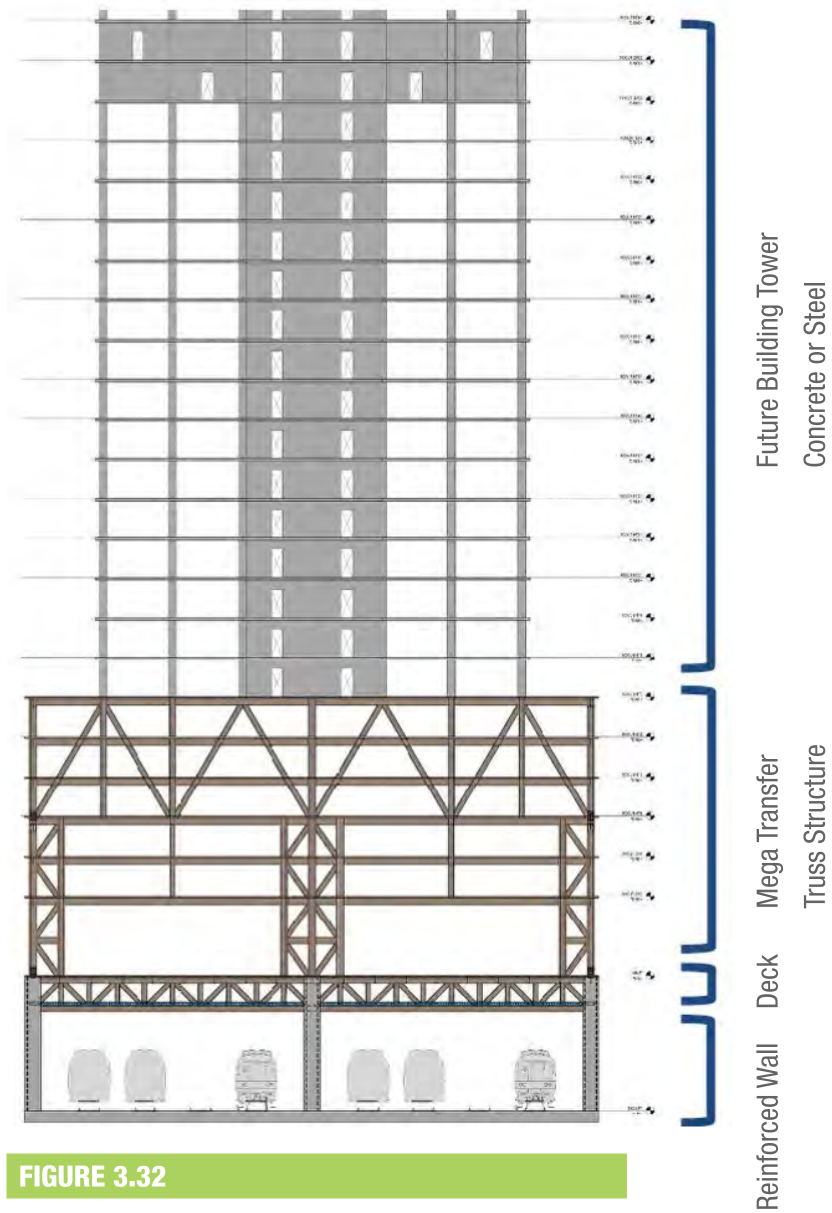


FIGURE 3.32

FIGURE 3.33 :SECANT PILES

Where the planned location of a foundation is severely constrained by tracks or other railroad infrastructure, a secant pile wall, consisting of overlapping drilled shafts, could be considered for support of low-rise or mid-rise buildings. Such support walls would not have the required rotational stiffness for high-rise towers. Secant pile walls have been used in Sunnyside Yard for the support of deep excavations for the East Side Access project. (Figure 3.33)

The estimated material quantities for the footings for different typologies and deck spans have been determined, and were used to develop cost estimates.

2. Support Walls and High-Rise Building Orientation

The support walls between tracks would serve two primary purposes: to transfer the vertical loads from the overbuild structures into the piled foundations, and to transfer horizontal loads (generated by wind and earthquakes) into the piled foundations. (Figure 3.32)

For vertical loads, relatively slender columns could be used. However, slender columns have minimal ability to transfer horizontal loads as they have insufficient flexural and shear capacity. On most railroad overbuild projects this condition is overcome by locating shear walls or X-frame cross-bracing parallel and perpendicular to tracks, where space permits. Such space may be adjacent to the railroad yard (such as at Hudson Yards-LIRR West Side Storage Yard). On other projects the tracks are in a cut, and horizontal loads can be carried above track level via a slab, and transferred directly into the surrounding ground (such as the Manhattan West development, immediately west of the Moynihan Building). At Sunnyside Yard's core yard most of the tracks are roughly parallel and are closely spaced. Space for shear walls perpendicular to the tracks is almost non-existent. To locate sufficient shear walls would require approximately one in eight storage tracks to be permanently removed, which is not feasible.

The technical solution proposed is to use continuous, or semi-continuous support walls with sufficient flexural and shear capacity to withstand horizontal loads. Tall buildings should be located such that the longer axis of the building footprint is perpendicular to tracks and should be sized/located such that horizontal loads are transferred to at least three support walls. This is advantageous because the maximum wind loads acting on the larger face of the building towers would be resisted by the walls' strong axis. Also, orienting the smaller wind exposure of a tower perpendicular to the tracks results in smaller forces acting in the direction of the walls' weaker axis, and enables the forces to be resisted by three walls, rather than two.

Figure 3.34 shows an example of how the column lines and structural considerations discussed in this report are being used to inform the layout of buildings. The towers are generally oriented perpendicular to tracks and straddle at least three lines of support walls.

The reinforced concrete support walls are composed of reinforced concrete with an embedded structural steel column every 10' or 20' on center, depending on structural demand. A typical elevation view and details are shown in Appendix A. The embedded steel sections add capacity and enable the support walls to be rigidly connected to deck trusses.

A wall thickness of 4'-0" was selected for use throughout Sunnyside Yard. The track alignments proposed by the Amtrak Master Plan accommodate structural supports up to and including this size between its main storage tracks. In other areas, spacing between tracks is less regular, but sufficient touchdown points for 4'-0" walls have been identified. In future design phases, supports can be designed using a variety of wall thickness, tailored to the specific characteristics of each touchdown point.

The stresses on the walls is a function of deck span and height of towers above. Higher stresses result in the need for more columns or intermittent support walls. The highest stresses require continuous support walls. Heavier structures also require more reinforcing steel within the columns and support walls. The reinforced concrete wall can have intermittent penetrations for required services. A concrete with very high compressive

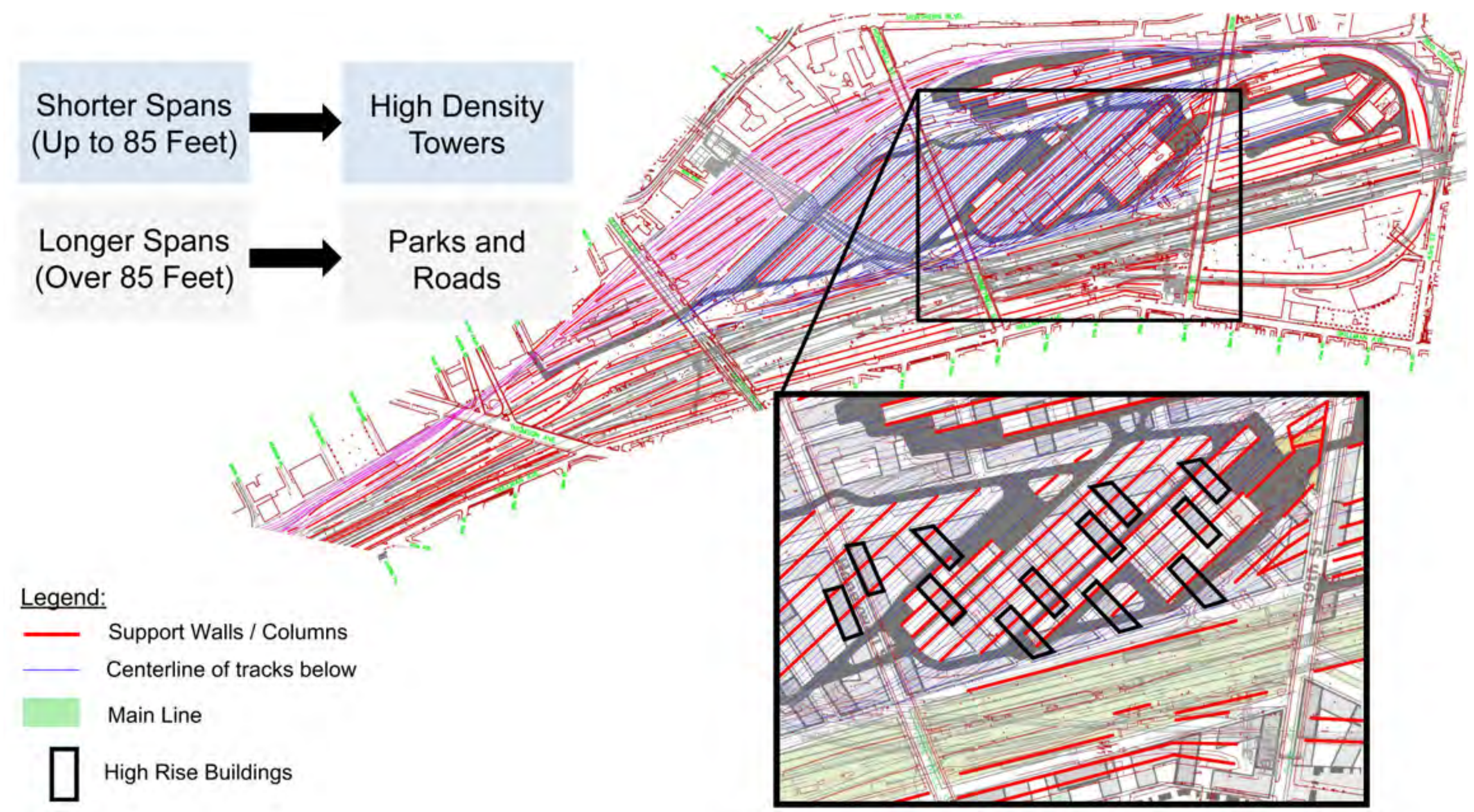


FIGURE 3.34: POTENTIAL COLUMN LINES AND INFORMING ILLUSTRATIVE OVERBUILD LAYOUT

strength of f'c=10,000 psi has been assumed. The design criteria used for the feasibility level analysis of the structural systems are presented in Appendix D. The estimated quantities of steel sections, reinforcement and concrete in the support walls/columns, deck and trusses determined through those analyses are also presented in Appendix D.

The acceptability and location of continuous support walls would need to be coordinated and approved by the railroad agencies as door or pass-through openings may be required for personnel or equipment. In general, the tallest overbuild structures have not been located above the railroad buildings so that support walls can have sufficient openings to permit railroad operations.

Using walls rather than columns is beneficial for impact protection in the event of a train derailment. The walls have not been analyzed as crash walls for this study, and the impact resistance would need to be determined with the railroads. The railroads may accept lower impact loads for trains in some parts of Sunnyside Yard, where they operate at slower speeds, and higher impact loads for walls adjacent to the Main Line tracks.

3. Structural Deck

Two alternative structural systems are commonly used for decks: a strengthened precast concrete beam system and a steel truss system. For the purposes of the feasibility study, the steel truss option was considered optimal and was used for a cost analysis. The main consideration was the difficulty of handling large, heavy, precast concrete members within the confines of Sunnyside Yard. Steel trusses are lighter than the equivalent concrete sections, potentially enabling longer crane pick radii or larger sections to be installed at once. Additionally, deep trusses have a greater stiffness over the long spans above Sunnyside Yard. The steel truss system also provides a better interface with the steel Mega Truss Transfer System that is required for the tower overbuild. Appendix A and Figure 3.35 show a typical proposed steel deck truss. Steel sections can generally be cut and spliced if member weight or size is constrained.

Concrete beams would likely require less depth, which could be useful near the edge of Sunnyside Yard where a lower top of deck promotes better connectivity to the surrounding neighborhoods. For example, the section of loop tracks between 39th Street and 43rd Street has three tracks, and could be spanned using concrete beams approximately 60' long. Access from each side of the loop tracks is better than elsewhere in Sunnyside Yard, which could make this option viable. A concrete deck beam option is shown in Appendix A. Future designs should consider whether a precast concrete deck is optimal in certain locations.

The depth of the steel deck truss is anticipated to vary from 9' for shorter spans to 16' for spans greater than 150'. At the top chord of the truss, future grade level for the overbuild development would be achieved by using a composite system of fluted metal deck and concrete topping. At the bottom chord of the trusses, a construction platform would be constructed using hollow core plank spanning between trusses. The space between the top and bottom chords, between the deck and platform, would serve as a future space for utilities, and potentially also serve other functions such as emergency egress corridors.

The loads considered on the steel truss deck system include a standard four-to-five-story Residential building of block and plank construction, a four-to-five-story Commercial building of steel construction, or 3' of soil plus 300 pounds per square foot (psf) of live load representing park/roadway loads. The structure of the deck has been analyzed at various spans to support these vertical loads while resisting the lateral loads from the overbuild development. The design information is presented in Table A-1 in Appendix D. The Steel Premium column in the table represents the total steel tonnage of the deck truss including chord and diagonal members. As summarized in the table, the steel tonnage, the required depth of truss, as well as the stiffness of the reinforced concrete walls/columns, increase as the length of the deck span increases.

As deck spans get longer the cost of providing structural supports for buildings becomes exponentially more expensive. To optimize the efficient use of the deck, the proposed layout of the overbuild development would generally locate major roads and open spaces on spans exceeding 115' where buildings would be infeasible or too costly.

The deck trusses would need to be protected with fireproofing. The hollow-core planks would also need to be fire-rated.

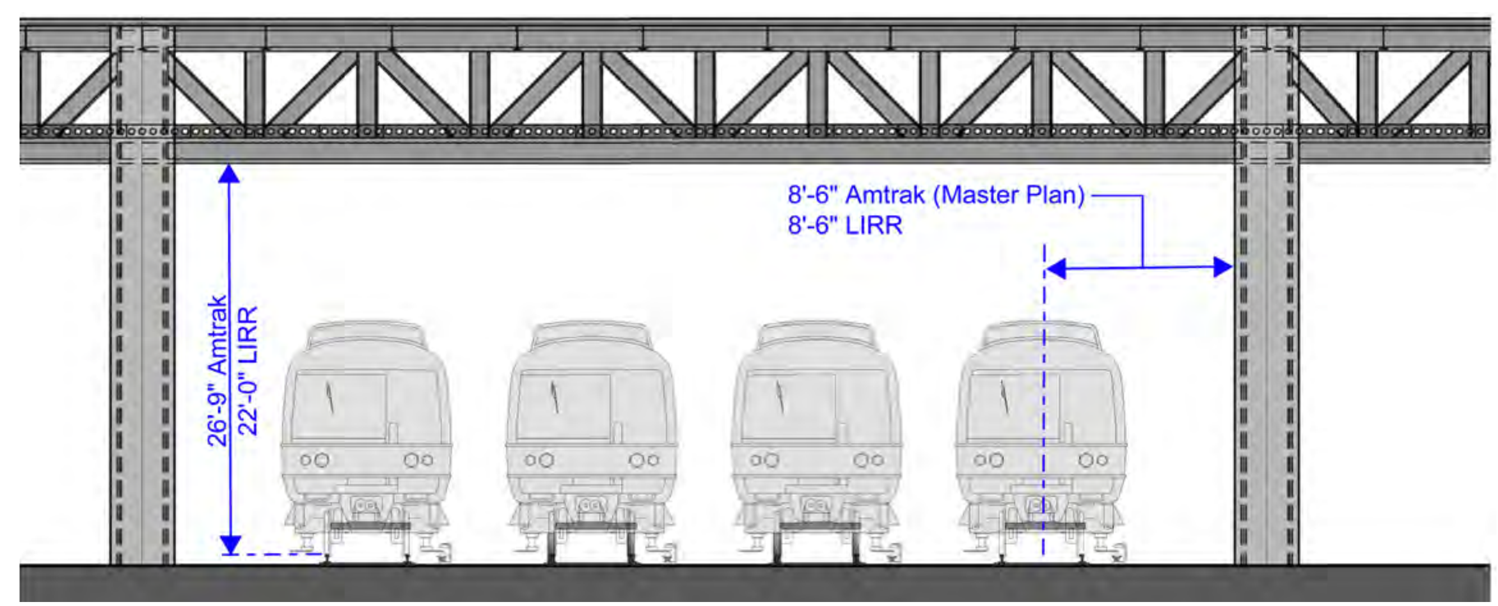


FIGURE 3.35: TYPICAL PROPOSED STEEL DECK TRUSS

4. Mega Transfer Truss and Building Typologies

The deck alone does not have the capacity to support buildings having more than four or five stories (60'). Taller towers require a mega transfer truss to support the weight of the tower, and to transfer it to at least three concrete support walls. (Figure 3.36)

The mega transfer truss system comprises three dimensional steel trusses that transfer vertical and horizontal loads to supports. It also accommodates the podium "skirt" around the base of the towers. The mega transfer truss is fabricated from heavy structural steel members with robust bolted or welded connections.

Mega transfer trusses, or a structural equivalent, would be required throughout Sunnyside Yard to support towers in areas with spans between supports varying from 30' to over 80'. In order to estimate the material quantities and cost of the mega transfer truss system, one 3-D analysis and numerous 2-D analysis were performed for various combinations of tower weight and support span. A 70'-0" deck span was analyzed in greater detail for various building typologies to determine additional material quantities required for overbuild of a tower. This span was based on the regularity of Amtrak's proposed storage tracks in the core of Sunnyside Yard.

The forces in the mega transfer members are unusually high for high-rise structures. This would require heavy specially fabricated members with high capacity connections, similar to those used on the Hudson Yards Project. (Figure 3.37) The overall weight of steel within the truss would be high. The additional amounts of steel in comparison to a building built on terra firma (deck plus mega transfer truss) for various building typologies applicable for a 70' span are shown in Appendix D.

The unit cost (dollars per pound of steel) would be high due to the specialized nature of the work. The combined large weight of the mega transfer truss and high unit cost results in the truss being a key cost driver for the overbuild development. Therefore locating towers to minimize the cost of the mega transfer structures is critical. In general, locating towers where support spans are shortest would be more cost effective. Locating high rise towers on the largest spans in Sunnyside Yard was determined to be technically challenging and the cost of the steelwork would render it infeasible.

Figure 3.38 illustrates the principle that taller structures require a deeper truss, even with shorter truss spans. The exponential increase in truss depth with increasing span (indicated by the boundary between the colors) also implies a rapid increase in cost. Therefore, tall towers are more suitable on terra firma and areas with

Building Analysis		
Building Typology	**Levels**	**Construction**
Platform with Open Space / Roads	N/A	Metal Deck on Steel Truss or Pre-Cast Concrete
Platform with 4 Story Building	4 Floors / 60'	Block and Plank
Platform with 4 Story Building	4 Floors / 60'	Steel
Residential-1	15 Floors / 160'	Block And Plank Tower with Steel Transfer Podium
Residential-2	43 Floors / 440'	Reinforced Concrete Tower with Steel Transfer Podium
Residential-2.5	55 Floors / 560'	Reinforced Concrete Tower with Steel Transfer Podium
Residential-3	69 Floors / 700'	Reinforced Concrete Tower with Steel Transfer Podium
Office-1 (Large floorplate "loft" office)	18 Floors/ 260'	Steel Tower with Steel Transfer Podium
Office-2	33 Floors / 475'	Steel Tower with Steel Transfer Podium
Office-3	44 Floors / 600'	Steel Tower with Steel Transfer Podium

FIGURE 3.36: CONSTRUCTION TYPOLOGY MATRIX

FIGURE 3.37: HIGH CAPACITY STEEL CONNECTIONS

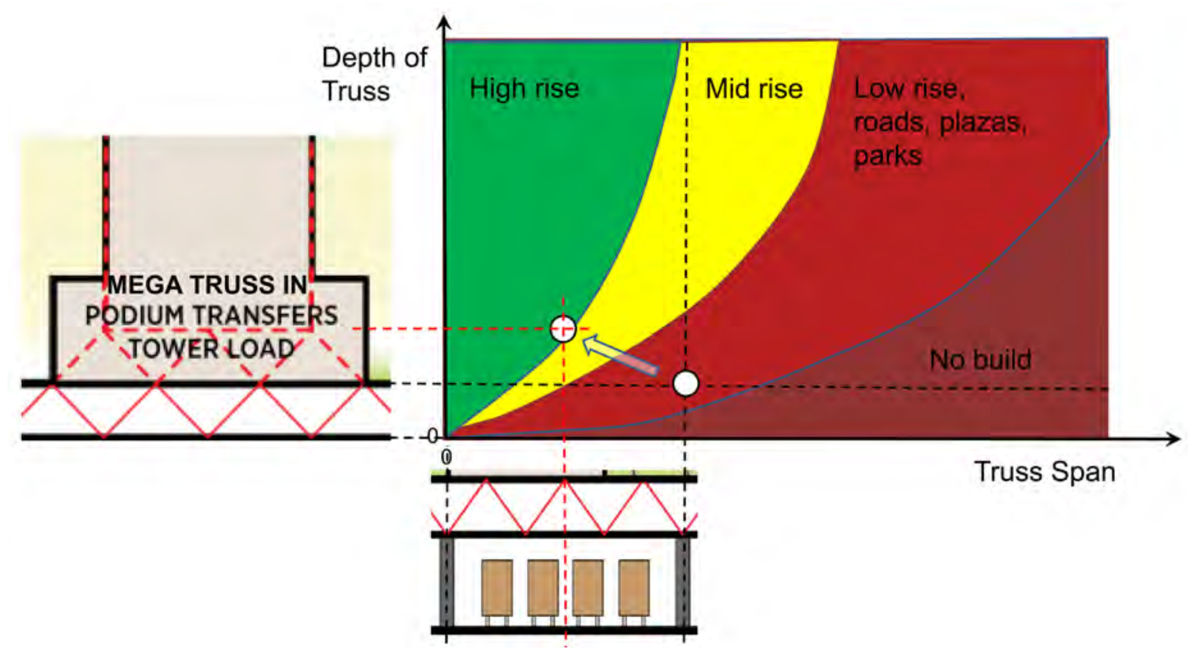


FIGURE 3.38: SPAN TO BUILDING HEIGHT RELATIONSHIP

spans shorter than 55’. Low-rise and open space development is well suited to areas with longer spans.

Overbuild Structures

The towers above a mega transfer truss will be generally structurally equivalent to those on a terra firma site. These towers are likely to have only minor atypical designs to accommodate the unusual nature of the site and these differences are not expected to significantly impact cost. This report focuses on the support structures for the towers, rather than the structure for the towers themselves. Towers may require some additional raking members above the truss to help distribute loads, and to stiffen the tower. Dampers may also be required, as discussed below.

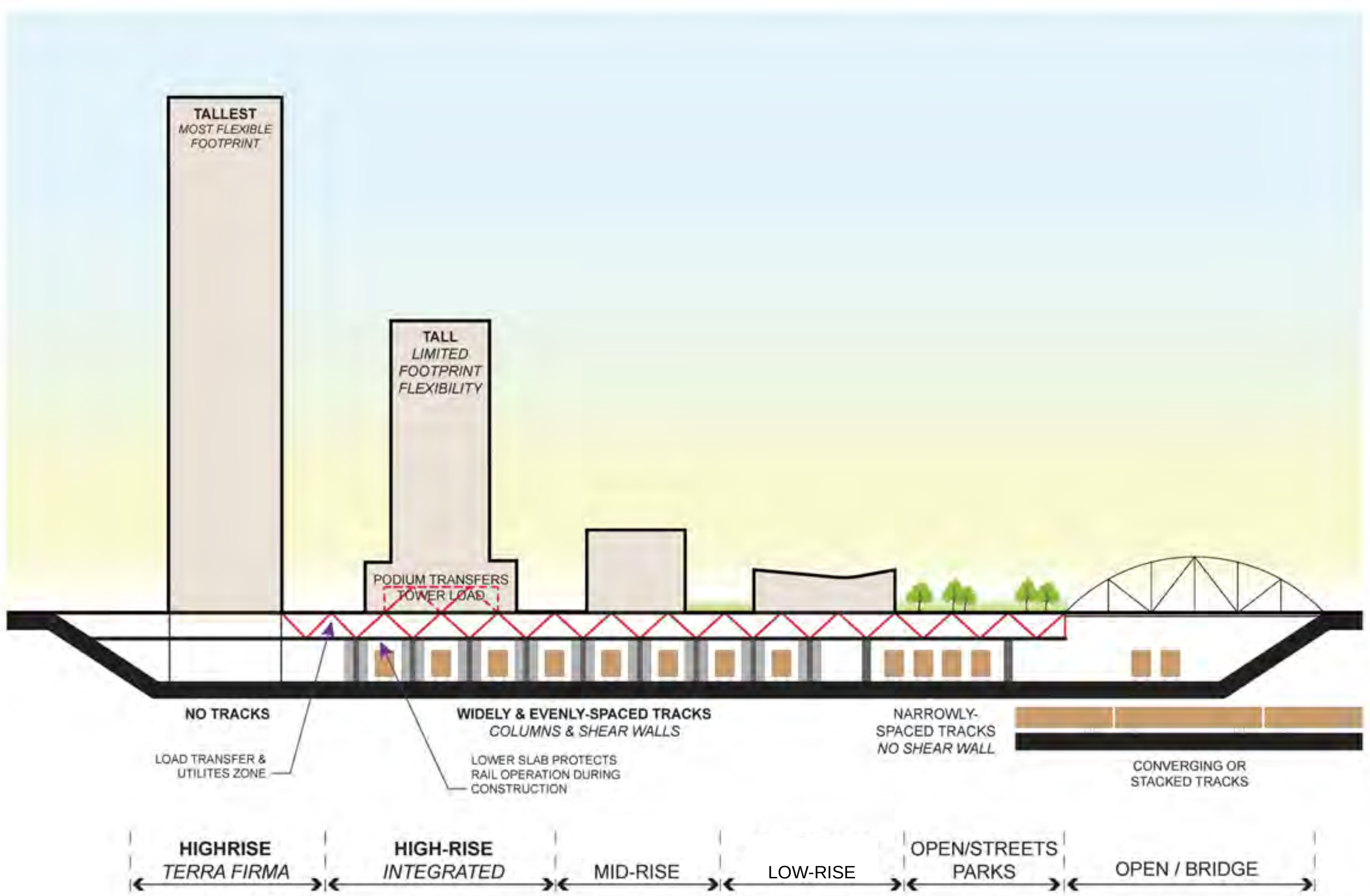


FIGURE 3.39: SCHEMATIC REPRSENTATION OF OVERBUILD

Figure 3.39 shows a schematic representation of overbuild, in section. As spans increase from zero (terra firma, left) to long spans (rail interlockings, right) the height of structures that can be economically supported reduces. The limits shown should not be considered absolute, but for larger spans costs would increase exponentially. Based on the analyses in previous sections, certain building typologies are only feasible on spans up to a specific length, as follows:

Light Residential and Commercial

Low-rise buildings are generally anticipated to be block-and-plank Residential construction, or large floor plate structures. Low-rise buildings of up to five-stories can be located on deck spans of up to 150’ with no mega transfer truss required. Longer spans (up to 200’) can technically be achieved, at a cost premium. Open space and roads follow the same span-length criteria as low-rise buildings.

Low-Rise Buildings

Residential buildings up to 14 stories and commercial building up to 17 stories can be supported on spans of up to 145’. Each building will require a mega transfer truss system oriented perpendicular to support walls.

Mid-Rise Buildings

Residential and commercial buildings up to 43 and 33 stories respectively can be supported on spans up to 115’. Each building will require a mega transfer truss system oriented perpendicular to support walls.

High-Rise Buildings

High-rise buildings have been studied up to 69 stories for Residential, and 44 stories for Commercial. Residential towers are anticipated to have a concrete core; Office towers are anticipated to use steel. Figure 3.40 shows a rendering of a potential Office tower. High rise towers can be supported on spans of up to 85’. The towers will require a mega transfer truss system oriented perpendicular to the support walls.

5. Tuned Slosh Damper / Tuned Mass Damper

Estimated wind and seismic loads, based on previous experience with similar structures, were used to determine the total base shear and overturning moment for each tower typology. The effect of the foundation stiffness on the towers was also considered. If a building does not have adequate lateral stiffness, building accelerations and occupant comfort can become an issue. In order to mitigate the effects of excessive acceleration and displacements, supplemental dampers such as tuned slosh dampers or tuned mass dampers are used in tall buildings.

Tuned slosh dampers are typically large tanks partially filled with liquid designed to reduce the accelerations of a building. Tuned mass dampers are large masses of steel or concrete strategically placed in a building also designed to reduce the accelerations of a building. The need for a supplemental damping system is typically

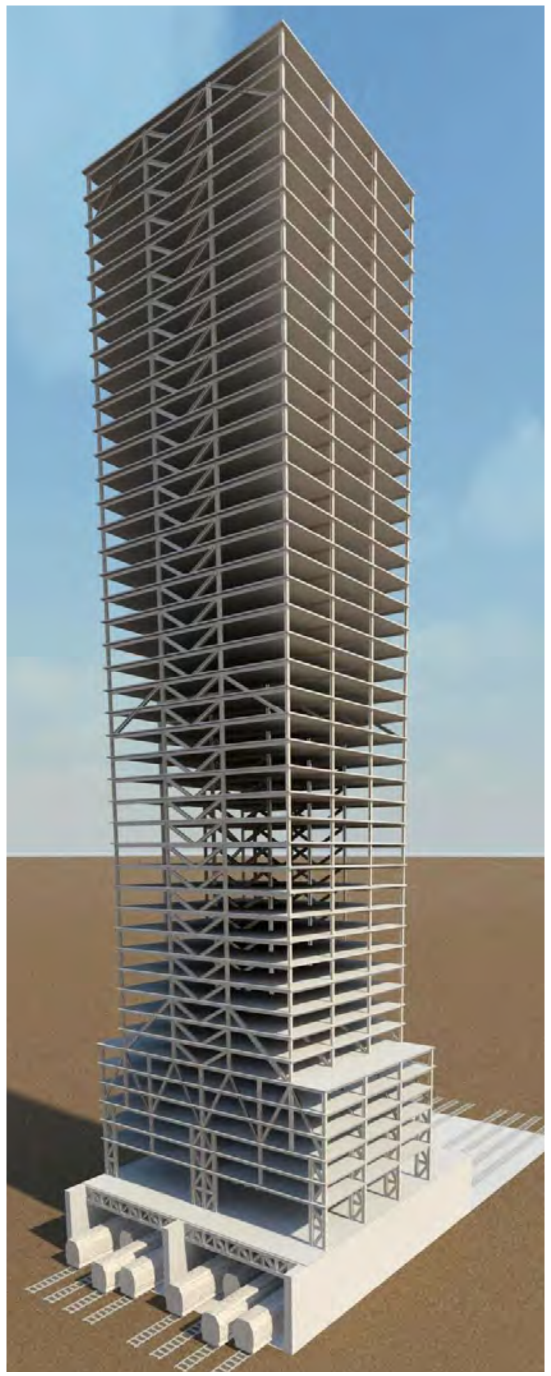


FIGURE 3.40: POTENTIAL OFFICE TOWER

assessed during the design process through wind tunnel analysis. Due to the loss of building's lateral stiffness resulting from the overbuild conditions, the likelihood for supplemental damping system for the various building typologies are presented in Appendix D.

6. Railroad Buildings

There are numerous existing railroad buildings throughout Sunnyside Yard. Many of these would be demolished and replaced under plans being advanced by Amtrak and MTA. The largest structure that is not currently slated for removal is the Amtrak frequency converter (near the Main Line bridge over the loop tracks). Since this building is located outside the active railyard, it would be feasible to construct the support walls outside the footprint and deck over it.

The Amtrak Master Plan for Sunnyside Yard proposes several new buildings. (Section C this chapter; Appendix A)

The proposed buildings have multiple stories, and some would likely project above the deck elevation. To accommodate this, the overbuild would need to be modified to enable the planned upper-story functions - typically offices, support facilities, control centers or storage - to be located within the buildings. The design development and construction schedule of facilities that are integrated with overbuild towers would require close coordination between planners, designers, schedulers, developers and railroads.

As discussed elsewhere in this report, the use of support walls between tracks within buildings, as well as wall openings, vertical clearances, and other considerations, would need to be agreed to with the railroads.

F. Constructability

1. Construction in an Active Railroad Yard

Any construction within Sunnyside Yard or surrounding areas would have an impact on train operations. The construction challenge is to minimize that impact and maintain train service while maximizing the efficiency of overbuild construction. As discussed in Section C1, most of Amtrak's property will be reconstructed per the Amtrak Master Plan for Sunnyside Yard; and portions of MTA's yards, such as the Mid-Day Storage Yard, will also be rebuilt. The overbuild constructability would be impacted by the development year, schedule, construction means and methods and the actual progress of various proposed projects. Appendix B includes color coded graphics to show the anticipated ease or difficulty of undertaking construction in different parts of Sunnyside Yard in the years 2016, 2020 and 2030. It also shows that as time passes, construction becomes more difficult due to increased train movements, which results in fewer available track outages. Additionally, new railroad infrastructure installed ahead of overbuild construction may need to be removed to make way for overbuild foundations, and subsequently replaced. This feasibility study generally assumes that overbuild construction would be performed at an optimal time, in a coordinated manner with the railroad construction projects described earlier in this chapter. The constructability of the future overbuild would be influenced by numerous factors, including the following:

- Train movements
- Availability of track outages
- Catenary (overhead traction power system) wires and supports
- Signal power towers and other overhead wires
- Availability of railroad personnel for de-energizing/re-energizing the catenary system, flag support, and other force account functions
- Protection of adjacent tracks/structures
- Crane size, location, pick radii, pick weights
- Protection/relocation of utilities
- Availability of laydown areas
- Access to construction sites
- Topology/sloping ground
- Contaminated ground/groundwater and hazardous materials
- Other construction in or adjacent to Sunnyside Yard

Staged construction in Sunnyside Yard will need careful planning and comprehensive working agreements between the developer of the overbuild and railroads. Working methods and schedules would need to be well coordinated to minimize disruption to railroad operations, to minimize the construction schedule, and to reduce overall cost.

The staged construction of the overbuild is analogous to two similar, but smaller, projects currently underway with the LIRR; the Hudson Yards project, which is building over the LIRR's West Side Storage Yard, and the Atlantic Yards Project, which is building over the LIRR's Vanderbilt Yard adjacent to the Barclay's Arena in Brooklyn, where agreements staged construction in conjunction with the operational needs of LIRR. It is anticipated that a comparable agreement would have to be reached with Amtrak, NJT and LIRR for development at Sunnyside Yard.

In the case of Atlantic Yards, agreement was reached with the LIRR that in all phases of construction the number of tracks taken out of service would be limited. There, the LIRR required that a certain number of tracks had to remain in service at all times. Once that agreement was reached, the LIRR's service plan was modified to account for a reduced number of trains that would operate to Atlantic Yards. Trains that were displaced were relocated to another storage yard. This movement required additional funds to account not only for the removal of the trains but also for the relocation of employees normally assigned to service the trains.

Once such an agreement is put in place, the Construction Management Team would coordinate with Amtrak and LIRR Project Management, Capital Program and Transportation personnel, as to the number of tracks that would be removed at one time. A work zone would then be designated encompassing those tracks. It is projected that Amtrak or LIRR Force Account personnel would be used for the physical removal of any active railroad facilities such as tracks, signals, catenary and utilities. The cost of this work is assumed to be included in the Amtrak Master Plan estimate, and is therefore excluded from the overbuild cost, except in areas outside the boundary of the Amtrak Master Plan.

The availability of track outages would have a significant impact on construction schedule, which in turn has a significant impact on cost. It is currently understood that, under their own Master Plan, Amtrak plans to remove and replace five tracks at a time within the storage yard. The five-track outage was assumed for the constructability study and cost estimate. If an arrangement to remove ten tracks, or more, at a time without significantly impacting railroad operations could be identified, it would have substantial benefits for construction efficiency, schedule reduction and cost reduction. This could potentially be achieved by identifying off-site storage locations in New Jersey, Connecticut, or elsewhere in New York State.

Main Line operations preclude large work zones from being established within the track area due to the need to maintain active tracks for train movements. This would limit the ability to place foundations within these areas.

The high volume of traffic along the Main Line typically limits weekday daytime track outages to one track at a time, and certain tracks cannot generally be taken out of service. While there may be instances where additional track outages are possible, production levels would be greater during the overnight periods or 55-hour weekend periods.

The loop tracks are also in near-constant use, with limited opportunities for track outages. The outer loop (Loop A) is typically less critical to Yard operations than the inner loops (Loops 1 and 2). (Figure 3.41)

It is anticipated that most materials would be delivered by truck, to areas surrounding and within Sunnyside Yard. Delivery by rail may be possible but is unlikely to be cost competitive. There is no freight service operated into or out of Pennsylvania Station, or between Harold Interlocking and Jamaica on the LIRR's Main Line. Also, there is no longer direct rail access from the LIRR Montauk Branch. If materials were shipped by rail, the operating windows would be severely limited by passenger train operations. Should material be shipped from east of Sunnyside Yard via the LIRR, it would have to be routed in a way so as to not block access to one of the four East River tunnels while positioning the train for movement into Sunnyside. Due to the weight and height restriction, rail operating windows and permitting processes, material delivery via rail was not used for the Hudson Yards or East Side Access projects.

Additional storage space could potentially be achieved within Sunnyside Yard by temporarily relocating certain functions off-site. This could include commissary, stores, offices, and materials storage, but this would need coordination and agreement with the railroads. However, initial feedback from Amtrak is that cost and efficiency impacts could be significant if storage efficiencies could be achieved. For later parts of the overbuild development, temporary materials storage may be possible on completed sections of the deck.

FIGURE 3.41: LOOP TRACKS

2. Foundations

Access for shaft drill rigs and other equipment would be difficult in many parts of Sunnyside Yard, primarily due to active tracks, overhead wires, and topography. On other similar projects, such as East Side Access or Atlantic Yards, many shafts were excavated by hand to avoid the access constraints and overhead clearance issues that arise with large drill shaft rigs. This would not be possible for deep-drilled shafts extending below the water table.

Low-headroom piling rigs would be useful for working adjacent to catenary and other aerial cables. Such rigs have been used in Sunnyside Yard on the East Side Access project. (Figure 3.42) However, the large diameter of the drilled shafts and the significant depth to bedrock (which varies by location) would generally require full-sized rigs. Construction of large pile caps for high-rise towers would require taking multiple tracks out of service due to their large footprints. The foundations would need to be completed before any track re-construction, as the pile caps are located beneath the track bed. To reduce the width of the excavation and impact on railroad operations, support of excavation systems such as sheet piles would be necessary. As a result, a premium constructability rate for foundations is applicable in most areas.

Another factor influencing constructability is that excavation and dewatering activities can result in soil settlement around existing tracks, structures, and other railroad infrastructure. A geotechnical and structural instrumentation and monitoring program should be prepared for monitoring the impacts of the overbuild construction on the existing structures and facilities. In addition, coordination of underground utilities such as water, sewer, power and communication would need to be done to identify locations to implement required utility relocations.

3. Support Walls and Columns

Support walls and columns can be constructed using standard means and methods for reinforced concrete support walls. Impact on adjacent areas can be minimized by using internally-tied formwork, rather than externally braced forms. (Figure 3.43)

Using steel sections in the support walls would reduce the weight and size of reinforcement cages that have to be tied and handled in Sunnyside Yard. Space for lying down and pre-tying cages would be limited, and it would be important to minimize tying of cages within the railroad yard to reduce the number of personnel and associated flagging and force account costs. The biggest challenge for the support walls would be to accommodate the existing and future catenary systems. The constructability challenges of the catenary system are described in Section B1 of this chapter.

FIGURE 3.42: LOW HEADROOM PILING RIGS

FIGURE 3.43: INTERNALLY TIED FORMWORK

FIGURE 3.44 SIGNAL BRIDGE INSTALLATION

4. Structural Deck

Span lengths for the deck would vary from 30’ to as much as 200’. The larger span trusses would be heavy, and typically would cross multiple tracks. Installing deck over the Main Line tracks and other critical tracks would be a constructability challenge, requiring multiple tracks out of service, large cranes and significant advance planning. Figure 3.44 shows a signal bridge installation over the Main Line. Deck trusses would be even larger and heavier, requiring larger cranes.

At a minimum, the tracks below the swing radius of the crane would need to be out of operation during the pick and placement. Adjacent tracks may also need to be out of service, depending on crane placement, and the potential for the crane boom to fall on adjacent tracks. In most of the development zones, such work would have to be performed only during night and weekend shifts.

A potential option to reduce risk, and the length of track outages, could be to incrementally launch the deck from previously constructed sections, rather than exclusively using cranes. This would not be possible in all areas, but could potentially be used in areas with regular support walls, such as above the main Amtrak storage tracks. In such a system, deck trusses would slide along the support walls to the desired location, each being launched from an easily accessible point such as a bridge. Alternatively, erection gantries could be used, similar to construction of post-tensioned bridge decks. These, and other alternatives, could be reviewed on a case-by-case basis during detailed design.

Completed areas of deck could be used as temporary staging areas for equipment and materials, for rigging and scaffolding, and potentially for some cranes. The existing catenary system of poles and wires would conflict with deck installation in many parts of Sunnyside Yard, as discussed in Section A. A well planned strategy for the construction means and methods could reduce the operational impacts to the railroad, shorten the construction schedule and reduce costs.

5. Mega Transfer Truss

By the point at which a mega transfer truss system is installed, it is anticipated that the deck would be providing some protection for the tracks. Three principal options arise for installation of the mega transfer trusses:

- Install the trusses in large sections, using high capacity cranes. The combined weight of the cranes and truss sections would likely be too heavy to be supported by the deck, requiring cranes to be located at track level. Deck trusses and overlying mega transfer trusses would be installed consecutively. The deck would not have sufficient capacity to protect the tracks from any falling mega transfer sections, so the work would need to be performed during night and weekend shifts.
- Install trusses in small sections, using smaller cranes. The cranes could be located at deck level and truss members could potentially be installed above a completed deck while tracks below are operational, subject to railroad approval. An area of deck could be completed ahead of installing the mega transfer structures, which allows great flexibility in scheduling activities and construction phasing.
- Install a combination of large truss sections in areas less affected by the railroad and small truss sections in areas with significant railroad operational constraints. Storing mega truss members on site would be difficult due to the limited space for laydown/staging areas.

G. Railroad Systems

1. Catenary (Overhead Traction Power System)

The Amtrak Master Plan for Sunnyside Yard proposes a complete replacement of the existing catenary system, with a new system suspended from a roof canopy. For an overbuild development, a new catenary system would likely be mounted directly to the underside of the deck. (Figure 3.45)

Amtrak Storage Tracks

The Master Plan replaces groups of five existing tracks with groups of four new tracks. Removal and reconstruction of Sunnyside Yard is planned

FIGURE 3.45: CATENARY MOUNTED UNDER DECK

incrementally, one track group at a time. This removal and reconstruction plan also applies to the catenary system, and will involve installing and energizing the new catenary system incrementally, while the existing system is being de-energized and removed. The existing system is approximately 100-years old, is not fully sectionalized (making it difficult to electrically isolate groups of tracks) and is difficult to modify. The significant height of the existing system also imposes physical constraints on the new construction. If left in place during construction (e.g., by leaving slots in support walls and gaps in the deck) it would restrict crane swings and would impact the ability to progressively construct the deck from one side of Sunnyside Yard to the other, using previous areas for access and laydown. These constraints also apply to construction of the canopy shown in the Amtrak Master Plan.

At the east end of Sunnyside Yard the loop tracks diverge into storage tracks, and at the west end of Sunnyside Yard they merge into Pennsylvania Station Lead tracks. These interlockings have complicated catenary systems that are not well suited to piecemeal modification.

Options for future considerations to improve constructability would need to be discussed extensively with Amtrak, but potentially include:

- The existing system could be removed incrementally from one side of Sunnyside Yard to the other. Removing the end support pole from a series would introduce unbalanced forces at the next existing pole, requiring new down guys (tension cables that are anchored in the ground) to be installed. This may or may not be possible, depending on the capacity and condition of the existing poles, which is generally poor. Such down guys would land in the construction zone and would impact constructability.
- Temporary catenary support frames could be installed throughout Sunnyside Yard to enable the catenary system to be adjusted as required to accommodate shifting construction zones. The frames would be installed across all the storage tracks with the existing system still functioning. They would be located above the existing catenary/contact wires that run along each track. The existing catenary/contact wires could then be transferred to the frames. This would enable the existing tall poles and high-level wires to be removed. During deck construction, groups of contact wires (and any temporary frames) could be removed and new contact wires installed above the new track centerlines, suspended from the deck.
- Large sections of the catenary system could potentially be removed if self-propelled (e.g. diesel) locomotives were used to relocate electric trains from tracks with catenary to those temporarily without catenary. To offset any loss in yard efficiency it may be possible to install additional non-electrified storage tracks. If off-site train storage locations could be identified this could also allow larger numbers of tracks/catenary to be removed. Maximizing the number of yard tracks that can be taken out of service concurrently is key to increasing construction efficiency and reducing the cost of the overbuild.

Main Line Tracks

Catenary poles along the Main Line extend up to 45' above the top of rail. Constructing a deck, as described, above the existing catenary system would make connectivity to surrounding deck and bridges extremely challenging, and the height of the support walls would make it infeasible to support tall buildings.

Constructing a lower deck would require replacement of the catenary system. As with any work on the Main Line, catenary replacement work would be constrained by the need to maintain Main Line operations and consequential limitation on track outages.

Potentially, sections of deck could be constructed between the existing poles/portals, and then the catenary/contact wire could be re-supported from the new deck. The old catenary would then be removed and the deck completed. Various intermediate catenary modifications and additional temporary supports may be required. It should be feasible in limited areas, but decking the whole of the Main Line while concurrently reconfiguring the catenary system would take many years given the limitations on track outages.

Loop Tracks

To accommodate overbuild, the existing loop track catenary system would need to be replaced. Although similar to the Main Line catenary, it is more feasible to replace given that there are fewer tracks (typically three, compared with seven) with fewer switches. Nevertheless, the tracks are heavily used, and the work would need to be performed during night or weekend outages.

Catenary could be moved onto new low-height portal frame structures prior to placing the deck, similar to the methods described above for the storage tracks.

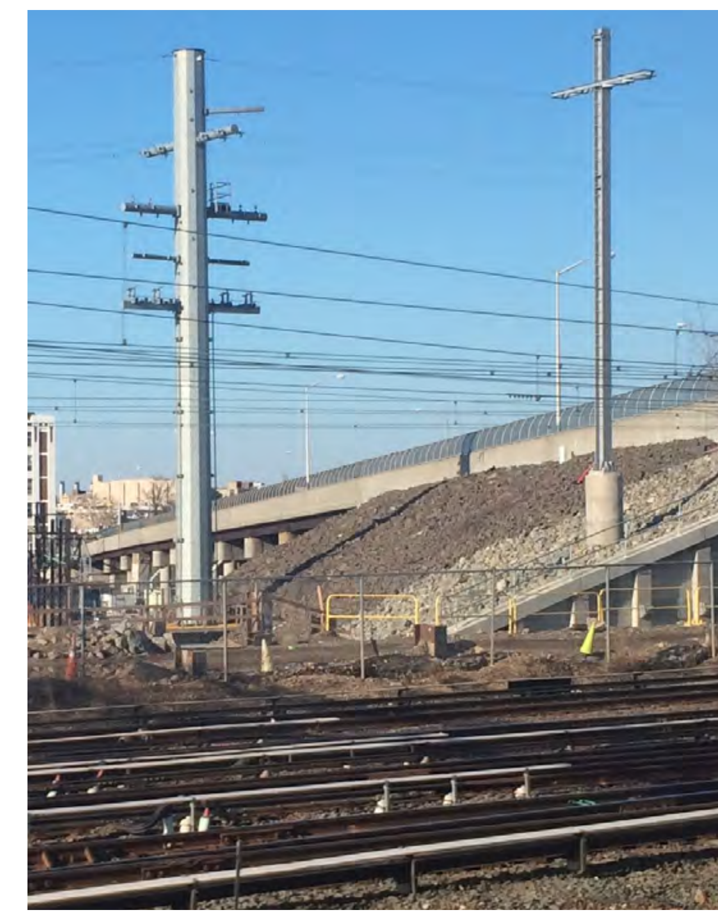


FIGURE 3.46: SIGNAL POWER TOWER

2. Signal Systems

Signal Power Towers

The Signal Power Towers and associated power cables were installed by the East Side Access project and are a key system for Harold Interlocking. The towers are up to 88' high, which is higher than any feasible deck. (Figure 3.46)

The track alignments shown in the Amtrak Master Plan would require relocation of some of the towers to make way for new tracks. Additional towers would need to be relocated to achieve full overbuild coverage of Sunnyside Yard. If the Main Line tracks were not decked over, it is possible that most of the towers could remain. However, they would still be a visual nuisance for any adjacent overbuild development.

If Sunnyside Yard is to be fully decked, the cables could be placed into a new micro-tunnel that would be constructed from 43rd Street to Hunters Point Avenue, with additional connections at various locations along Harold Interlocking. The technical challenges of this would be considerable given the existing tunnels below the Main Line, the bouldery ground, the sensitive infrastructure above the tunnel, and the special requirements for high-voltages cables (heat generation/dissipation, electromagnetic frequency interferences, maintenance access between high voltage lines and other electronic devices, cable pulling, waterproofing, etc.). These would need to be investigated and discussed with the railroads.

Signal Heads

Only minor modifications, if any, are anticipated to the track layout in Sunnyside Yard to accommodate an overbuild development. As such, no fundamental changes to the signal system are anticipated. Localized relocation of signal troughs and cables may be required to accommodate footing locations. In the storage yard, dwarf signals (smaller profile signals used in low speed or restricted clearance areas) are currently used. However, the Main Line and loop tracks use signal bridges with illuminated signal heads placed approximately 25' to 30' above the tracks, above the catenary system. It is necessary for train engineers (drivers) to have maximum line of sight distances to the signals. The existing signals bridges (supporting the signal heads) are approximately 32' tall. To maintain this height, the deck would need to be above this elevation throughout the Main Line and loop tracks. This would impact connectivity to bridges and other areas of the deck. For this study it has been assumed that new signal heads could be suspended from the underside of the deck. The acceptability of this approach, would need to be confirmed with the railroads.

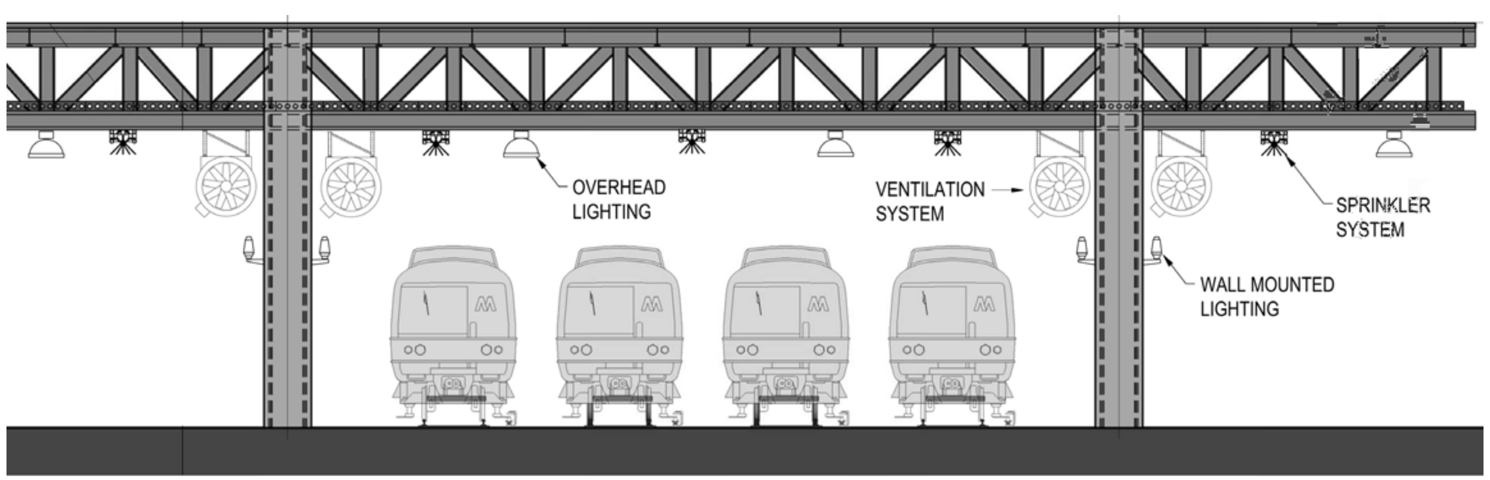


FIGURE 3.47: LIGHTING AND VENTILATION MOUNTED UNDER DECK

H. Ventilation and Fire Protection Systems

The deck would create an enclosed space at train level. A significant design consideration will be ventilation and fire safety. Potential design solutions have been considered, drawing from experience in other overbuild projects in New York and beyond. The exact nature and extent of the enclosed space would depend on the extent of Sunnyside Yard that is covered, the location of any deck openings, whether the existing East River Tunnel portals are covered, whether the Main Line is covered, whether walls are continuous (which would subdivide the space), and other factors. These variables would need to be considered during the development and refinement of future overbuild plans. The following sections provide an overview of feasibility considerations for ventilation and fire protection systems.

Fire is a significant risk presented by enclosing Sunnyside Yard. A fire within a train car could create a smoke condition that endangers life and health below the deck, and could release heat that impacts the deck structure.

The overbuild would need to comply with Amtrak's Design Policy for Overbuild of Amtrak's Right-of-Way (Reference 7) and project-specific requirements of Amtrak and LIRR. Fire protection systems should also be designed and installed to meet the requirements of NFPA 130 (Reference 8), FDNY, and the building codes of New York State, New York City and the FRA. Neither the Amtrak Policy for Overbuild, nor NFPA 130, specifically address covered railyards, but they do address "tunnels", which would likely be applicable to the Main Line and loop tracks. For the storage track areas, the documents cited above should be used, in coordination with the railroads and agencies, as a guide for analyses using computer modeling of fire scenarios.

1. Fire Suppression System

A dry type automatic sprinkler system and a dry type fire stand pipe system should be provided. Sprinklers are likely to be mounted on the underside of the deck within 6" of the deck. (Figure 3.47) A wet system is undesirable as it would require more maintenance, would be susceptible to freezing and railway operators typically do not like wet water pipes crossing over live railways. A standpipe system should be provided, including Siamese connections for firefighting in the enclosed railyard and connections for FDNY should be provided on the surface.

2. Fire Alarms

Detection and alarm systems are required below, and potentially within, the deck. Responsibility for fire responses in different parts of Sunnyside Yard should be clearly defined, and alarms provided to centralized or dispersed notification points, as applicable. The extent of fire alarm system should be developed based on the likely hazards in Sunnyside Yard and the requirements of FDNY and the responsible rail operator.

Emergency Egress / Emergency Services Access

Access and egress provisions would need to address normal use, emergency services access and evacuation of Sunnyside Yard or trains.

Stairways would need to be enclosed and fire-rated. Amtrak and NFPA require that the distance to a stairway should not exceed 800'. Locations of the stairways would need to be coordinated with support walls for the overbuild and with railroad infrastructure.

Above deck level, headhouses for stairways would need to be coordinated with the development plan. Stand-alone headhouses may compromise the value of open spaces. It may be preferable to incorporate stairways into buildings on the deck. It may not be possible to directly align the top and bottom of flights of stairs, however, it may be possible to introduce short horizontal egress passages within the deck trusses to link the top and bottom of offset stairways.

Stairways would also be required for conventional uses to provide access between deck level and yard level. This would be necessary if employee parking is located on the deck, or if certain railroad functions such as support facilities, offices or warehousing are located in buildings above deck level. Elevators would also be required.

3. Emergency Ventilation System

Ventilation would be required for managing smoke in a fire emergency as well as managing train heat and other air quality impacts from diesel locomotives or maintenance operations. Emergency ventilation would be required to control potential smoke conditions, and to provide a tenable egress route with sufficient visibility for workers, train crews, and passengers (as applicable) during a fire event.

It is anticipated that the emergency ventilation system would consist of either an exhaust system or an exhaust and supply system as per recent New York City overbuild projects. Alternatively multiple jet fans could be used at each end of a section of deck, adjacent to a section that is open to the sky. (Figure 3.48) If support walls separate the enclosed space into individual channels, the ventilation requirements of each could be considered separately. In areas where the deck is supported by columns or discontinuous walls, larger ventilation zones would need to be considered.

Future evaluations should consider the phased-development of the overbuild to ensure that the system provides the proper ventilation during construction, during all phases of development, and in the final completed overbuild condition.

The ventilation system should include sufficient redundancy to account for maintenance downtime and mechanical failures. The system would also need to consider sufficient reliability of the primary power supply, and the potential need for secondary feeders or the use of stand-by generators. The emergency ventilation fans can be used at a lower speed to provide necessary ventilation to support maintenance operations and heat dissipation. Diesel locomotives are used minimally in Sunnyside Yard, and emissions from such self-propelled locomotives are likely to become cleaner during the phasing of overbuild development. In the absence of significant numbers of diesel trains, the emergency ventilation condition would likely govern the design. Requirements for control of diesel emissions are provided in the ASHRAE HVAC Applications Handbook. (Reference 9) Future analyses should consider temperature control during maximum train storage with running equipment and peak outside temperatures, and requirements for outside air exchange.

The noise generated by the fans, and its impact on the working environment under a deck, should be evaluated. The impact of noise on buildings above a deck should also be considered. Silencers on the fans may be required.

4. Normal and Emergency Lighting

Lighting would be required under the deck to support normal yard operations. Emergency lighting would also be required, with emergency power and backup generation, to meet applicable codes and guidelines.

Amtrak requires illumination levels of track and walking surfaces of at least 2 foot-candles with a train in position on an adjacent track. Lighting fixtures would be mounted on the underside of the deck or on support walls. (Figure 3.47) Temporary lighting would be required during deck construction.

FIGURE 3.48: JET FANS

I. Conclusion

Construction of an overbuild development over Sunnyside Yard is technically feasible, but has many engineering challenges. In the most challenging areas, such as over the Main Line, the practicality of constructing a deck is questionable. In other areas, such as over the former Railway Express Area east of 39th Street, the technical solutions are relatively conventional. The major reconfiguration of Sunnyside Yard proposed by Amtrak and MTA is a key factor in making overbuild feasible. Overbuild construction can potentially occur while tracks and other infrastructure are removed and replaced, which would require a coordinated approach by the railroads and developers.

Chapter 4: Overbuild Guidelines

Table of Contents

A. CHAPTER OVERVIEW

The guidelines outlined here are intended to help ensure future Sunnyside Yard planning, development, and infrastructure projects are informed by the technical considerations identified in this study and that they are part of a cohesive urban design framework that enhances the form, scale, and character of both Sunnyside Yard and the surrounding neighborhoods.

Railroad operations and structural considerations are the primary factors dictating possible building locations and heights. The Overbuild Guidelines are a direct result of the constraints of building over an active railyard, with very limited touchdown points for structure.

The planning principles describe urban design strategies and requirements for the overbuild, including approaches to land use, open space, connectivity, parking, and placemaking. They are intended to create complete neighborhood districts that meet a broad range of needs, and enhance the overall viability of the overbuild. Consistent application of principles over the long-term planning and development schedule will strengthen the identity and functionality of the overbuild by encouraging compatible development across different zones.

B. Key Considerations

1. Ownership

Land ownership imposes constraints on development and must be considered in the planning of an overbuild. Sunnyside Yard is owned by multiple entities. Amtrak is the majority owner with significant portions owned by MTA and private owners.

- Amtrak Owned: 142.2 Acres
- MTA Owned: 31.2 Acres
- Privately Owned: 7.4 Acres

Development rights ("air rights") are also owned by multiple entities including the City of New York, Amtrak/Federal Agencies, the MTA, and private owners. Ownership is one of the criteria taken into account in defining potential development zones and project phasing. (Figure 4.1)

It should also be noted that Sunnyside Yard impacts the operations of Long Island Railroad (LIRR) and New Jersey Transit (NJT), though these entities are not land owners. LIRR has an easement agreement with Amtrak to operate trains over the mainline. By 2023, LIRR will use a new Mid-Day Storage Yard located on the MTA-owned property. New Jersey transit rents storage track space from Amtrak.

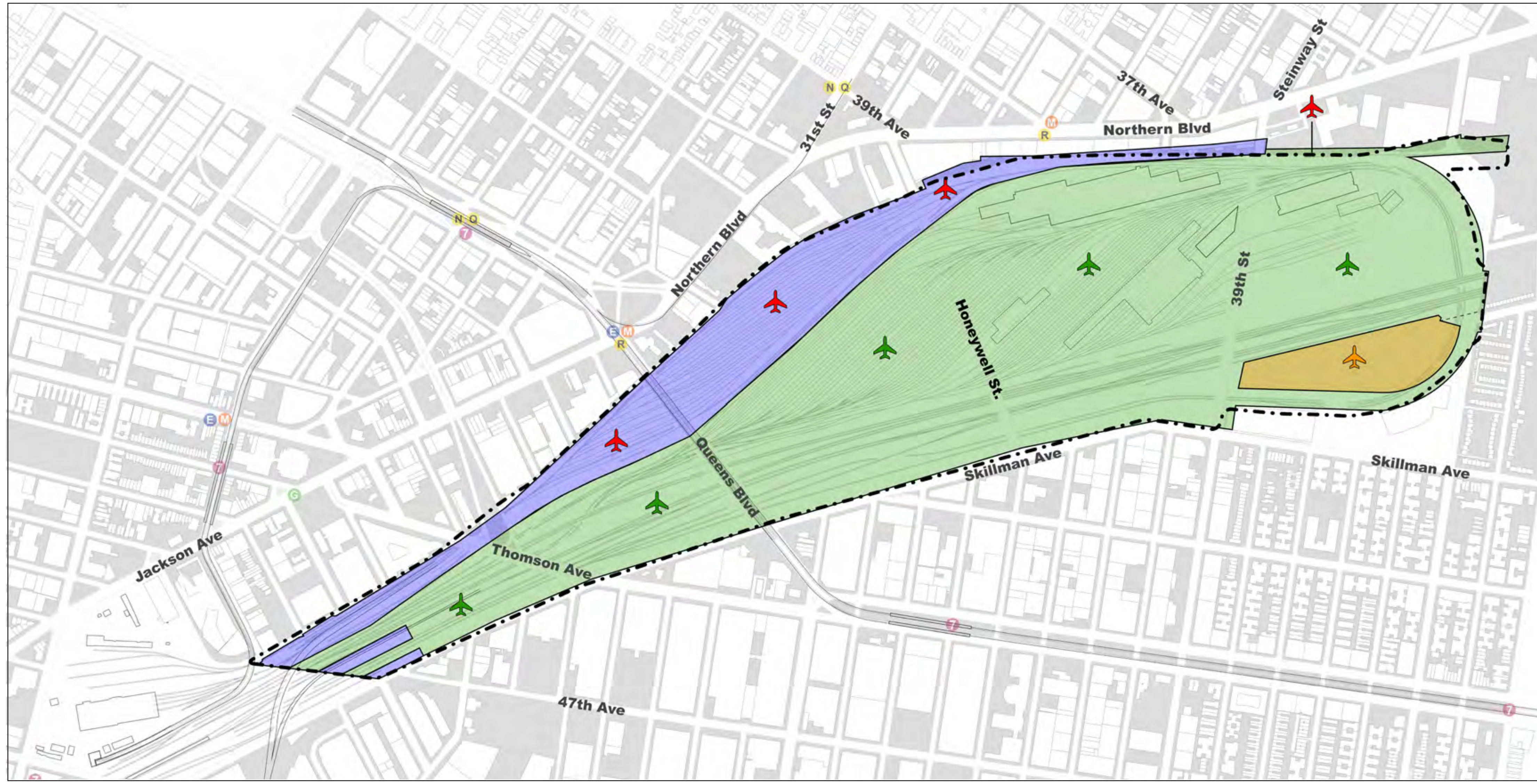


FIGURE 4.1: SUNNYSIDE YARD OVERBUILD LAND AND AIR RIGHTS OWNERSHIP

- Amtrak Land Ownership
- MTA Land Ownership
- Private Land Ownership
- Amtrak Air Rights Ownership
- City of New York Air Rights Ownership
- Private Air Rights Ownership

2. Deck Height Requirements Relative to Grade

The height of any deck over the tracks would vary across Sunnyside Yard, based on Amtrak, LIRR, and Main Line railroad vertical clearance requirements, railroad operations, and existing/planned ground topography/track elevation. (Figure 4.2) Existing grade elevations vary as much as 60' across the site. Some tracks slope down as they move from east to west to enter tunnels, while the Main Line gradually climbs as it moves from west to east, so that it crosses approximately 18' to 19' above street level at 43rd Street at the eastern end of Sunnyside Yard.

The required vertical clearance from the top of rail to the underside of structural deck or fixtures is 26'-9" for Amtrak and 22'-0" for LIRR. This is a desired clearance, and, in practice, Amtrak and MTA may agree to grant waivers to reduce it. It should be noted that existing bridges have clearances as low as 16'-8" and do not meet the desired clearance requirements. While it may be possible to extend suboptimal clearances for a limited distance from the bridges, they cannot be extended across the entire deck area. As a result, the proposed deck surface is often considerably higher than the existing bridge surfaces. This situation is exacerbated at the two ends of a bridge where it slope down to meet the at-grade street network.

Existing catenary and the towers that carry it create further complications for a potential deck. A replacement system for the catenary towers and lines would need to be integrated into any deck structure. A potential deck itself would range from 9' to 16' deep (vertical thickness between top surface and underside), depending on span and load conditions. For more information refer to Onsite Conditions in Chapter 3.

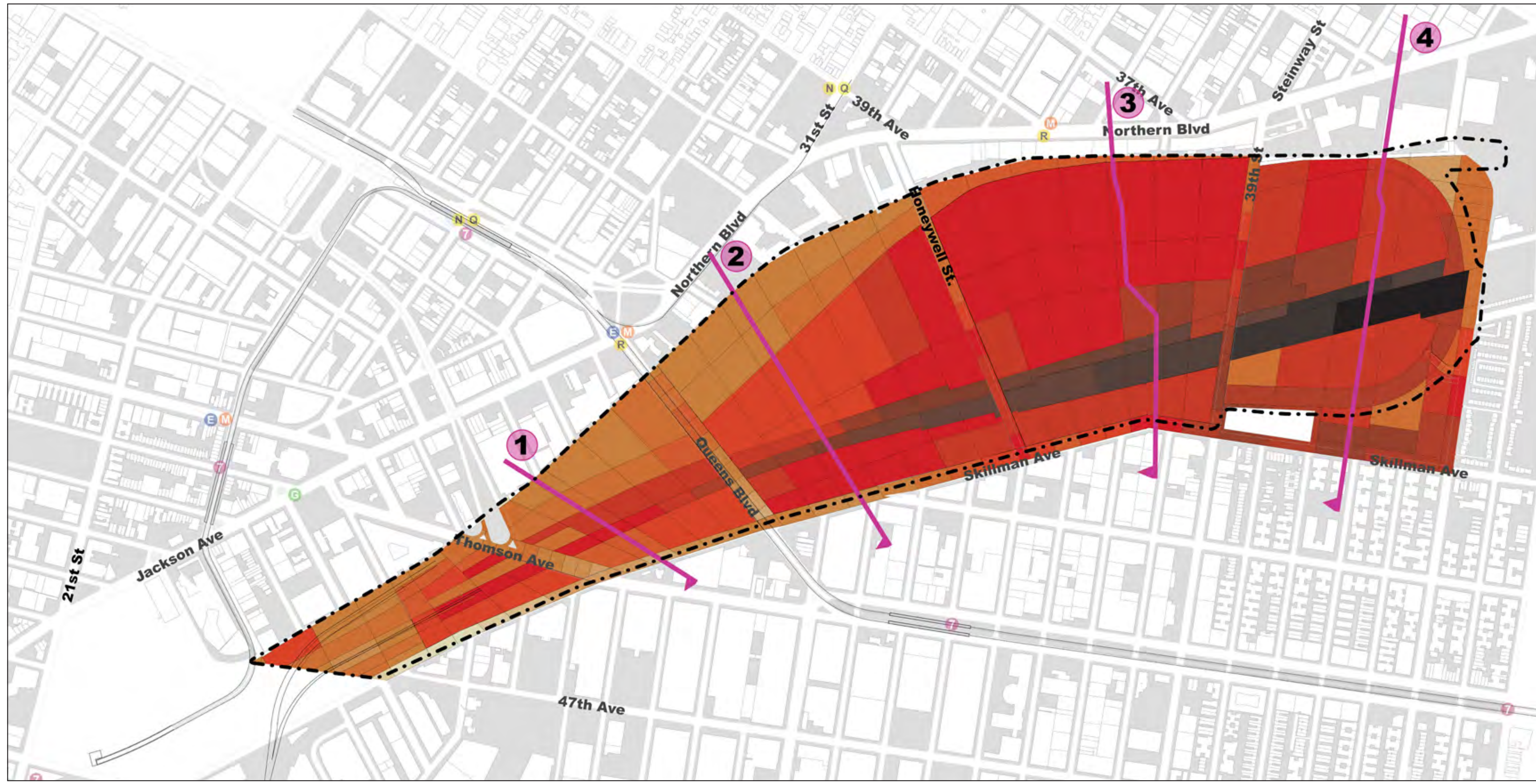
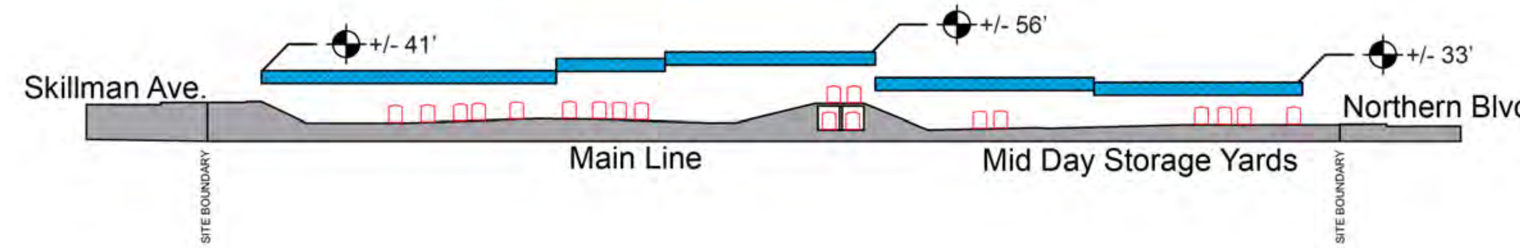


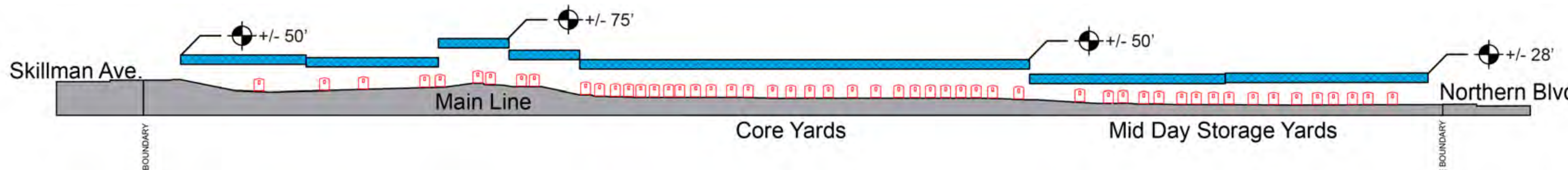
FIGURE 4.2: DECK HEIGHTS

Assumed Clearances:							
Amtrak: 28'-9" Above Max. Grade	5'-9'	20'-24'	35'-39'	50'-54'	65'-69'	80'-84'	95'-99'
LIRR (Yard Track): 22' Above Max. Grade	10'-14'	25'-29'	40'-44'	55'-59'	70'-74'	85'-89'	100'-104'
LIRR (Main Line): 36' Above Max. Grade	15'-19'	30'-34'	45'-49'	60'-64'	75'-79'	90'-94'	105'-109'
Depth of Proposed Platform: 10'							

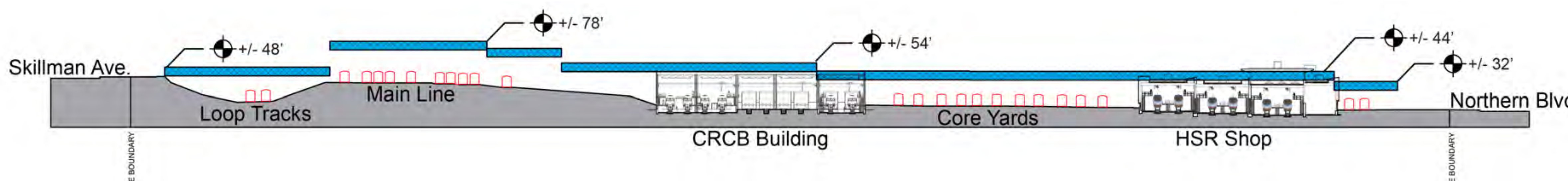
The height of planned or existing railroad buildings also exceeds the proposed deck height in certain places. (Figure 4.3A/B/C/D) At these locations, a modification of the building or the deck would be required. Possible strategies to accommodate these buildings include: “mounding up” the deck over these buildings to provide additional clearance; extending the buildings up through and above the deck; relocating these uses to other above-deck developments; and/or reducing the heights of the buildings to fit below the deck.



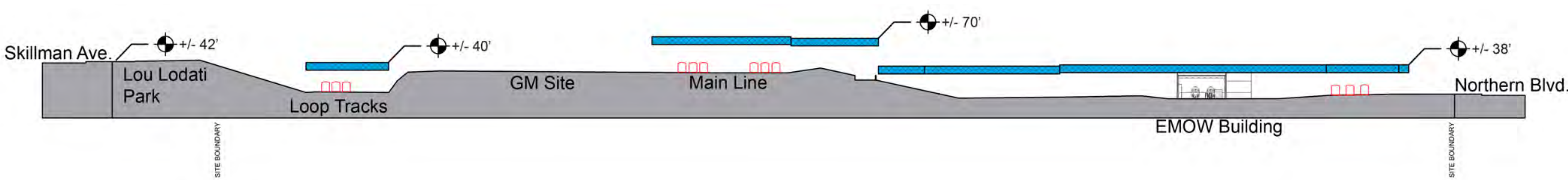
1 FIGURE 4.3-A: SECTION 01: BETWEEN THOMSON AVE AND QUEENS BOULEVARD



2 FIGURE 4.3-B: SECTION 02: BETWEEN QUEENS BLVD AND HONEYWELL STREET



3 FIGURE 4.3-C: SECTION 03: BETWEEN HONEYWELL ST. AND 39TH STREET



4 FIGURE 4.3-D: SECTION 04: BETWEEN 39TH STREET AND 36TH CRESCENT

3. Deck Access

Because of the abrupt change in elevation between the surrounding streets and the proposed deck, and the limited horizontal space available for gradual slopes or transitions, the vehicular access opportunities to the deck are limited. Although steeper grades could be possible, a 5% slope was targeted as the maximum desirable slope for vehicular access. Much of the perimeter of Sunnyside Yard, particularly along its northern edge, is bounded by private property, so adjacent public right-of-ways are only available where streets "dead-end" into the railyard. Potential access points from public right-of-ways can be as much as 2,000' apart along the railyard perimeter. While pedestrian access points can be built within a smaller footprint, especially where elevators are used, the lack of access from public right-of-ways also limits the number of places available as access points. More opportunities for pedestrian access exist along the southern edge of Sunnyside Yard where Skillman Avenue runs directly adjacent to the railyard, although vehicular access is still constrained by the lack of a transition zone to resolve grade differences.

This study examined a wide range of access types and points, many of which proved to be infeasible due to the height of the deck and a restricted footprint to negotiate the grade change between existing grade and top of deck. Described here are a range of strategies that should be thought of as a "kit-of-parts" for linking the street grid and pedestrian circulation network on the deck to the surrounding neighborhoods. (Figure 4.4) These may be deployed in different locations and circumstances, and serve as a starting point for more detailed study of specific opportunities.

FIGURE 4.4: POSSIBLE ACCESS POINTS

Proposed Boulevard Location
Existing Bridges
Possible Access Points
Possible Boulevard Segment

<u>*Onsite Deck Access*</u>

Bridge Access: 1, 2, 3

Onsite access to the deck would be primarily from four existing bridges (Thomson Avenue, Queens Boulevard, Honeywell Street, and 39th Street), which each arc gently over Sunnyside Yard from surrounding street grades. The prevailing deck surface elevation – established to provide the required railroad clearances – is generally higher than the surface elevation of the bridges. In order to minimize transitions, the optimal places to connect to the deck are at the bridges' apex points.

Where the deck would taper down to meet an existing bridge, waivers for reduced railroad clearances would need to be worked out with the railroads. These reduced clearance transition areas would be localized to key junctures, and would generally be extensions of areas where the bridges already do not meet the desired clearance requirements. In cases where the difference in elevation between the bridge surface and the deck is minimal, the deck depth might be locally reduced, so its surface tapers to meet the bridge height. Some locations could employ a combination of these strategies.

The relationship of the deck to the existing bridges would need to be carefully evaluated to facilitate connectivity between the deck and the existing roadways, while minimizing the need for clearance waivers. These waivers are essential to allow for sufficient access to the deck to make development feasible.

Where new on-deck development abuts the edges of existing bridges, and especially at the intersection of the bridges and proposed cross streets, it is important that the streets be activated by street-level uses within the buildings. Along the bridges, and where cross streets meet those bridges, a zone of 30' to 60' within the building development area beyond the public right-of-way would need to be kept at the same elevation as the sidewalk to allow for proper ground-level activation of the streets. Elevation differences of more than 3' between a building's ground floors and the adjacent sidewalks would generally fail to properly activate or enliven the public realm. The zone of suboptimal train clearances would be expected to extend beyond the existing bridges and new cross streets for an additional distance to allow for these active street-level uses. (Figure 4.5, Figure 4.6, Figure 4.7) Access to the deck from the bridges and ensuring the activation of the adjacent public realm would require substantial further study, analysis, engineering, and coordination with railroad operations, but is essential to the quality of the development of Sunnyside Yard.

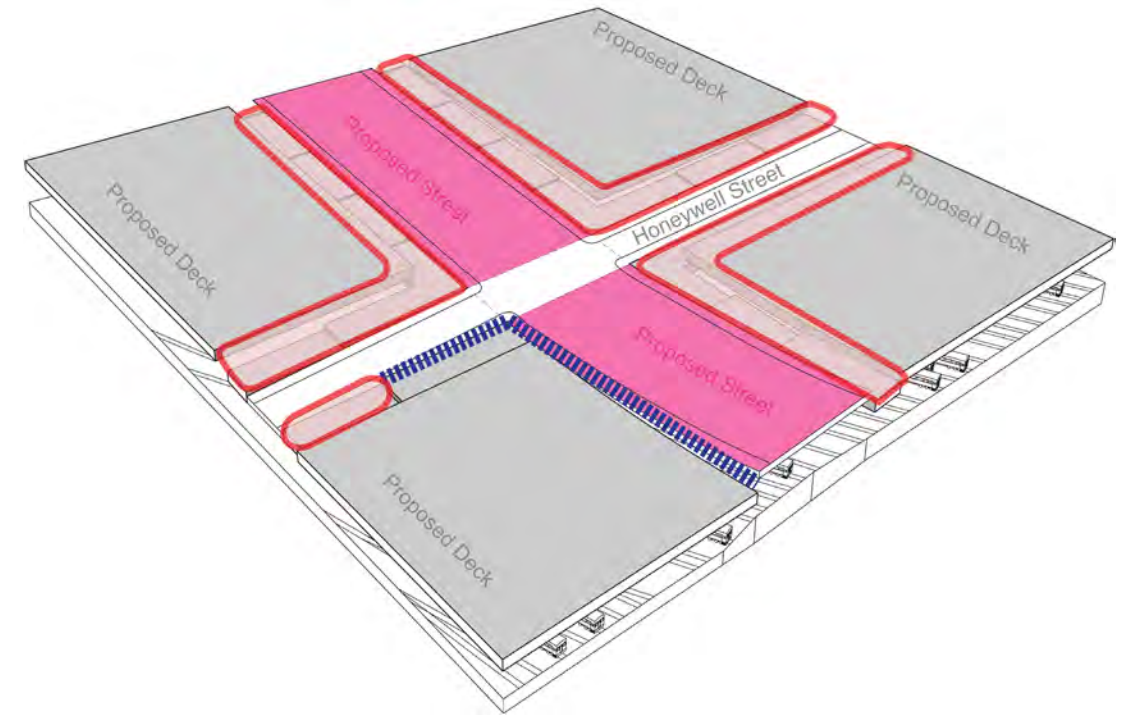
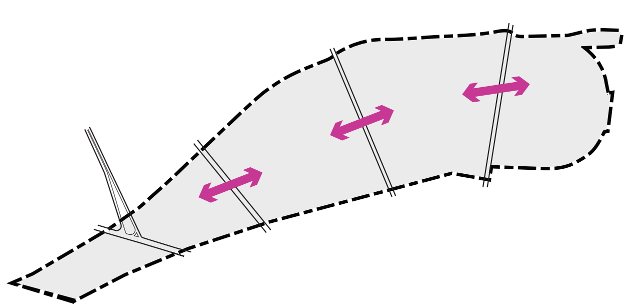


FIGURE 4.5: HONEYWELL STREET AND SUNNYSIDE YARD VEHICULAR MEDIATION

Transition deck to permit active street frontage (requires additional rail clearance relief)
Active street frontage approximately at or below adjacent sidewalk elevation



KEY PLAN

Access Point

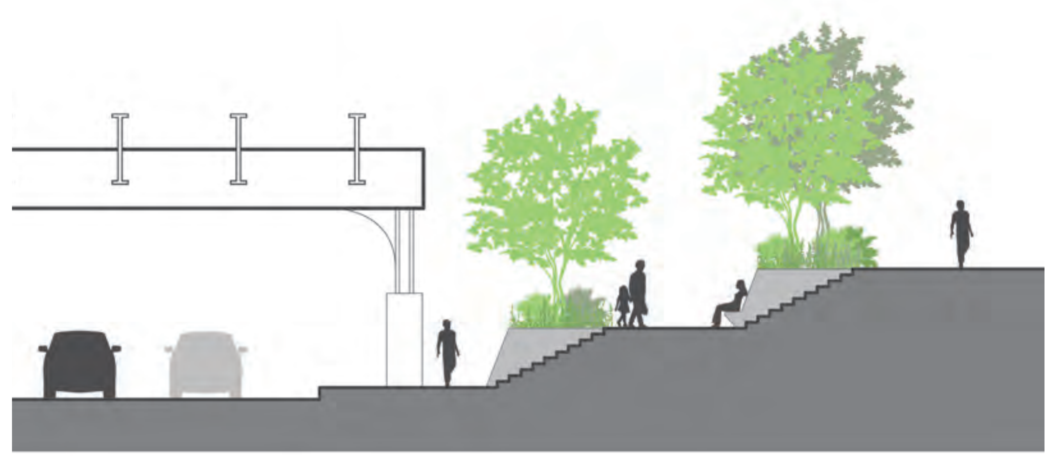


FIGURE 4.6: QUEENS BOULEVARD AND SUNNYSIDE YARD PEDESTRIAN MEDIATION

FIGURE 4.7: HONEYWELL STREET AND SUNNYSIDE YARD PEDESTRIAN MEDIATION

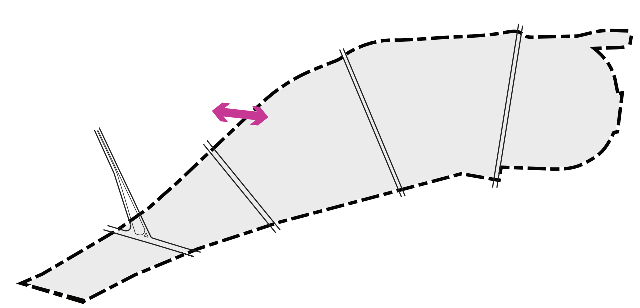
Offsite Deck Access

The deck surface is generally 20' to 40' above the street level of the surrounding area. Creating an accessible link between the deck and the adjacent streets presents a design challenge. Most areas along the perimeter of Sunnyside Yard offer very limited horizontal space to make a gradual transition. Grades of 5% or less are recommended for comfortable transitions for both vehicles based on standards for public buses and for pedestrians, based on the threshold slope for a ramp by code building code. Slopes steep enough to be considered a ramp by code require railings, landings, and other elements that complicate their design. Grades of up to 14% are possible for short distances for vehicles. Switchbacks, stairs, or elevators will be required to make pedestrian connections. All pedestrian access routes are required to meet ADA requirements for accessibility.

Potential vehicular and pedestrian connections around the site perimeter were studied. The studies included connections within the public rights-of-way, and on both publicly- and privately-owned property, all of which require further study should this project advance to more detailed planning stages.

Deck Access 4: Queens Plaza

This potential access point at the east end of Queens Plaza would be for pedestrians only. A vehicular connection at this location was deemed infeasible due to the steep grades required and the configuration of traffic flows at the Queens Boulevard/Northern Boulevard intersection. The potential access would extend the activity of Queens Plaza up and onto the site by way of a grand stair and/or switchback ramp to provide connections between the new overbuild development and subway stations served by the E, M, R, N, Q and No. 7 trains. (Figure 4.8)



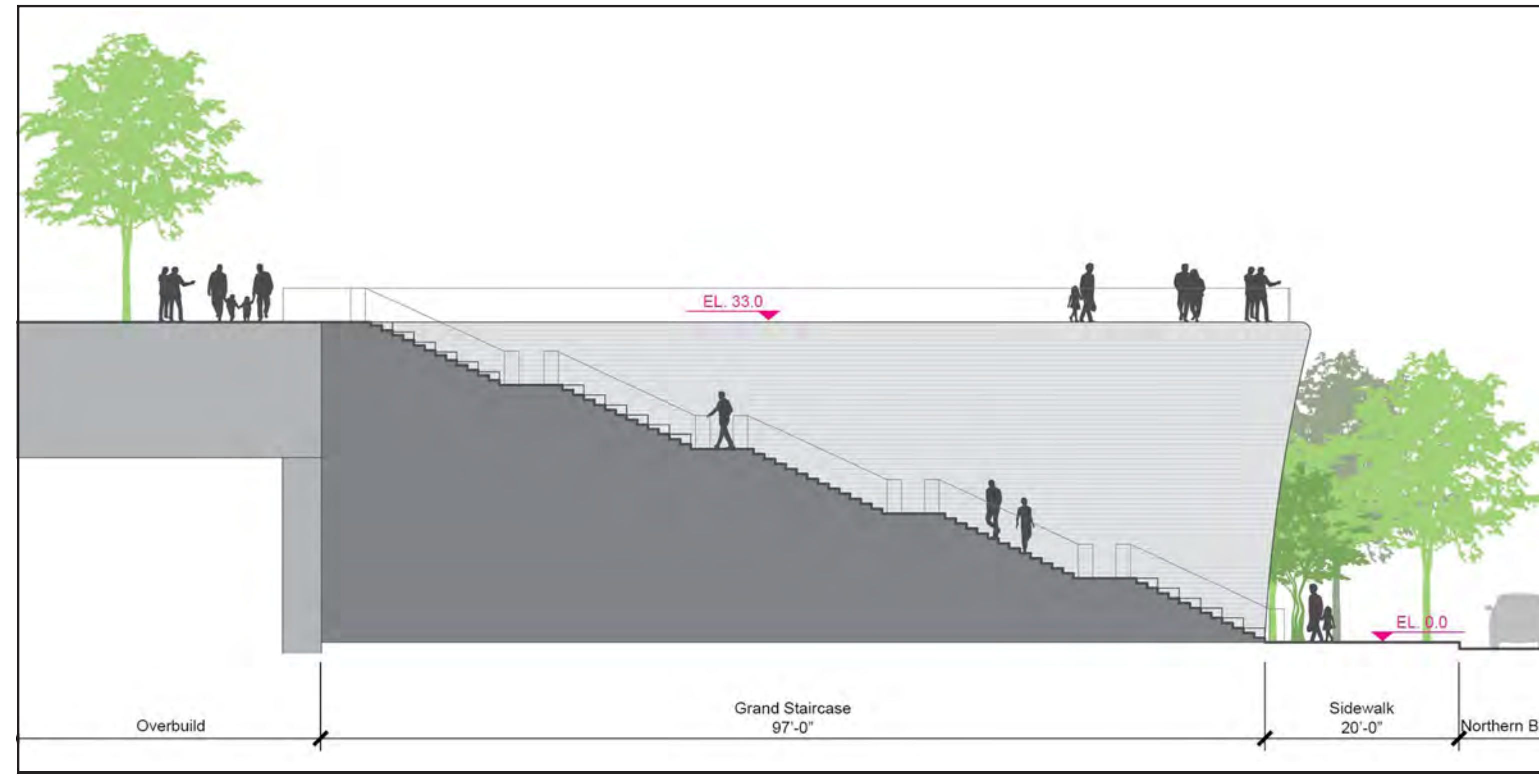
KEY PLAN

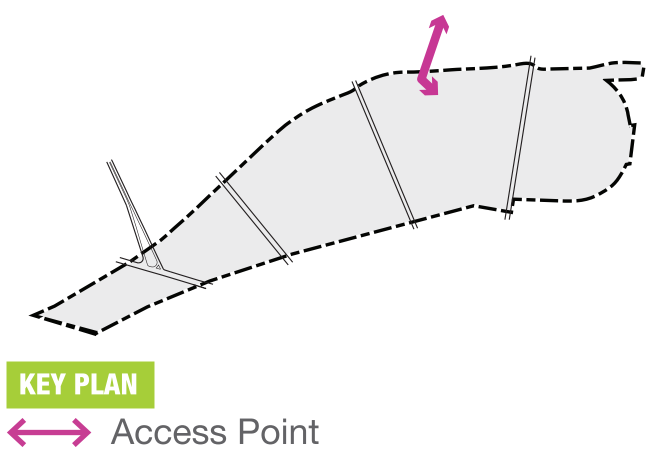
⟷ Access Point

FIGURE 4.8: ILLUSTRATIVE QUEENSBORO PLAZA PEDESTRIAN ACCESS

Deck Access 5: Northern Boulevard West

The potential access point between Honeywell and 39th Streets would also be for pedestrians only. The limited horizontal space available creates grades that are too steep for vehicular access. A grand stair and landscaped stepped terrace or slope are possible. Alternate access would be provided by a ramp and elevator. These could connect the activity of the active park in Zone C to Northern Boulevard. The access would also provide a connection to the 36th Street subway station served by the M and R trains. (Figure 4.9)





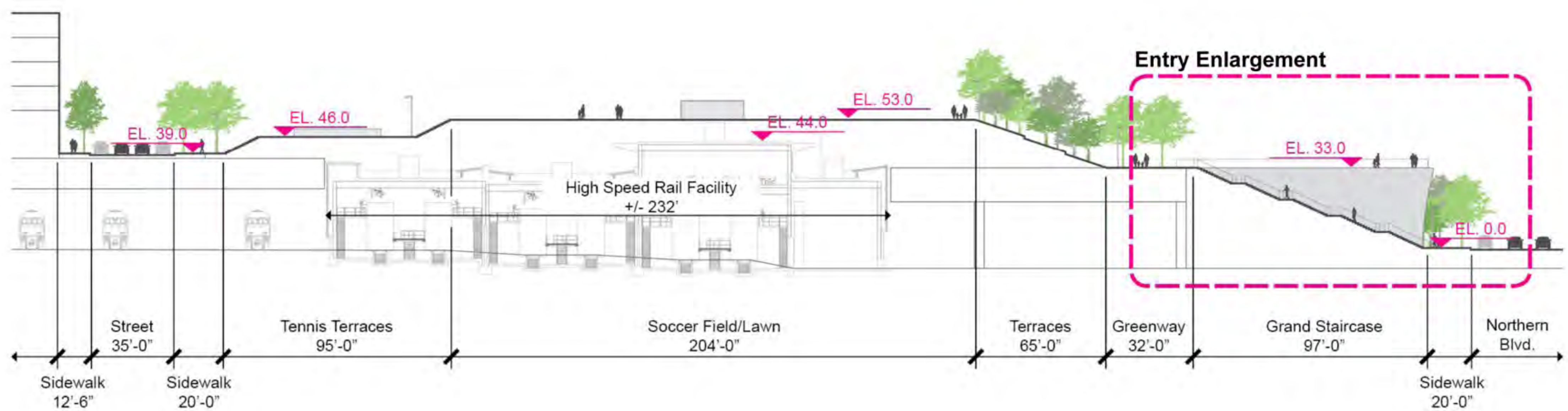


FIGURE 4.9: ILLUSTRATIVE NORTHERN BOULEVARD PEDESTRIAN ACCESS

Deck Access 6: Northern Boulevard East

This potential access point for vehicles and pedestrians is at the northeastern corner of the site and takes advantage of a portion of the site that extends east and straddles both sides of 42nd Place. The access road would bridge over 42nd Place before turning north and ramping down to meet Northern Boulevard near its intersection with 36th Avenue. As a primary connection between Sunnyside Boulevard and the surrounding street system, this connection would be important to the connectivity of the development. (Figure 4.10)

Deck Access 7: 43rd Street

The potential access point is at the southeastern area of the site, located approximately where an existing bridge crosses over the Loop Tracks. This access point takes advantage of a piece of the site where the top of the proposed deck is roughly at the same elevation as the adjacent street (43rd Street). The access would be for both vehicles and pedestrians. (Figure 4.12)

Deck Access 8: Skillman Avenue/41st Street

The potential access point at the southeastern area of the site would be for vehicles and pedestrians and takes advantage of a portion of the site where the top of the proposed deck is roughly at the same elevation as Skillman Avenue. (Figure 4.11)

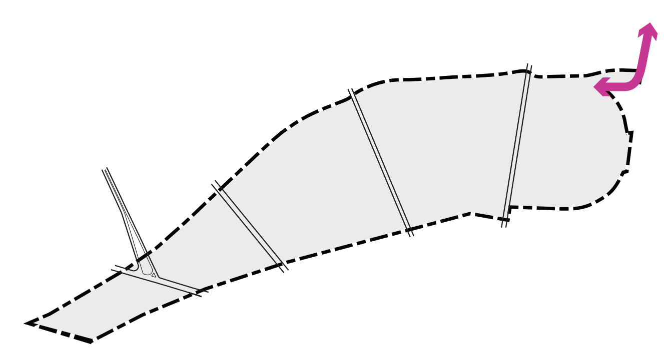


FIGURE 4.10: DECK ACCESS 6

⟷ Access Point

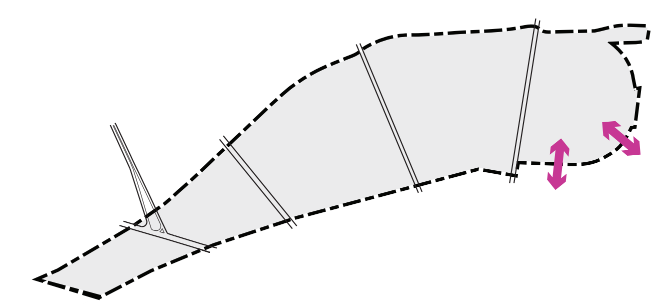


FIGURE 4.11: DECK ACCESS 8/9

⟷ Access Point

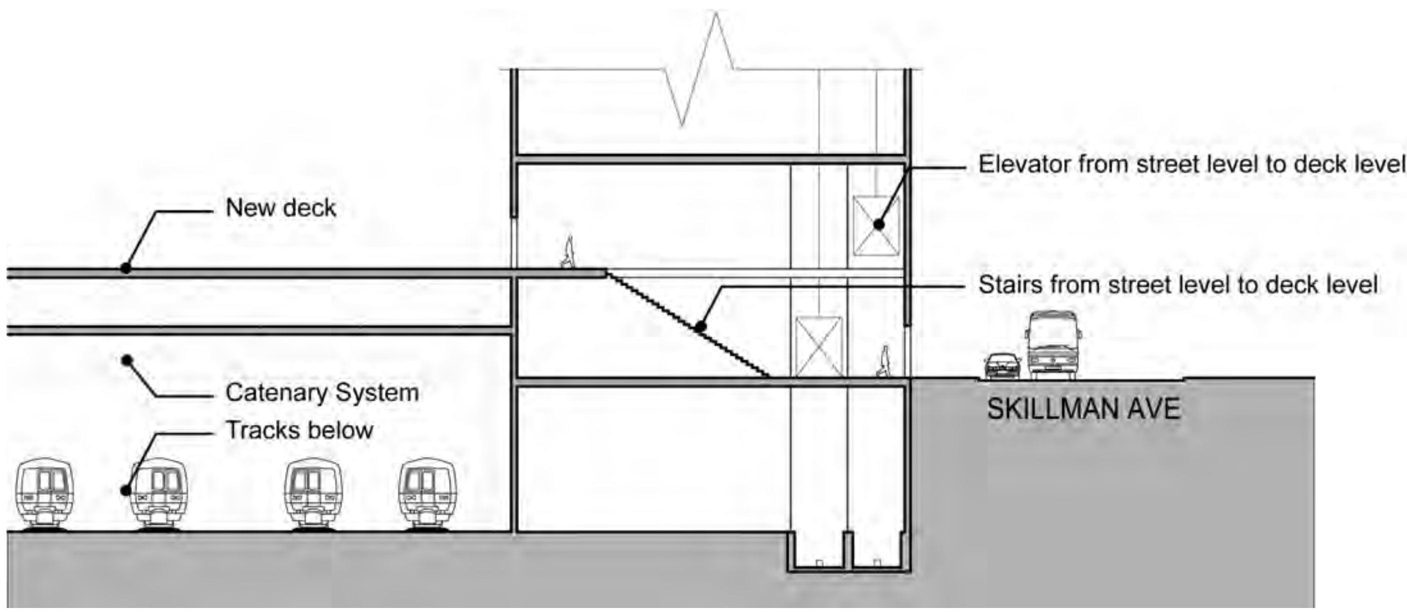


FIGURE 4.12: PEDESTRIAN ACCESS AT SKILLMAN AVENUE

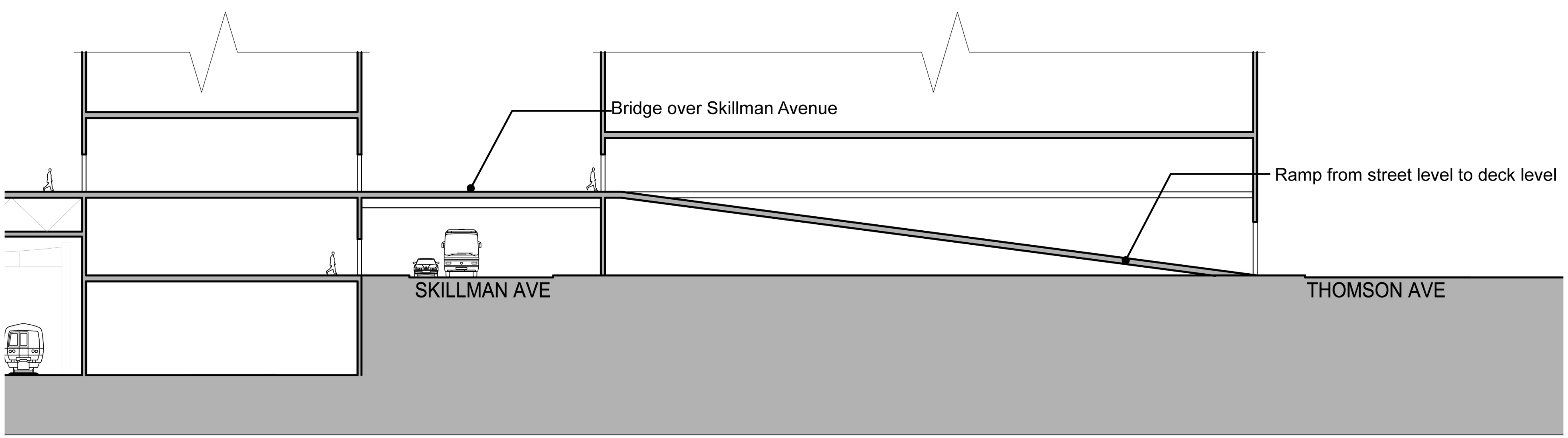
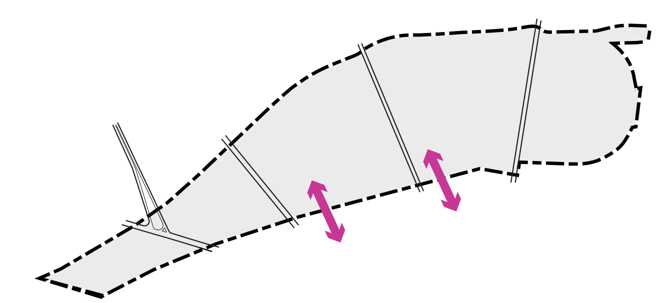


FIGURE 4.13: PEDESTRIAN ACCESS BRIDGING ACROSS SKILLMAN AVENUE

Offsite Deck Access 9-10: Strategies for Pedestrian Access

There are ample opportunities along Skillman Avenue for pedestrian access to the deck. Pedestrian access strategies rely on a combination of ramps, stairs, escalators and elevators and can be considered a "kit of parts" that can be applied around the site to improve connectivity to, and the porosity of, the site. There are multiple locations, at street ends, at sidewalks, or traffic islands, where these strategies could be implemented.

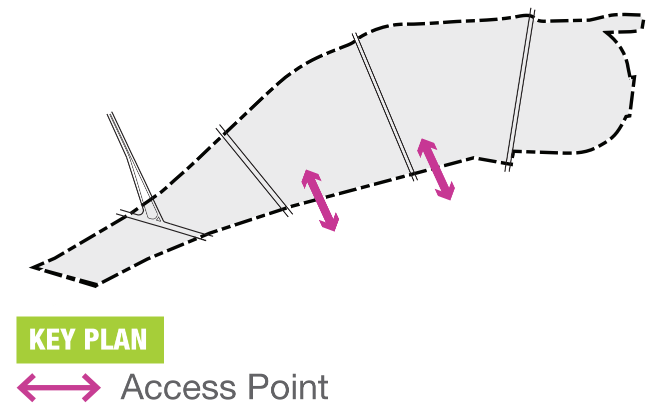
- **Building-Integrated:** At locations where new development is located along the deck edge with access both at existing street level and at deck level, vertical access can be integrated into the buildings including stairs, ramps, or elevators. This is especially applicable to the Skillman Avenue edge of the site where there is some terra firma and buildings would line the face of the deck. (Figure 4.12, Figure 4.13)
- **Elevator:** Elevator access is efficient and flexible in terms of footprint and location opportunities. Elevators represent a considerable expense relative to stairs and ramps, and also require greater ongoing maintenance. They are also limited in their capacity to quickly move large volumes of people. However, elevators have a smaller footprint and could provide access in places with limited space where connectivity is important.



KEY PLAN

Access Point

- **Ramp with Bridge:** In places where the footprint needed for a ramp is not available immediately adjacent to the deck, a bridge over the adjacent right-of-way could allow for a ramp nearby. This may be appropriate south of the site where Skillman Avenue cuts diagonally across the street grid creating triangular traffic islands which could accommodate ramp touch down points. (Figure 4.14)
- **Stair:** A stair could be an efficient means to connect to the deck, requiring a smaller footprint than a ramp and relatively easy maintenance. This strategy would be applicable over a wide range of deck edge conditions, but would need to be accompanied by an elevator or other means of ADA-compliant access at the same location.
- **Main Line Bridges:** Potential lightweight pedestrian bridges spanning over the Main Line, situated between the existing vehicular bridges, could act as extensions of pedestrian access points along Skillman. They would connect the northern part of the deck to Skillman Avenue and areas south. They would also provide additional north-south connections between development areas on the deck that are separated by the open cut for the Main Line.
- **Ramp:** Where a larger footprint is available adjacent to the deck a ramp can provide access. Depending on configuration, the ramp could be oriented parallel or perpendicular to the deck edge, or configured as a switchback ramp. This could be appropriate where streets dead-end into Sunnyside Yard or where the adjacent public right-of-way runs parallel to the deck edge. Existing parking lanes could be used as an area for ramps, which would minimize impact on pedestrian or vehicular flow. (Figure 4.15)



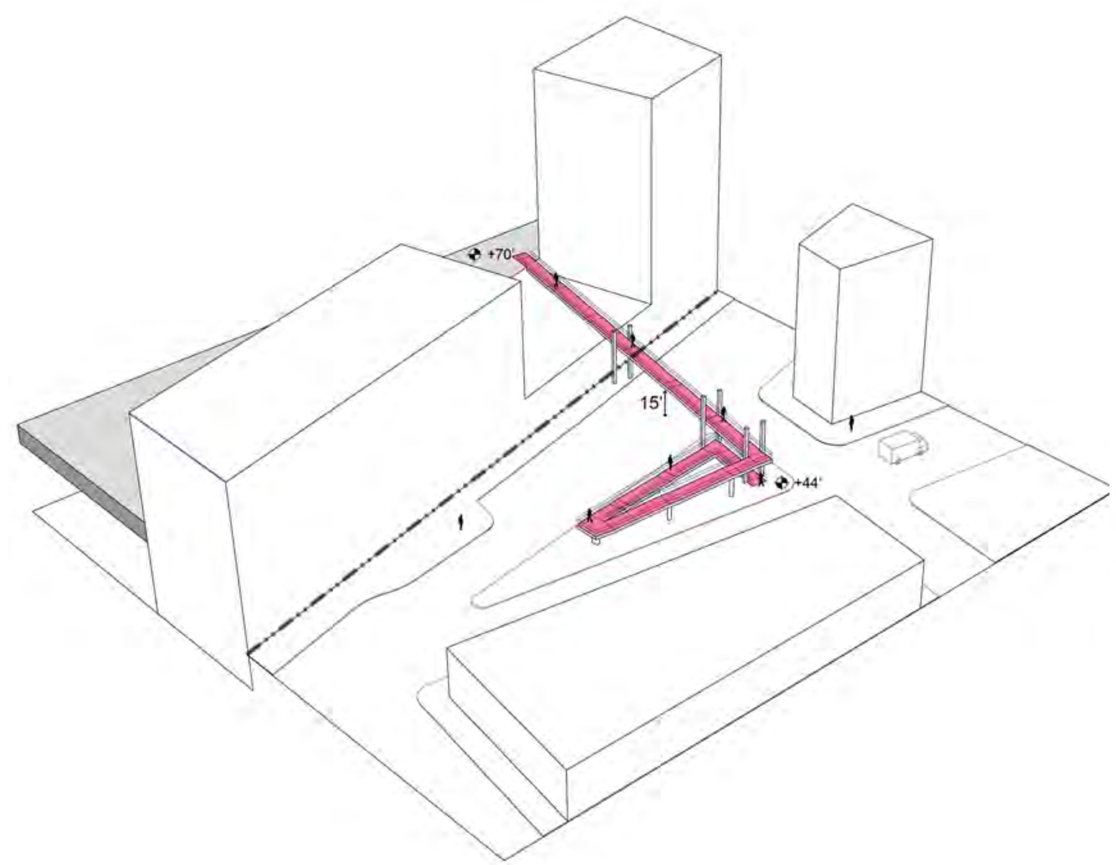


FIGURE 4.14: PEDESTRIAN ACCESS BRIDGING ACROSS SKILLMAN AVENUE

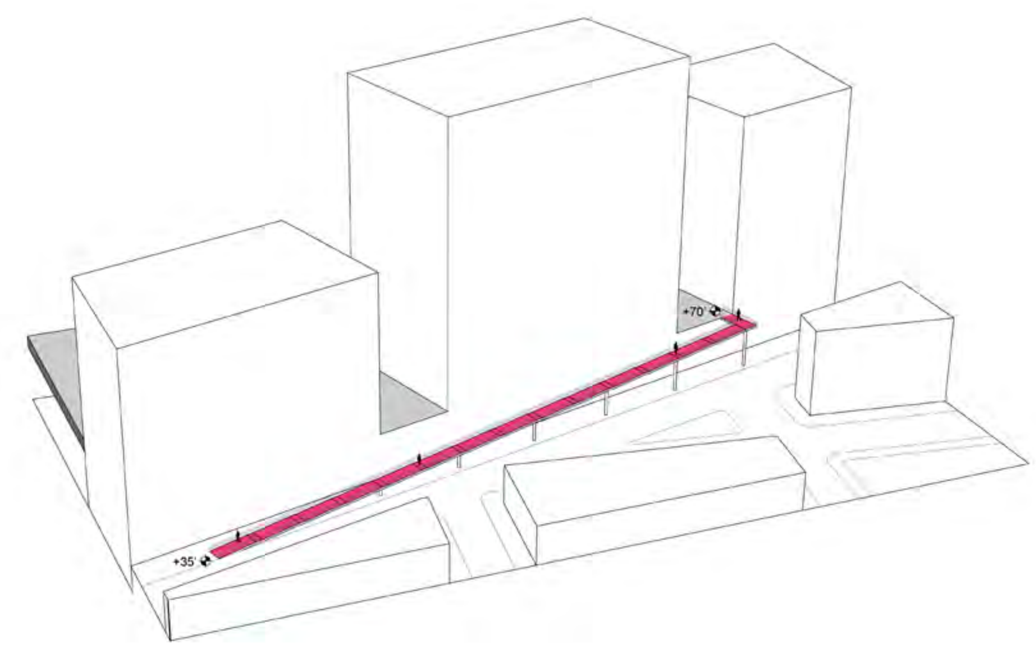


FIGURE 4.15: PEDESTRIAN ACCESS PARALLEL WITH SKILLMAN AVENUE

'All renderings, illustrations, and plans in this study are intended for illustrative purposes only. There are a variety of potential design solutions and these renderings, illustrations, and plans shall not be construed to be a representation of an intended design solution'

4. Tower Optimization

Maximizing the amount of square footage that can be developed while minimizing the structural costs to build it helps optimize the feasibility of overbuild development. Taller buildings, “towers”, create a large amount of square footage in a small footprint. The strategic placement, height, and footprint of the development towers is key to the feasibility of an overbuild.

The design process for maximizing the feasibility of a Sunnyside Yard overbuild begins with a careful understanding of the structural constraints. Rail alignments, with their associated horizontal clearances, limit the areas of terra firma available to bring structural support systems to grade and connect to below-grade foundation systems. In addition to track location, roadways at the track level (for service vehicle access) limits where support columns or walls can be located. As discussed in Chapter 3, Section D.2, vertical train clearances and the structural span distances between vertical supports results in limitations to overbuild development, particularly mid- and high-rise towers. Long spans (greater than 200’) cannot feasibly support structures taller than 60’, although they can carry roads, open space and low-rise development.

A set of generic building typologies were generated to test the structural feasibility and development area yield of overbuild development. These typologies include a series of assumptions about the building form, structural systems, and use patterns based on common building practices.

Baseline Typology Assumptions

All buildings are assumed to have a 60’ base or podium. Buildings without towers are assumed to consist only of a podium. While some additional space may be possible in a cellar level within the deck, no assumption was made about the feasibility of this and no cellar space was included in the study.

Buildings with towers are assumed to require a mega transfer truss. This structural frame, which would be located in the upper one to three floors of the building podium, transfers the load of the tower to the column lines below. (Figure 4.16) The basic breakdown of mega transfer truss size by typology is as follows:

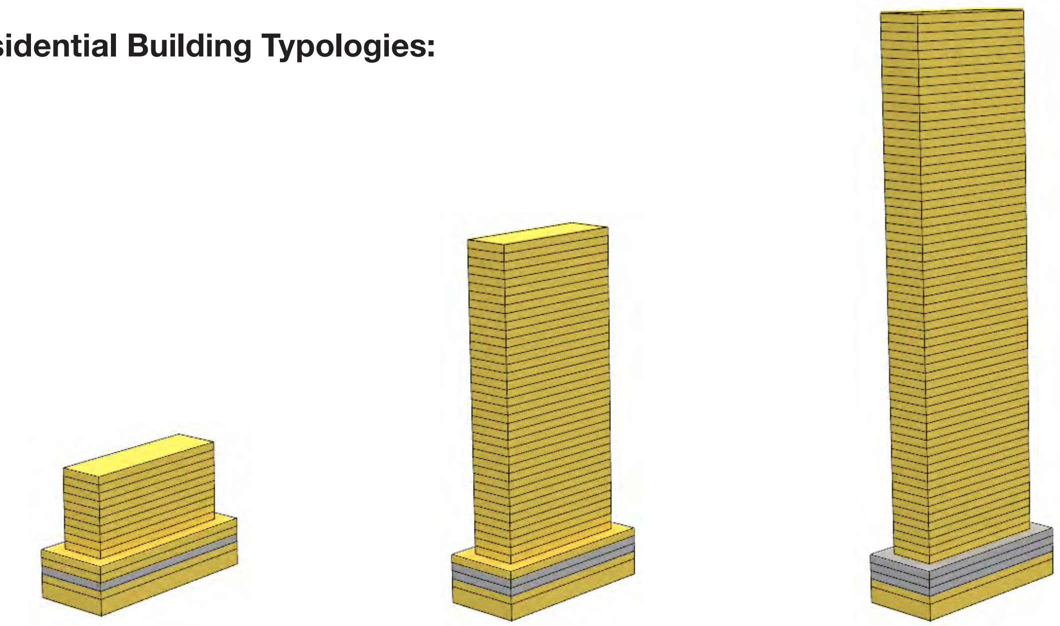
Residential Buildings

- Low Rise:
  - Up to 10 floors above podium
  - 1 floor of mega transfer truss
- Mid Rise:
  - Up to 38 floors above podium
  - 2 floors of mega transfer truss
- High Rise:
  - Up to 64 floors above podium
  - 3 floors of mega transfer truss

Office Buildings

- Low Rise:
  - Up to 14 floors above podium
  - 1 floor of mega transfer truss
- Mid Rise:
  - Up to 28 floors above podium
  - 2 floors of mega transfer truss
- High Rise:
  - Up to 39 floors above podium
  - 3 floors of mega transfer truss

Residential Building Typologies:

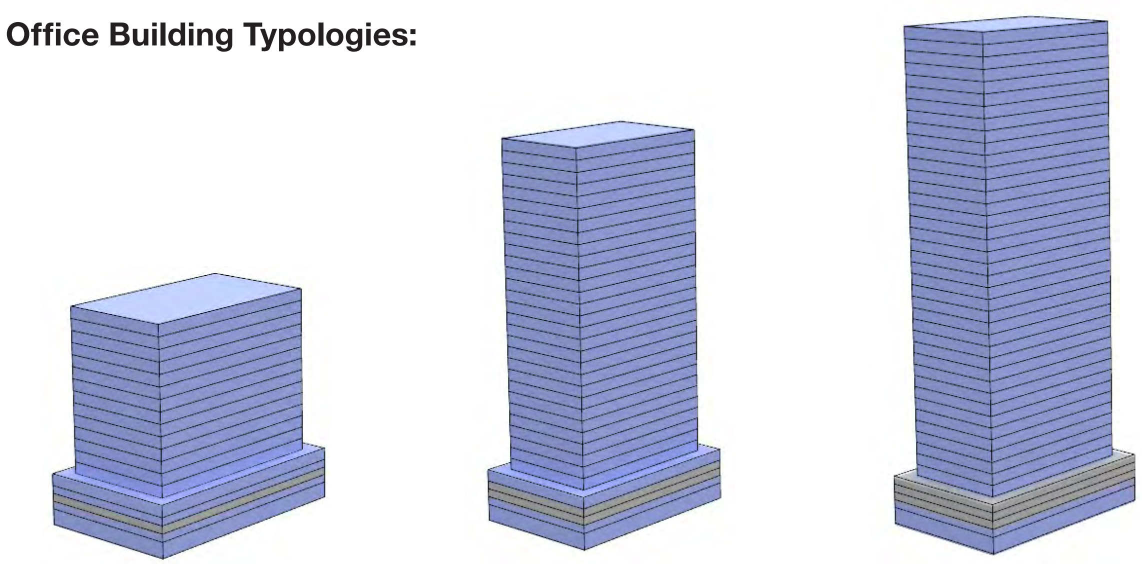


Residential low rise: 10 floors above podium, 1 floor of mega transfer truss

Residential Mid Rise: 38 floors above podium, 2 floors of mega transfer truss

Residential High Rise: 64 floors above podium, 3 floors of mega transfer truss

Office Building Typologies:



Office Low Rise: 14 floors above podium, 1 floor of mega transfer truss

Office Mid Rise: 28 floors above podium, 2 floors of mega transfer truss

Office High Rise: 39 floors above podium, 3 floors of mega transfer truss

FIGURE 4.17: TOWER TYPOLOGIES

- Residential Program
- Office/Commercial Program
- Mega Transfer Truss Floor

In some locations, because the structural considerations outweigh the floor area, mid-rise towers may be more cost effective than high-rise towers.

The building floors within the mega transfer truss zone can be habitable, but would need to be designed to work around the truss and will be considerably less spatially efficient. It is assumed that space on these floors will likely be considered for mechanical space or building amenities, which are more flexible in working around structural constraints than residential units or office plans. While some individual truss floors may have a marked decrease in efficiency, project-wide the total loss of efficiency is calculated to be 1% or less.

Parking for residential buildings is assumed to be incorporated into the building podiums, generally within one to three levels, wrapped by single-loaded residential units. Parking for the commercial office is assumed to be incorporated in to the building podiums. More parking assumptions are described later in the Planning Principles section of this chapter.

Building Typologies

For the purposes of this feasibility study, a series of building typologies were developed to test structural feasibility and costs. (Figure 4.17) These typological assumptions were based on floor plates and floor-to-floor heights for new buildings in New York City, including the following:

Residential

- Tower footprints above a podium base are assumed to be 60’ x 175’-195’.
- 10’ floor-to floor heights with a 20’ ground floor level.

Commercial

- Tower footprints above a podium base are assumed to be 125’-130’ x 200’-210’ for commercial office towers, and 150’ x 250’ for creative office towers.
- 15’ floor-to-floor height with a 20’ ground floor level.
- Schools are assumed to have a 15’ floor-to-floor height.

Optimization Principles

The following are some basic guidelines for optimizing the locations of building towers:

- **Orientation:** Towers should be oriented to maximize structural efficiency. They are most efficient with the long face of the tower perpendicular to tracks and to the lines of structural support below.
- **Tower Footprints and Column Lines:** Tower footprints for taller structures must be located where the mega transfer truss can transfer the tower load to at least three, and in some cases four, column lines at the track level. Taller towers and longer spans require more column lines.
- **Tower Spacing:** For Residential towers, space between towers facing each other should be a minimum of 100’ wide, with 120’ being preferable. For comparison, buildings on opposite sides of a typical Manhattan side street would generally have a spacing of 60’ at the building base and 90’ between building towers above the base. A slightly higher standard was used because of the anticipated density, and the desire to avoid creating overly narrow street canyons.
- **Height and Column Spans:** The achievable height for buildings generally corresponds to the length of spans required between column lines at the track level. Taller towers work over shorter spans, but not over longer spans. At long spans the deck itself can support open space and low-rise development of 60’ (five residential stories) or less.

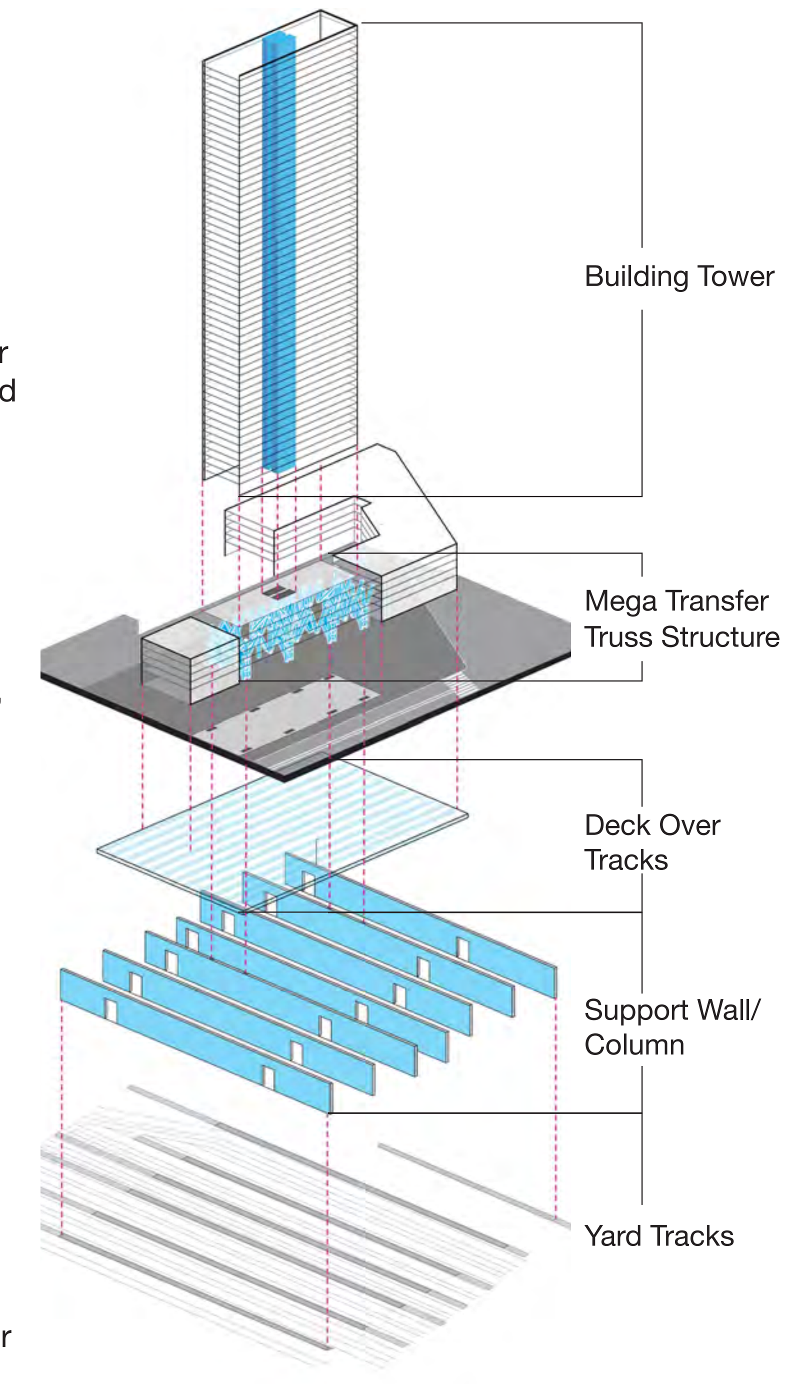


FIGURE 4.16: TOWER AND TRACK STRUCTURE RELATIONSHIP

5. Street Grid and Transit

Street Grid

The Sunnyside Yard street network should have a clear hierarchy and sufficient redundancy. Sunnyside Yard's roadways also have the potential to augment and enhance the surrounding street system. The adjacent neighborhoods have an array of street grids which are neither contiguous nor aligned with each other, where the current railyard acts as a break in the urban fabric.

While planning studies for new development in dense urban environments might normally start with a street grid system and develop building and tower patterns from that grid, at Sunnyside Yard the placement of towers relative to rail and column lines is the governing factor, and the street grid must be shaped to accommodate the tower placement opportunities. The internal street system must be developed and optimized to serve potential towers while minimizing undevelopable areas. It is also important to develop a street system that connects and unites development zones across the site.

The street grid should comprise a network of roads designed for appropriate traffic flows, speeds, and development context. New streets should accommodate a wide range of users, including vehicles, pedestrians, and cyclists, with attention to safety, accessibility, and function. The character of streets contributes significantly to the quality of the development. Because of the long-term build out, the street grid will be completed incrementally and its design will require an understanding of both existing and future contexts.

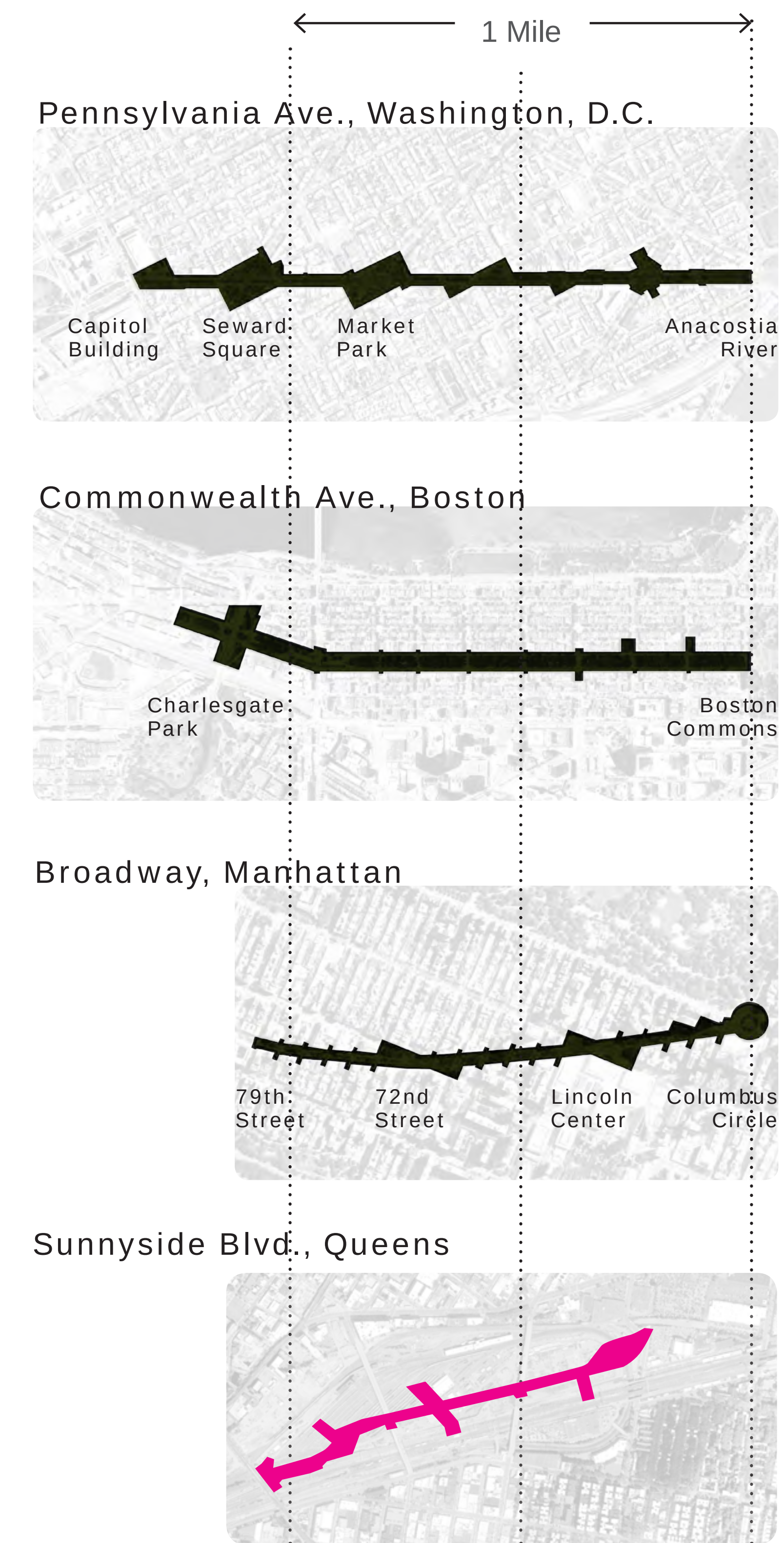


FIGURE 4.18: NATIONAL SCALE COMPARISONS

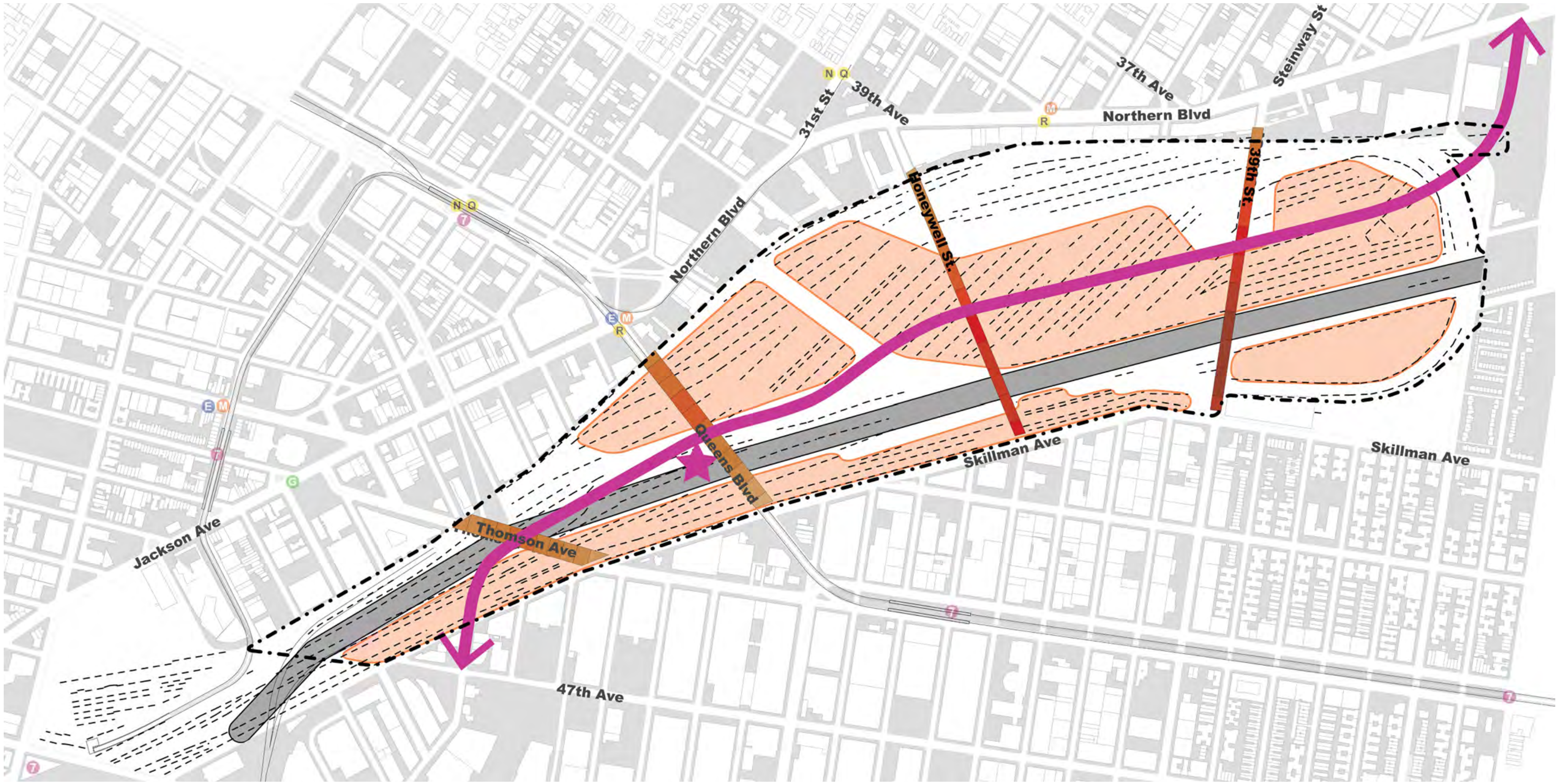


FIGURE 4.19: SUNNYSIDE BOULEVARD

Proposed Boulevard Location
Proposed Column Center Lines
Zones of Possible Towers
Existing Bridge Elevations
Main Line
Sunnyside Station

A variety of street grid patterns and block sizes were studied. Specific elements of the proposed street grid include:

Primary Roads (Sunnyside Boulevard)

This central boulevard would be the main east-west roadway across Sunnyside Yard, potentially connecting 47th Avenue in the west with Northern Boulevard to the east, running nearly a full mile in length. (Figure 4.18) Sunnyside Boulevard is intended to be a central spine for development: a wide street with two-way traffic separated by a broad landscaped center median. (Figure 4.20) A number of different lane, median, and sidewalk configurations would be possible. (Figure 4.21) The 120'-wide roadway will function as a collector street to functionally and visually link multiple development zones. Because the elevation of the deck is generally higher than the existing bridges, the Boulevard should meet these bridges near the high point of each bridge. The street also provides some redundancy with Northern Boulevard. (Figure 4.19)

Secondary Roads

Secondary roads would work with Sunnyside Boulevard to create an interconnected street grid. These local roads would be typically 60'-wide with two-way traffic, 11' travel lanes, curbside parking, sidewalks and street trees. (Figure 4.22)

Minor Roads & Neighborhood Parks

In certain locations and scenarios, minor roadways line either side of a central open space to create defined neighborhood parks. These roadways are envisioned as 45'-wide paired one-way roads, with 11' travel lanes, curbside parking, and street trees.

The central open space could provide the community both active and passive recreation areas, and could serve as part of a network of landscaped pedestrian and bike routes that weaves through the new development. (Figure 4.23)

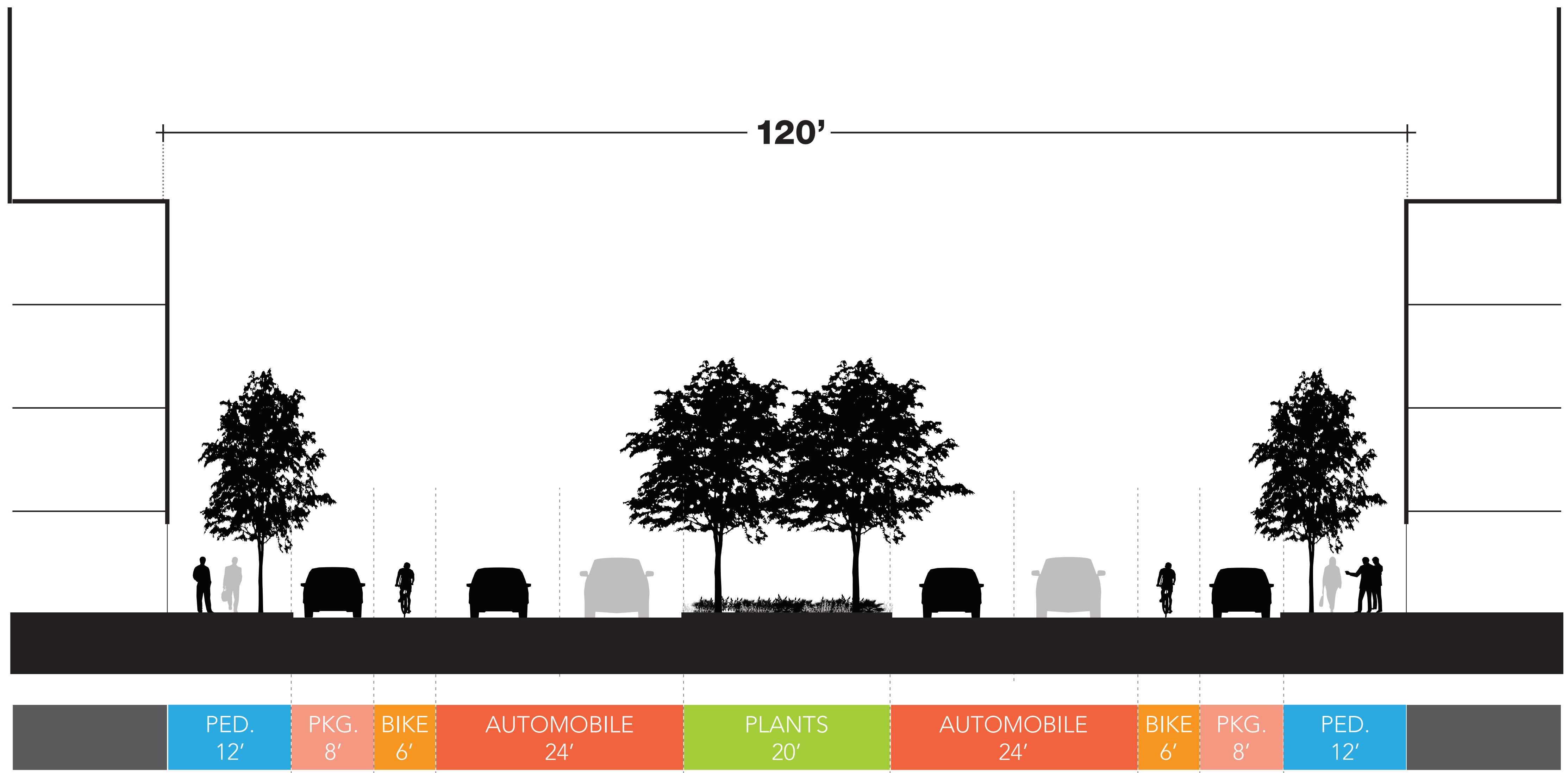


FIGURE 4.20: ILLUSTRATIVE BOULEVARD SECTION

Figure 4.21: Sunnyside Boulevard Organization Variations

Sunnyside Boulevard's generous 120' width, nearly mile-long length, and diversity of neighborhoods it passes through allow for a multitude of organizational variations. Below are three basic organizing variants that use the same basic components of bike lanes, travel and parking lanes, street trees, and sidewalk seating but deploy them in multiple ways illustrating the range of possibilities on the grand boulevard.

VARIATION 01

- 20' planted median, no pedestrian access
- 12' travel lanes
- Two-way bike lanes
- Curb-side parking
- Street trees

VARIATION 02

- Pedestrian path through planted median
- Travel lanes reduced to 11.5' in width from 12'
- Designated two-way cycle track
- Parallel parking

VARIATION 03

- Planted median reduced to 14'
- Travel lanes reduced to 11' in width from 12'
- Two-way bike lanes
- Sidewalks expanded to 18', includes cafe space
- Two-way bike lanes
- Curb-side parking

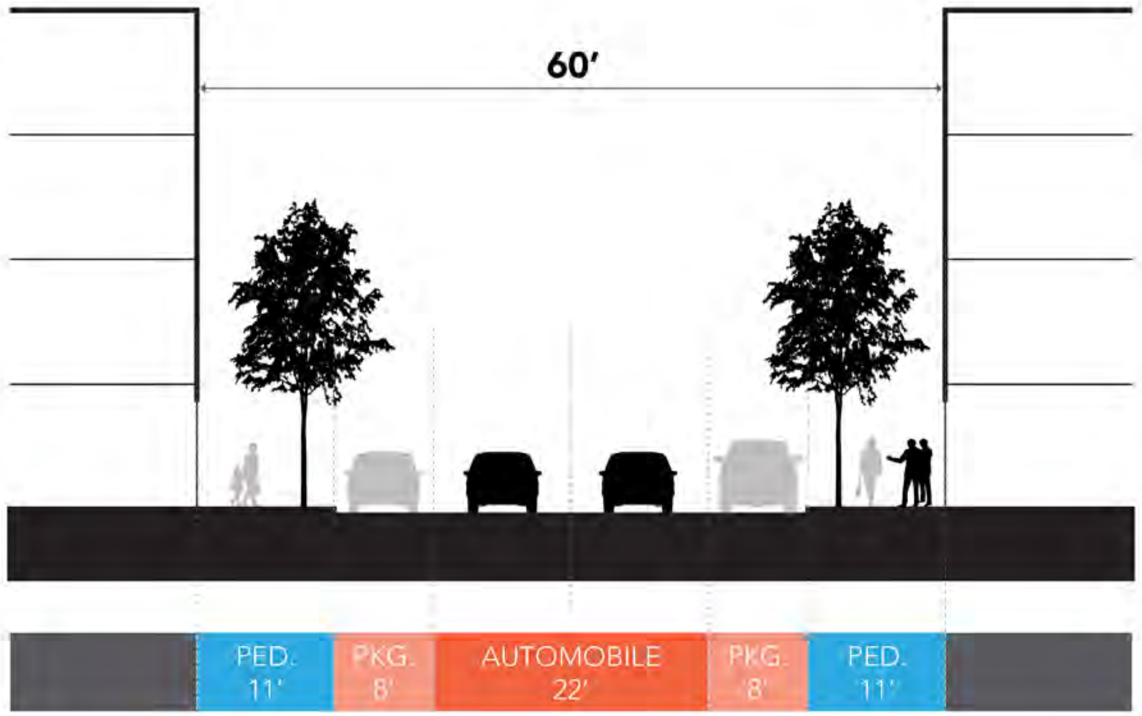


FIGURE 4.22: SECONDARY ROAD

- 60' wide Right-of-Way
- 2 way traffic
- 11' travel lanes
- Curb-side parking
- Street trees

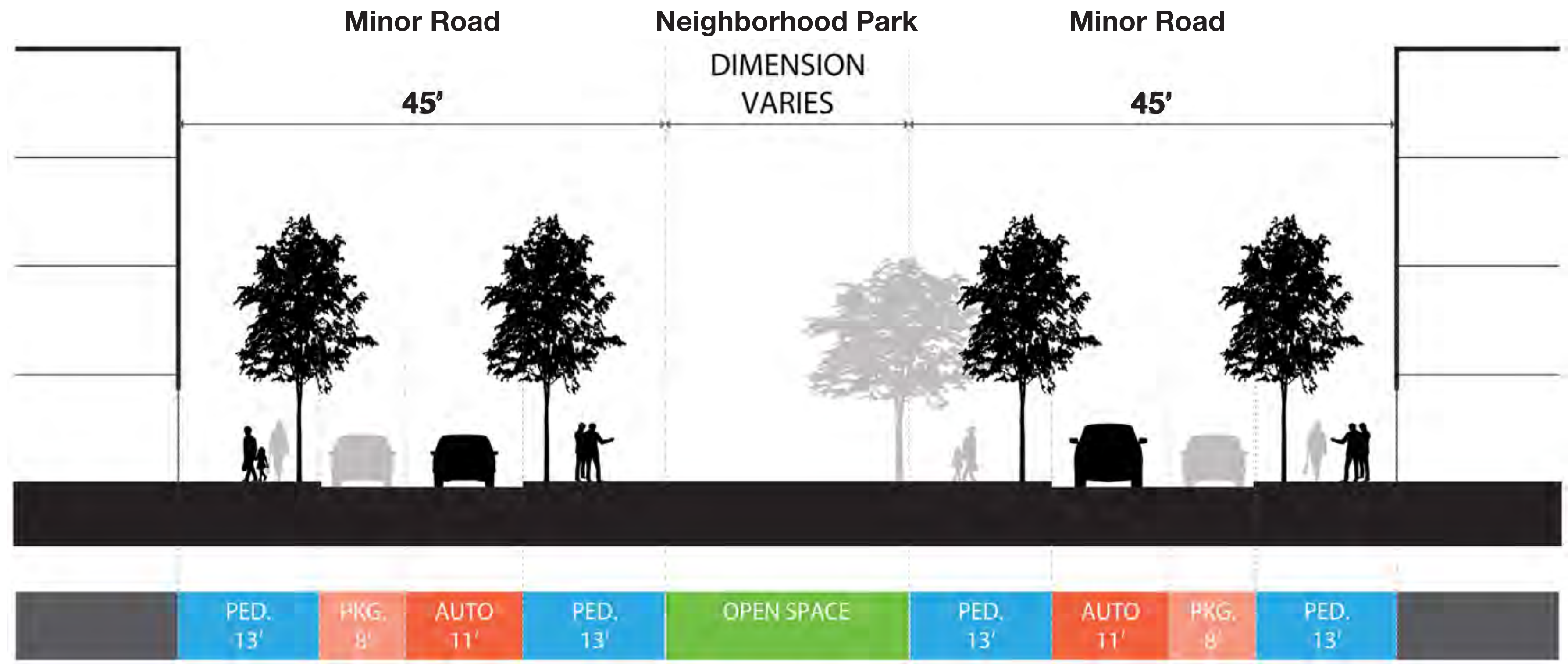
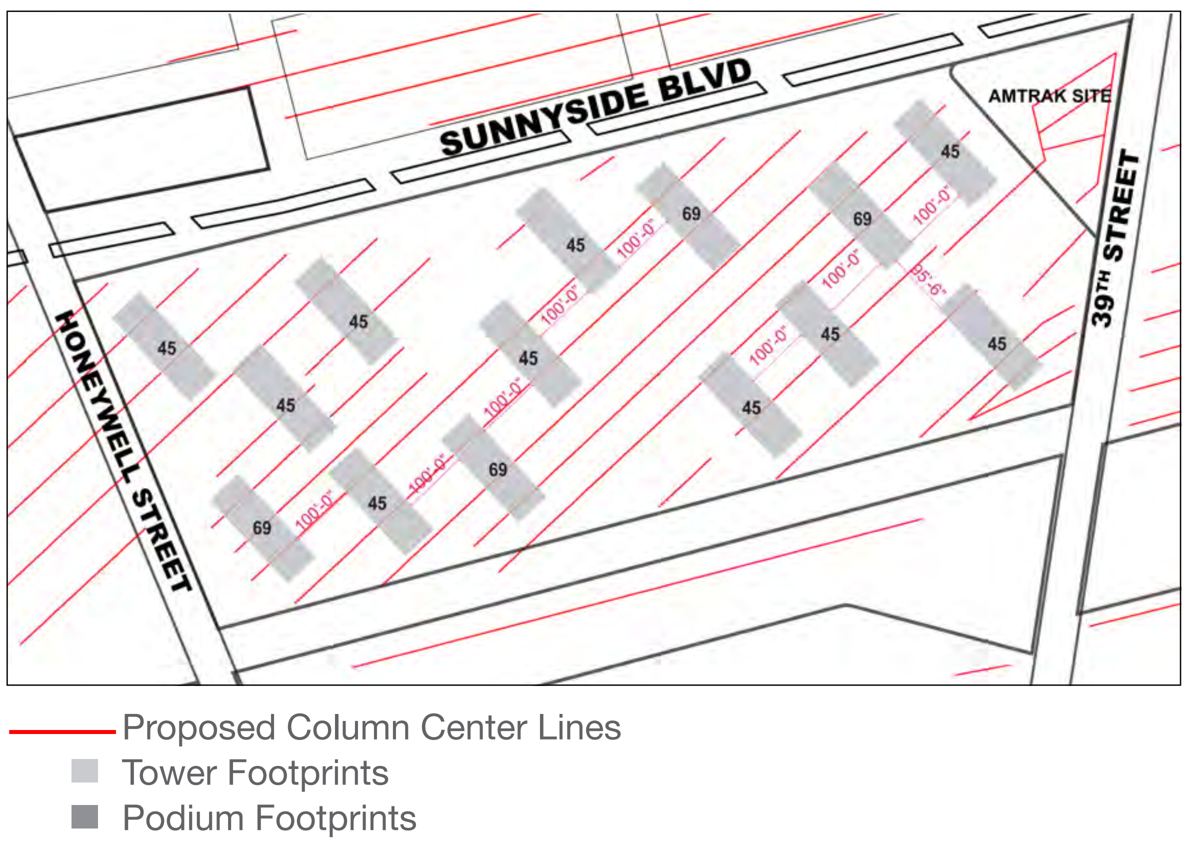


FIGURE 4.23: MINOR ROADS & NEIGHBORHOOD PARKS

- Two 45' wide Right-of-Ways
- Both 1 way traffic
- 11' travel lanes
- Curb-side parking
- Street trees
- Center open space varies by location and adjacent land use

Block Shape

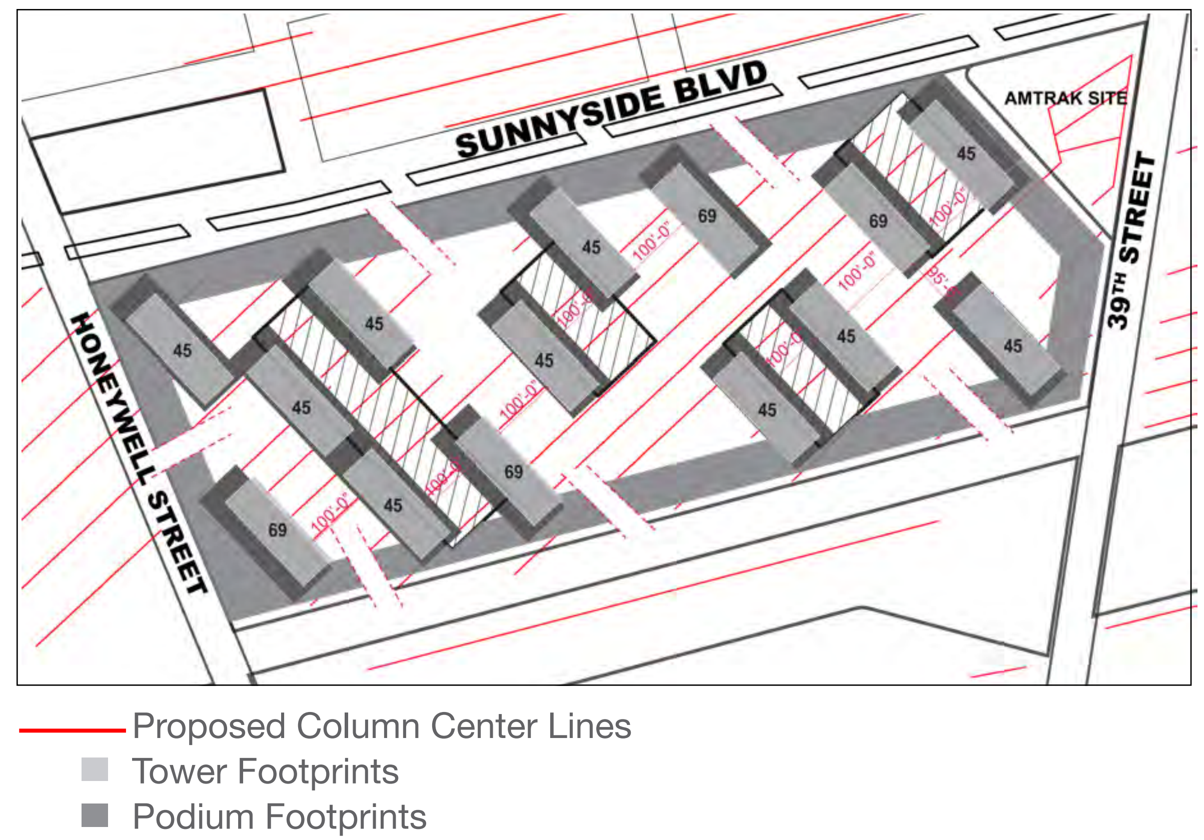
In order to optimize building structure, streets running generally north–south are aligned perpendicular to track and structural lines. When this street orientation is combined with the desire to provide east–west longitudinal roadway connections between existing bridges, generally parallelogram-shaped blocks are created. A study was undertaken of the impact of the block shape on potential building configurations and unit layouts within the buildings, particularly at the acute-angled corners. A variety of design solutions were developed, including chamfers, courtyard niches, and softened corners. The potential for numerous solutions established the viability of the trapezoidal block shape.



Spacing Optimized to Maximize Towers:

- Towers are placed in optimal locations in relation to the track and column spacing below.
- A distance of 100' between long faces of towers allows for minimal access to light and air.
- The given constraints allow for 14 tower footprints at 175' long by 60' wide.

FIGURE 4.24-A: TOWER SPACING OPTIMIZATION



Floor area Optimization with Streetwall Liner:

- 5 floor (60') liner added to increase floor area at minimal additional cost.
- Liner improves urban experience:
- Defines streetwall.
- Conceals structured parking.

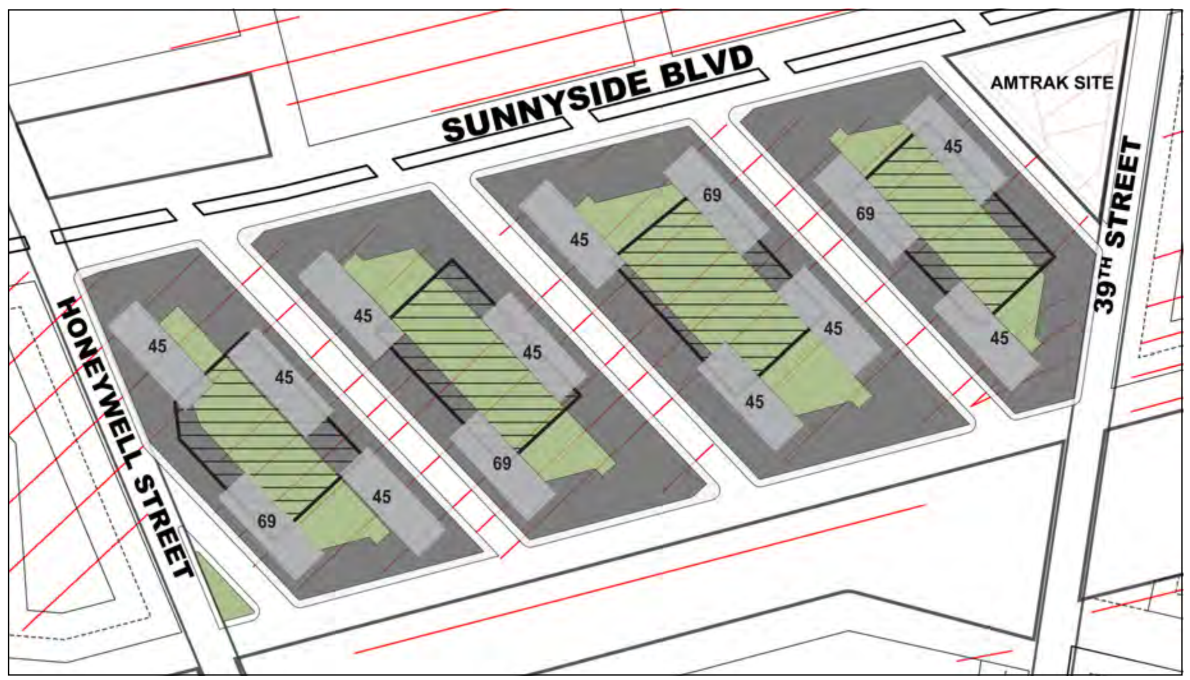
FIGURE 4.24-B: TOWER SPACING OPTIMIZATION WITH SUPERBLOCK PODIUM

Block Size and Depth

Block size and depth is influenced by tower locations, the need to provide access to towers, and the desire for a walkable environment. Blocks should create a connected, walkable network, while not overly reducing the area available for building development.

As part of street grid, block, and tower optimization, a central area of Sunnyside Yard was tested with a variety of block systems, from a perimeter superblock to typical New York City blocks to extra-deep blocks. The area between Honeywell Street and 39th Street was chosen for this analysis as it has the most regular column line configurations and the potential to achieve a high density of towers. (Figure 4.24-A)

The initial analysis assumed that keeping the boulevard north of this area in a zone where long deck spans limited building development, and creating regular blocks perpendicular to the tracks and column lines, would help maximize the number of towers. However the structural limitations north of the boulevard meant there could be no tall buildings in that area, and this created a largely single-loaded condition for the boulevard. (Figure 4.24-B/C)

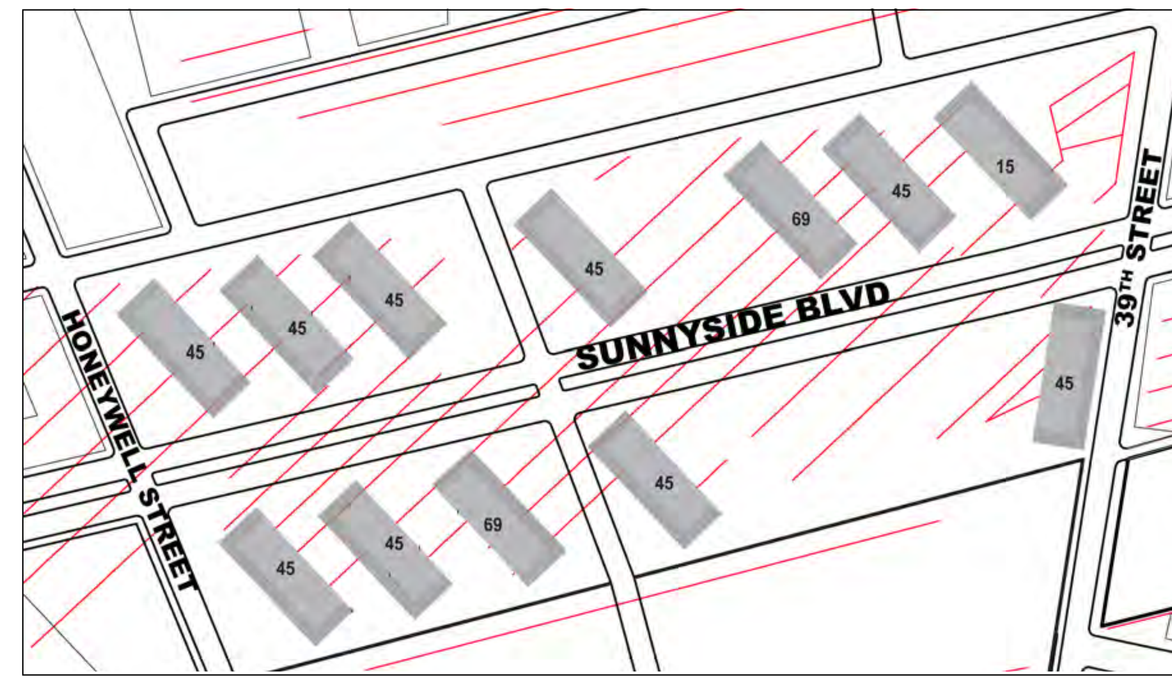


Proposed Column Center Lines
Tower Footprints
Podium Footprints

Tower Optimization with Regularized and Defined Streets:

- Regularized street grid applied with 5 story podium defining all street edges.
- Allows for the creation of an urban environment and a walkable block scale.
- Creates a single loaded boulevard & would be difficult to produce a complete neighborhood.
- Side boulevard impairs the creation of a connected gird.

FIGURE 4.24-C: REGULARIZED STREET GRID APPLIED



Proposed Column Center Lines
Tower Footprints
Podium Footprints

Tower Spacing Optimized to Accommodate Center Boulevard:

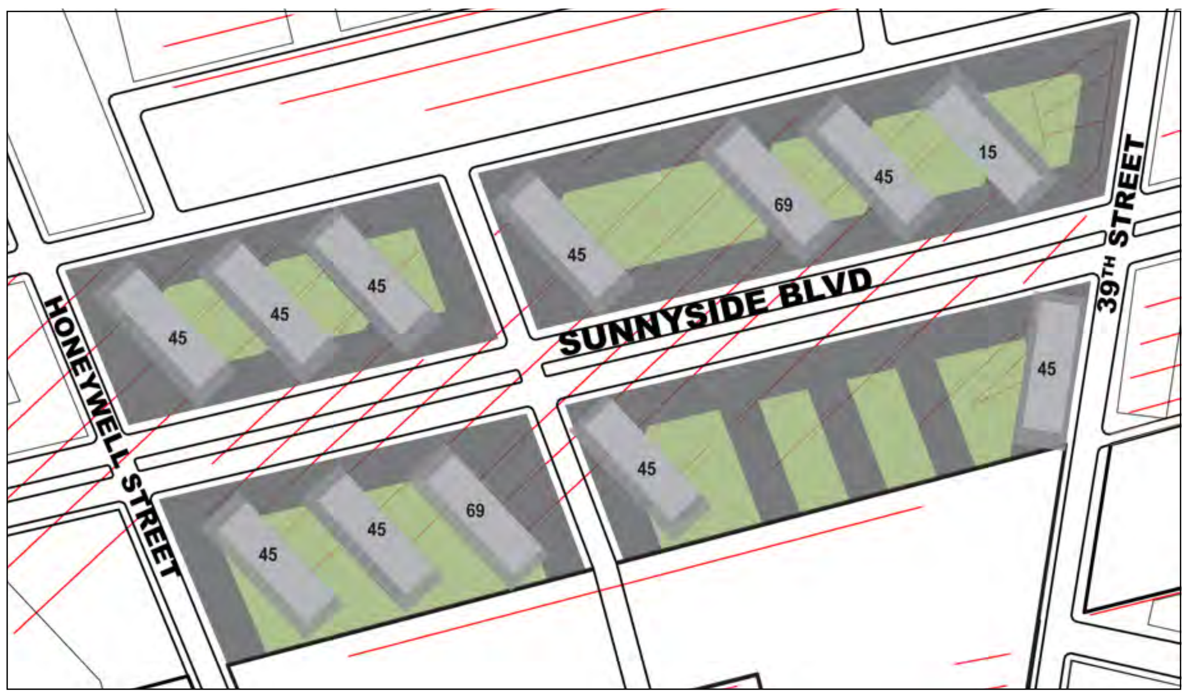
- Tower re-optimized with new more efficient center boulevard.
- Though having slightly less towers the urban condition with a double loaded boulevard is much more successful and conducive to active street life.
- The central boulevard also allows for less road surface area which allows for better financial feasibility. (See Section 5 for further reference)

FIGURE 4.25-A: TOWER OPTIMIZATION WITH CENTER BOULEVARD

The analysis showed that by shifting the boulevard south to run through the center of this core area, the number of towers could still be optimized. The more southern boulevard location provides other benefits as well. The centralized location allowed for double loading the vehicular corridor and creating an effective circulation spine, more coherent phasing, and a strong identity. (Figure 4.25-A/B)

For the purposes of this study, the maximum number of technically feasible towers was evaluated for marketability at a high level. While dense and walkable mixed-use neighborhoods are in high–demand and often result in increased property values, there is a point where an increase in density negatively impacts the quality and livability of the environment.

To improve marketability, some additional modifications were made to block length, walkability, and access to light and air. (Figure 4.26) While these modifications slightly reduced the number of towers, they yielded a more successful urban environment. The resulting development blocks are generally 300’ in depth. While the length varies greatly, the average length for blocks with building development is around 480’. Shorter open space blocks, and open space areas within blocks are interspersed to add variety and relief to the long street walls and improve walkability and connectivity. While not always feasible, blocks over 650’ in length should be discouraged.

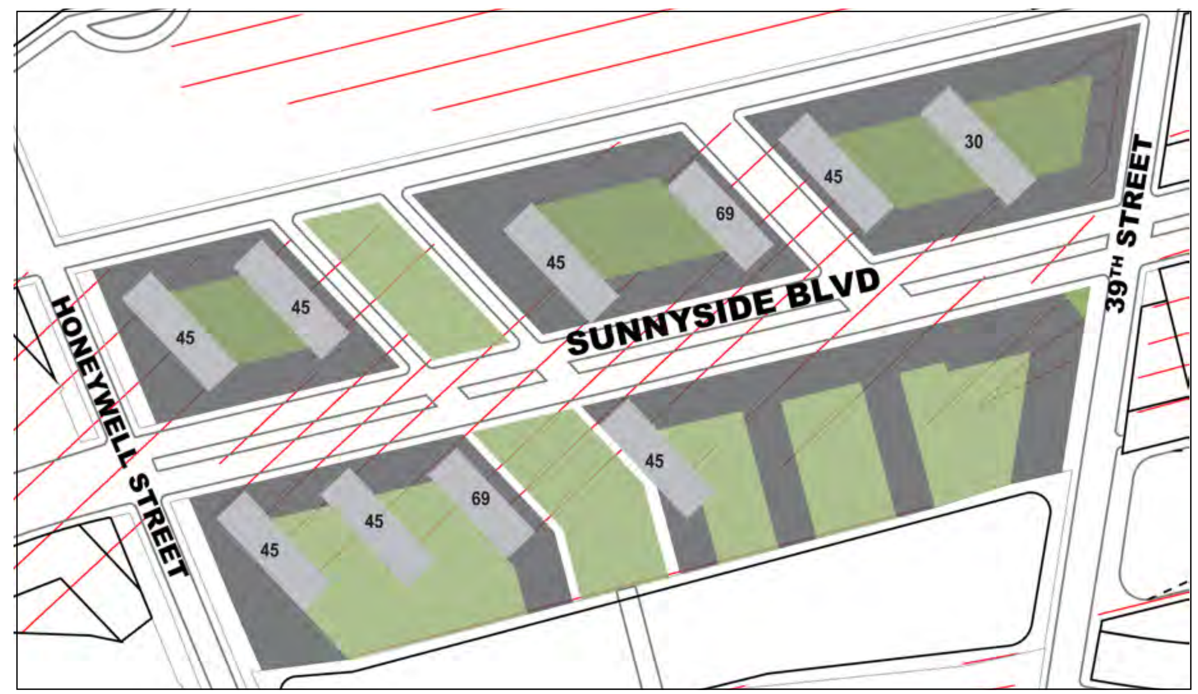


Proposed Column Center Lines
Tower Footprints
Podium Footprints

Tower Spacing Optimized to Maximize Towers:

- 5 floor (60’) podium added to increase floor area and define streetwall.
- Back of house and parking are now front the open Main Line.
- Tower footprints lengthened to 195’ where structure would permit to increase financial feasibility.

FIGURE 4.25-B: STREET GRID AND DEFINED STREET WALL APPLIED WITH 195’ LONG TOWERS



Proposed Column Center Lines
Tower Footprints
Podium Footprints

Tower Locations with Urban Design Principles Applied:

- Towers removed to create a more generous pedestrian realm.
- Tower spacing increased in key areas to allow for better light and air.
- Podiums cut back and shaped to facilitate pedestrian movement and create more optimal program usage.

FIGURE 4.26: FINAL TOWER OPTIMIZATION WITH URBAN DESIGN CONSIDERATIONS

Transit

An effective transit network is required to serve development at Sunnyside Yard. As discussed in Chapter 2, subway and bus lines in the adjacent areas already serve the area well. The networks and existing stops are generally well located for overbuild development, with the vast majority of Sunnyside Yard lying within a 5-minute walk of an existing subway stop. However existing transit networks lack capacity to handle the additional development of a full buildout. Investments would need to be made to improve capacity at existing subway lines and stations.

Bus, BRT, and even streetcar or light rail networks could be accommodated on the proposed new street network. Skillman Avenue could also be a potential location for a surface transit line.

The feasibility study for Sunnyside Yard assumes the construction of the previously proposed Sunnyside Station. Located along Queens Boulevard, the station's basic configuration was developed in the early 2000's and was included in the Environmental Impact Statement for the East Side Access project. The station would serve LIRR lines and provide a quick connection to midtown Manhattan. It would also help reduce pressure on subway lines surrounding Sunnyside Yard. An overbuild development would increase demand for transit, and Sunnyside Station is an important way of increasing capacity.

This study assumed the same functional configuration of the previously proposed Sunnyside Station, while describing the potential for expanding and shifting the headhouse component to have a greater presence on Queens Boulevard. (Figure 4.27-A/B) There is also the potential to add an additional elevated station stop on the No. 7 subway line on the Queens Boulevard Bridge, and connect this to Sunnyside Station as a possible intermodal station. Sunnyside Station and the open space in front of it would become the terminus and western anchor to Sunnyside Boulevard, creating a civic presence at this key intersection. Office and retail uses along Queens Boulevard could also be anchored and enhanced by this key transit node. Sunnyside Station is a key component of providing transit access to the site and any such station should be fully connected to the pedestrian network.

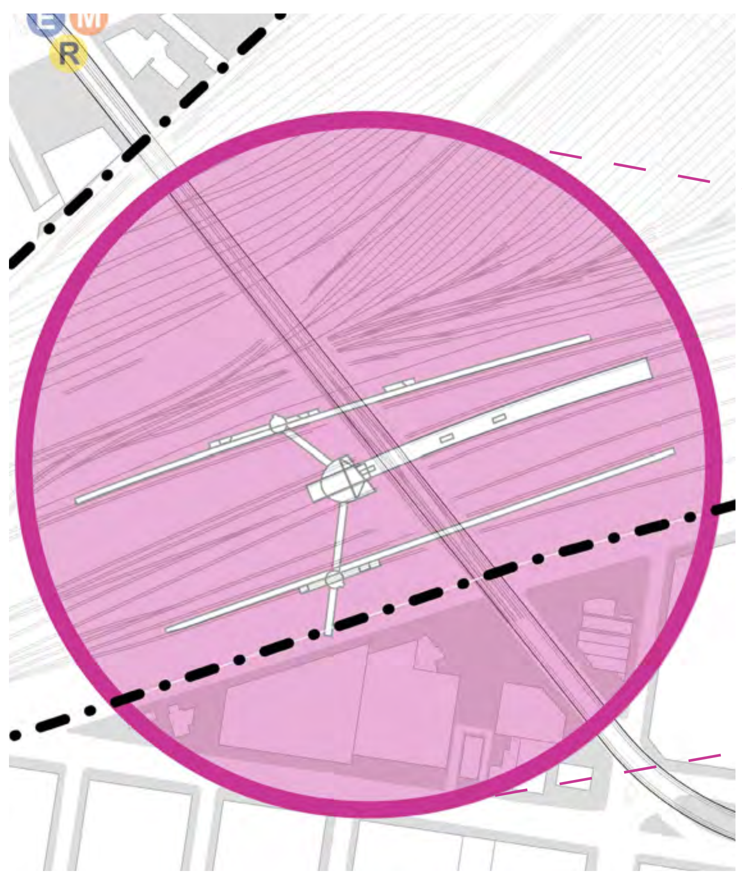


FIGURE 4.27-B: SUNNYSIDE STATION AND FUTURE TRACK LAYOUT

FIGURE 4.27-A: SUNNYSIDE STATION IN CONTEXT

6. Open Space Network

Open space is required for good neighborhoods, especially in high-density environments. The decking over of large portions of Sunnyside Yard provides opportunities for the creation of a diverse range of open spaces that could be integrated into an overall development. The open spaces studied and described as part of the overbuild have the potential to make a significant contribution to quality of life in both the study area and existing surrounding neighborhoods. Different types of open space would also help to define the character of the new neighborhoods and navigate the transitions between existing neighborhoods and new development.

The potential location and configuration of major open spaces is driven primarily by the limited structural capacity of certain areas of the deck. In these areas, development of towers is infeasible but parks can be supported by the structure. The resulting open spaces afford significant opportunities for new community amenities. These spaces, along with smaller open spaces interspersed through the development could form an interconnected network of green space onsite that would be nearly 31.5 acres in size, representing approximately 17.5% of the project site. This does not include the area of the studied offsite expansion of existing Lou Lodati Park, which would contribute an additional 4.5 acres of open space (2.4 acres in Lou Lodati Park and an additional 2.1 acres offsite) The open spaces described include discrete open spaces – some elevated, some at-grade, and some closely linked to schools and other public or civic uses. Two larger open space areas would become Anchor Parks serving the new neighborhood districts. (Figure 4.28)

Diverse size and extensive distribution throughout the site would enable the open spaces to be easily accessible from nearly every development parcel and adjacent neighborhoods. Relative to the projected residential population, the aggregate open space described provides approximately .97 acres per 1,000 residents. While this is below the recommended CEQR target of 1.25-acres per 1,000 residents, the quantity is equal to or above what is provided by other large-scale developments in New York City.

These open spaces can accommodate a broad range of programs and uses. The potential program and uses for the open spaces are informed by their size and configuration as well as the adjacent land uses and development programs. The open spaces vary in size from .05 to 11.7 acres. Within the overall network of diverse open spaces, three primary open space typologies are proposed: anchor parks, plazas and pocket parks, and linear parks.

FIGURE 4.28: OPEN SPACE NETWORK

Yard Park (Anchor Park)

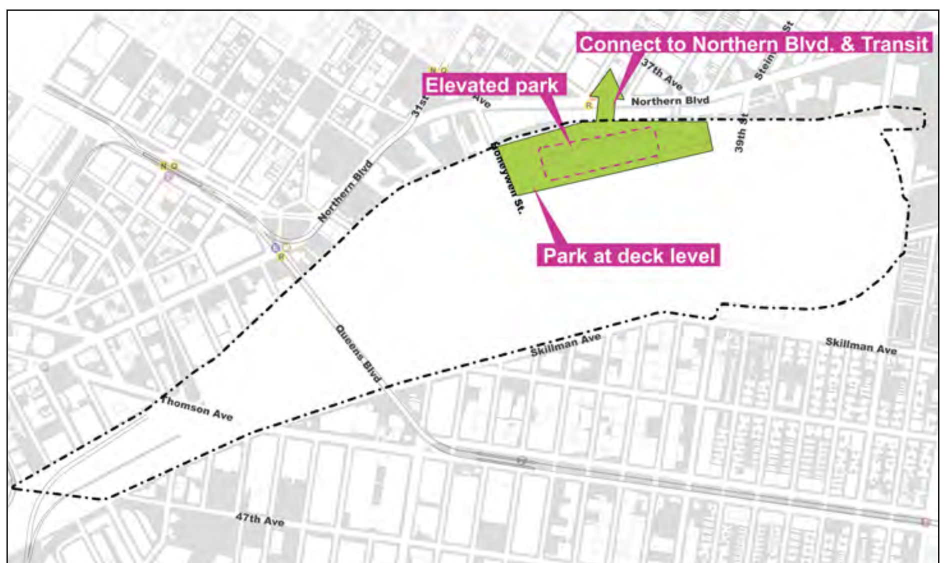
This open space would lie along the northern site boundary. The park is largely positioned above Amtrak's future High Speed Rail Facility which will protrude above the level of the surrounding deck. The constraints of building above this structure suggest a multi-level open space that incorporates the facility. This configuration can support active recreation facilities: sports fields, ball courts, etc. and should include the planting of larger trees to complement the active recreation program. These facilities would be an amenity for the denser residential areas proposed immediately to the south. Access can be provided from Northern Boulevard making it accessible to the neighborhoods to the north. (Figure 4.29)

Sunnyside Commons (Anchor Park)

Located at the southeast corner of the site, bordering Skillman Avenue and 43rd Street, this open space would expand and extend the existing 2.4 acre Lou Lodati Park and could include and additional 2.1 acres of offsite green space. The park would be located at grade and would provide an attractive buffer as an interface between the existing low scale and historic Sunnyside Gardens neighborhood and the proposed new development. The park would deck over the Loop Track where development of buildings is challenging. It would serve as a significant community amenity and could provide a range of programmatic elements such as a broad lawn, large shade trees, community gardens, athletic courts, a dog park, and water features. (Figure 4.30)

Plazas and Pocket Parks

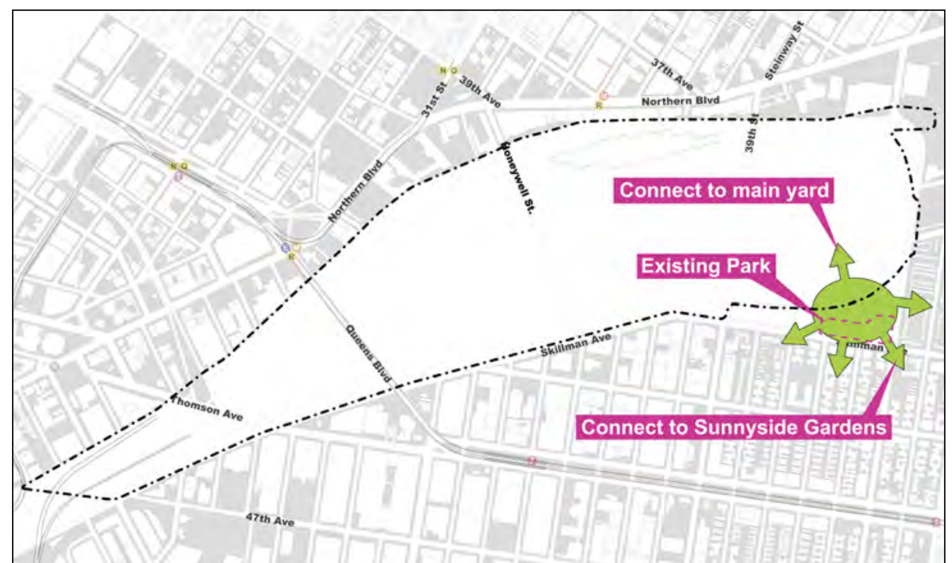
Numerous urban plazas are intended to be distributed throughout the overbuild, ranging from gateway plazas to shaded pocket parks. Studied at a variety of scales, embodying aesthetic and design diversity, these open spaces should provide a range of user experiences and distinctive local character. They can be located where structural constraints limit overbuild. These smaller spaces contribute to a network of open space connections across the site. (Figure 4.31)



Yard Park:

- Multi-level park to mediate Amtrak rail facilities.
- Major pedestrian connection to Northern Boulevard and transit.
- Active recreation and sports fields due to structural limitations of intensive planting.

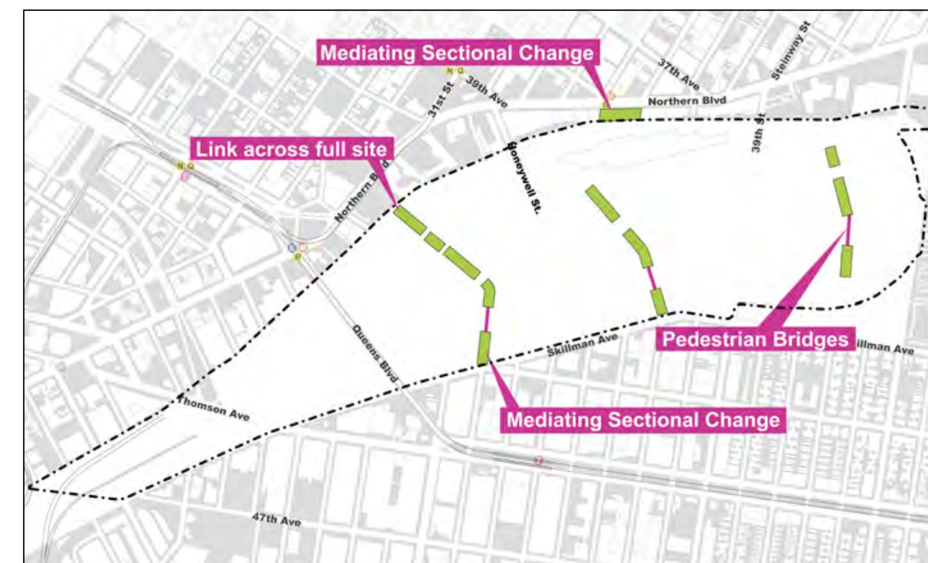
FIGURE 4.29: YARD PARK



Sunnyside Commons:

- Engage with Sunnyside Gardens neighborhood.
- Expand on existing park and playground.
- Variety of amenities including lawns, trees, and courts.

FIGURE 4.30: SUNNYSIDE COMMONS



Plazas and Pocket Parks:

- Varied in scale and program.
- Form a pedestrian network across the site.
- Help to mediate grade change between deck and street.

FIGURE 4.31: PLAZAS AND POCKET PARKS

Linear Parks

"The Sideline" A New Regional Amenity

A linear park could run along the northern edge of the project site, here dubbed "The Sideline". This public space would provide a buffer between the overbuild and immediately adjacent existing structures. Some 13 streets crossing Northern Boulevard currently dead-end into the Sunnyside Yard site. This park has the potential to leverage these dead-ends, transforming them into programmed public spaces with direct connections to the adjacent overbuild. (Figure 4.32) "The Sideline" could also tie into the Montauk Cutoff, an abandoned freight rail line, a segment of which is currently being considered by the MTA for development as a High Line-style public open space. (Figure 4.33 A/B/C/D)

Other Linear Parks

Other linear parks and pedestrian routes are intended to work in conjunction with the street network, creating a secondary set of north-south routes, which, with the existing bridges, form a roughly radial network of streets and open spaces. Linear parks, parkways, and pedestrian bridges form these linear green routes connecting across the site.

FIGURE 4.32: SIDELINE

Illustrative Deck Access Points

FIGURE 4.33-A: SKATE PARK

FIGUARE 4.33-B: CINEMA + VISUAL ARTS

FIGURE 4.33-C: URBAN WATERFALL

FIGURE 4.33-D: SHARED GROVE

7. Schools, community facilities, neighborhood retail

The potential Sunnyside Yard overbuild is intended to be a complete community (or communities), with schools, civic and cultural facilities, neighborhood retail, and other onsite amenities. To achieve this, established standards, planning ratios, and precedents were used for this study and are recommended as a starting point for future study and development. Schools should be planned using ratios consistent with CEQR to determine the size and type of school. Community facilities and neighborhood retail uses should be planned for using ratios consistent with thresholds established by appropriate precedents.

Schools, community facilities, and neighborhood retail should be distributed throughout the project's multiple neighborhoods with the goal of locating the amenities within a 10-minute walk of all residents. Neighborhood retail and community facility uses should be integrated with residential and commercial uses, and co-located in the same buildings as those primary uses wherever feasible. Neighborhood retail should be used to activate the ground floors of buildings and adjacent public realm to enhance the pedestrian experience.

8. Parking

Parking assumptions in the feasibility study were made to provide a realistic approach to parking, accommodating the required parking while also considering potential costs and impacts on the public realm. While every effort should be made to make walking, public transportation, and cycling as accessible and functional as possible, parking will need to be provided, and should be considered as part of an integrated transportation system. Parking should be integrated with building development and shielded from direct view. While freestanding parking garages are less costly than those integrated within development, they are aesthetically less attractive and destructive to the quality of the public realm.

Consumer mobility behavior is expected to change drastically over the next two decades. Over the timeframe of the project, the rise of car-sharing, automated vehicles, and other technological advances suggest that car ownership and parking requirements may decrease. However, to be conservative, for this feasibly study parking ratios for each program type are based on an analysis of current parking requirements in surrounding zoning districts, actual parking demand at comparable projects, and applicable current parking regulations. The underlying parking ratio assumptions are:

- Residential: 0.3 spaces per residential unit
- Office: 1 space per 4,000 GSF
- Mixed-Use Retail: 1.96 spaces per 1,000 GSF
- Higher Education: 1 space per 4,500 GSF

Self-parking at 350 GSF per space has been assumed for low-rise residential buildings. For other typologies, including other residential and commercial typologies, valet parking and stackers have been planned for at 250 GSF per space. As with many of the assumptions underlying the feasibility study, these parking assumptions may not accurately describe parking strategies employed in individual buildings, but taken in sum they provide an accurate basis for feasibility.

C. Planning Principles

An overbuild development at Sunnyside Yard would be a long-term project that would become a new neighborhood – or neighborhoods – with broad impacts. Large–scale buildings and higher densities will be required to maximize the development potential and the economic viability of the project. Strong and consistent placemaking strategies are essential to balance and "humanize" the scale and density of development, even at this feasibility level of study. The density and scale of the project will also demand design innovation and excellence to create a compelling skyline and first-class public realm.

The planning principles proposed embrace urban design strategies that support both functionality and placemaking for the development of Sunnyside Yard.

1. Create a well-connected environment, including physical, transportation, and visual connections.

Development at Sunnyside Yard should be well-connected within the site, to adjacent neighborhoods, and to the rest of the city via road and transit networks. Direct connectivity between an overbuild and adjacent neighborhoods is difficult due to the access challenges described earlier in this chapter. However, building over Sunnyside Yard could stitch together the adjacent neighborhoods now separated by a perceived "no-man's land".

Successful urban environments require a high degree of connectivity across multiple modes of transportation. High connectivity requires a transportation network with the capacity, organization, and redundancy to permit ease of movement in multiple directions and provide access to other parts of the city.

Good vehicular, transit, bicycle, and pedestrian networks are essential to the success of future development, as residential, commercial, retail, and community facility land uses all benefit from good transportation. Connections to and between different transportation modes should be clear and direct.

Pedestrian links can be a combination of pedestrian-friendly streets and open spaces, ideally connecting to and extending existing offsite networks as part of an overall system. Onsite street grids and pedestrian walkways should form a continuous network between destinations and neighborhoods in different onsite development zones. (Figure 4.34)

2. Create new focal points, or nodes, and reinforce key existing ones, to help create a sense of place and identity.

Nodes and focal points are spatially or programmatically significant places or moments in the urban fabric. These can include transit stops, public open spaces, key intersections, areas of high activity, and civic or visual landmarks. Sunnyside Yard nodes must be considered both in areas of new development and in the immediately adjacent context. Focal points should reinforce the organizing framework of the development by marking key intersections, important uses, or terminating visual corridors.

New nodes would be created where the new Sunnyside Boulevard intersects with the four existing bridges. Sunnyside Station is also a key node as a transit gateway to the site, with a visual presence on Queens Boulevard. Other key open spaces may also act as nodes.

Existing areas of activity around the site, including Queens Plaza, should be incorporated into the planning of Sunnyside Yard. Other important offsite nodes, such as subway stops or civic buildings, should be physically or visually connected to new development. Highlighting these key elements would help establish a strong, legible identity for a Sunnyside Yard overbuild and supports a varied and connected urban experience for current and new residents alike. (Figure 4.34)

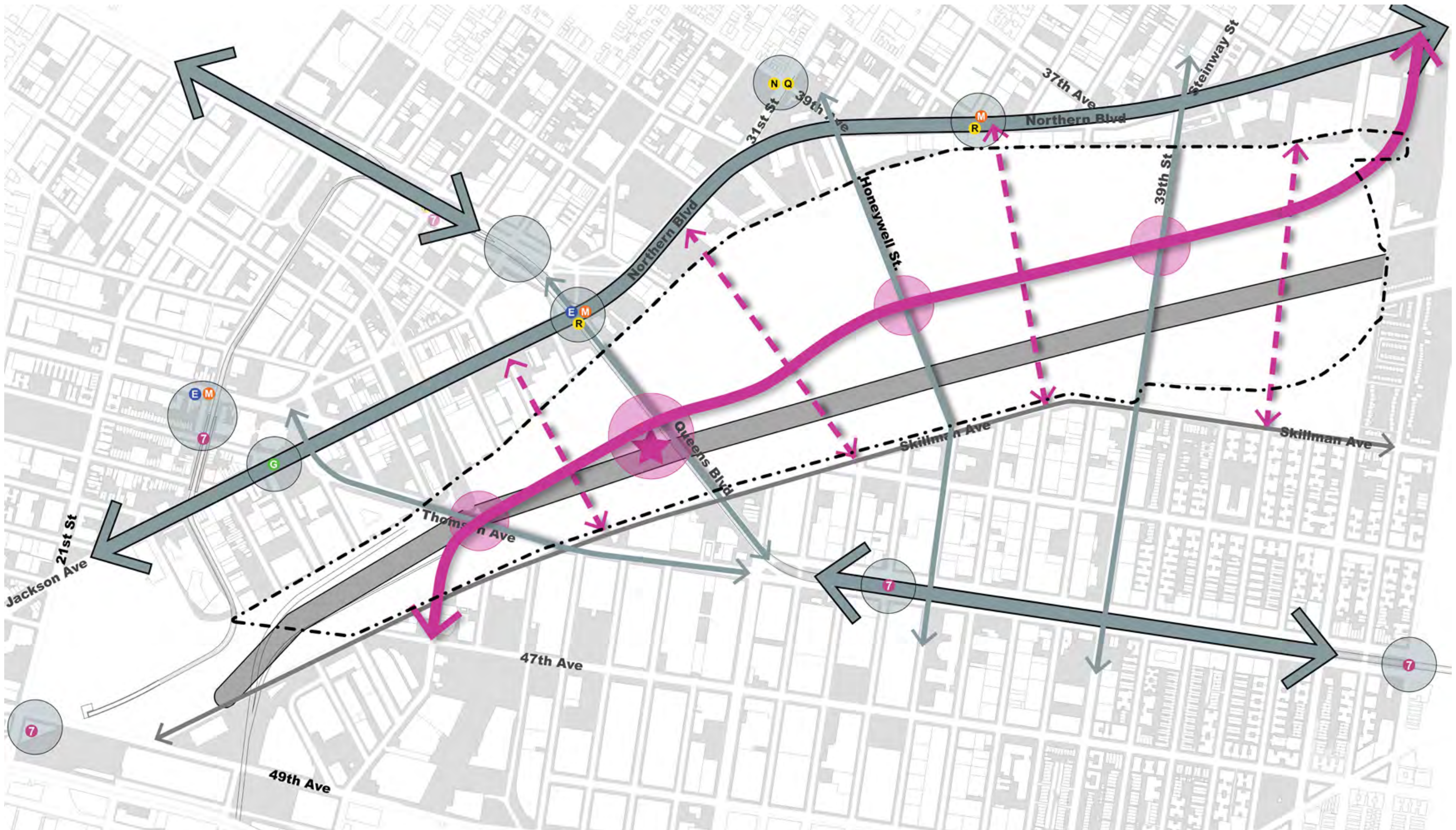


FIGURE 4.34: KEY NODES/CORRIDORS

Existing Primary Corridor
Existing Secondary Connections
Existing Nodes
Potential Primary Corridor
Potential Pedestrian Corridor
Potential Nodes
Sunnyside Station
Main Line

3. Embrace a mix of different uses in new development. Uses should respond to and complement use patterns of the surrounding context.

All development scenarios for Sunnyside Yard should include a mix of uses, including residential, retail, office, educational, cultural, and community facilities, as part of a comprehensive urban environment. A well-balanced mix is essential to the success of the Sunnyside Yard development. Although proximity to a mix of uses may not be the most significant variable affecting property values, a mixed-use environment, especially in a dense multi-family neighborhood, generally has a positive impact on property values and will improve the feasibility of the overbuild.

The mix of land uses should respond to the character of western Queens, and should complement and enhance the adjacent communities in use and scale. Market forces and City policy choices will also have an impact on the overall program mix and location of uses.

It should be noted that much of western Queens is currently undergoing significant change, and both land-use and scale patterns are in flux in many areas. Future growth patterns must be anticipated to the extent possible. Areas to the north and west of the site are currently experiencing growth with a number of high-rise buildings recently completed, under construction, or being planned. Areas to the south and east, including the IBZ zone and the Sunnyside Gardens Historic District are less likely to change in scale and use.

The organization of land uses should be guided by responses to the onsite and offsite contextual conditions. Understanding Sunnyside Yard in terms of general “use zones” provides a framework for organizing uses. The zones should be understood as broad generalizations of character and focus, not strict limitations or proposed zoning designations. Overlap and blurring of zone edges is encouraged, and exceptions to the generalizations may be merited. The following describes the general use and use zone principles. (Figure 4.35)

High Density Residential

The core of the residential uses should be located in the central and eastern areas of Sunnyside Yard. The more regular spacing of tracks in this area permits higher building heights and densities.

Transition Buffer/Mixed-use

There are two mixed-use zones that can act as buffers or transitions to adjacent neighborhoods. The northern mixed-use zone extends emerging commercial activity along Northern Boulevard and extends residential uses north from the core. Open space, retail, commercial office, creative office, schools, and residential uses should be integrated for this area. This area is also appropriate for mixed-use buildings. Due to track spacing, areas for high-rise towers are limited in this zone.

The southern mixed-use zone should provide active use frontage on Skillman Avenue to conceal the overbuild platform edge and to negotiate grade differences. This strategy takes advantage of a narrow strip of terra firma along the edge of Skillman Avenue for building lobbies, vertical circulation, and direct street-level access to buildings. The area is suitable for commercial, creative office, residential, educational, or institutional floor plates, and offers an area of transition to the mid-scale industrial, educational, and residential uses to the south.

Commercial/Office

The commercial/office core establishes a focus for commercial office and institutional uses near Sunnyside Station, supporting Queens Boulevard as a commercial spine, and extending the commercial focus of Queens Plaza east onto Sunnyside Yard. Commercial office uses in this location would take advantage of the many good subway connections in and around Queens Plaza, as well as a connection to the LIRR at Sunnyside Station. The noise and shadow of the elevated No. 7 subway line creates an environment less suitable to residential or retail use. While there is not a large market demand anticipated for office use, this section of Sunnyside Yard is seen as the area best suited for such uses.

Other Uses

Community and cultural facilities are assumed to be located within buildings with other primary uses (residential, office, or retail) with the exception of freestanding schools. Collocation is beneficial to the facilities and their users, and to the neighborhoods in general. For the purposes of this feasibility study, community facilities, other than freestanding schools, were not assigned specific locations, but accounted for as a percentage of the overall building development.

Neighborhood retail should be located throughout the site to complement residential, office, and other uses. As with community facilities, for the purposes of this feasibility study local neighborhood retail was not assigned to specific locations but assumed as a percentage of the overall building development (and assumed to be primarily a ground-floor use).

Parks and open spaces will be important amenities for the new development as well as an asset for adjacent neighborhoods. A variety of scales and types of open spaces offering a range of activities were studied. These open spaces are dispersed throughout the site to serve the new development, enhance the surrounding neighborhoods, and provide pedestrian linkages throughout the site. Open spaces are also best located where the development of towers is not feasible due to structural constraints or neighborhood context.

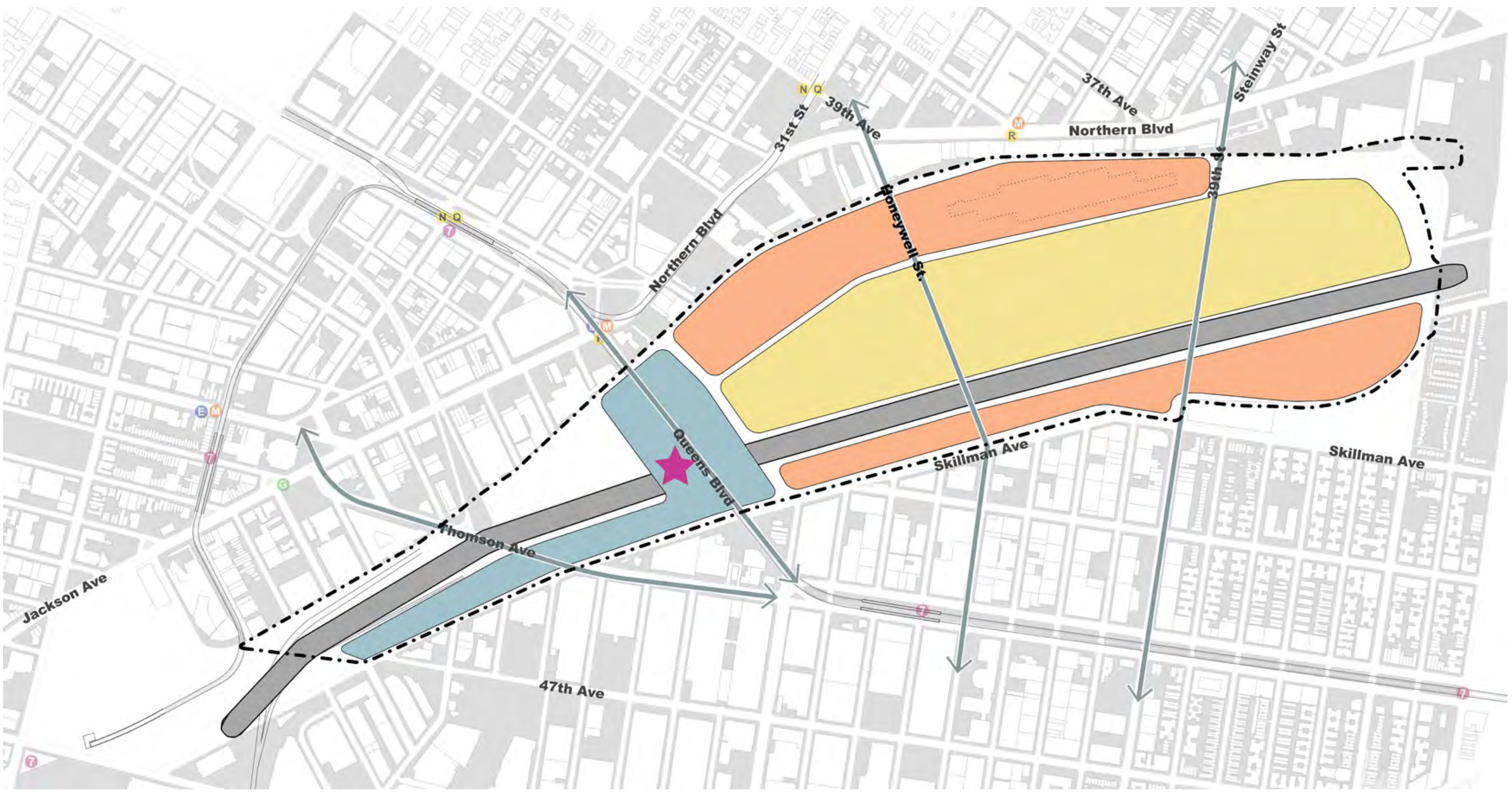


FIGURE 4.35: LAND USE LOCATIONS

High Density Residential
Transition Buffer/Mixed-use
Commercial/Office
Existing Bridges
Main Line
Sunnyside Station

4. Adjust density and height for new development in response to adjacent context, constraints of railroad operations, and structural systems.

Railroad operations and structural constraints limit where density and the tallest towers can be located. Additionally, density and height must be sensitive to the context of adjacent neighborhoods. (Figure 4.36)

- The highest densities and tallest structures should be located in the central portion of Sunnyside Yard, north of the Main Line, where regular track spacing allows for construction of taller towers, and the location offers some separation from existing context.
- Stepping down levels of density and height in the southeast area of Sunnyside Yard will allow a transition to the scale and historic nature of the Sunnyside Gardens community.
- The area along Skillman Avenue should also be limited to medium-high densities and heights because of the challenges of building near the Main Line tracks, and in response to the scale of the neighborhoods immediately south.
- Along the north-western section of Sunnyside Yard, structural constraints and railroad operations call for medium-low densities and heights.
- The lowest density and height lies in the northeast area of Sunnyside Yard where, due to the constraints of building over Amtrak maintenance facilities, open space was studied.

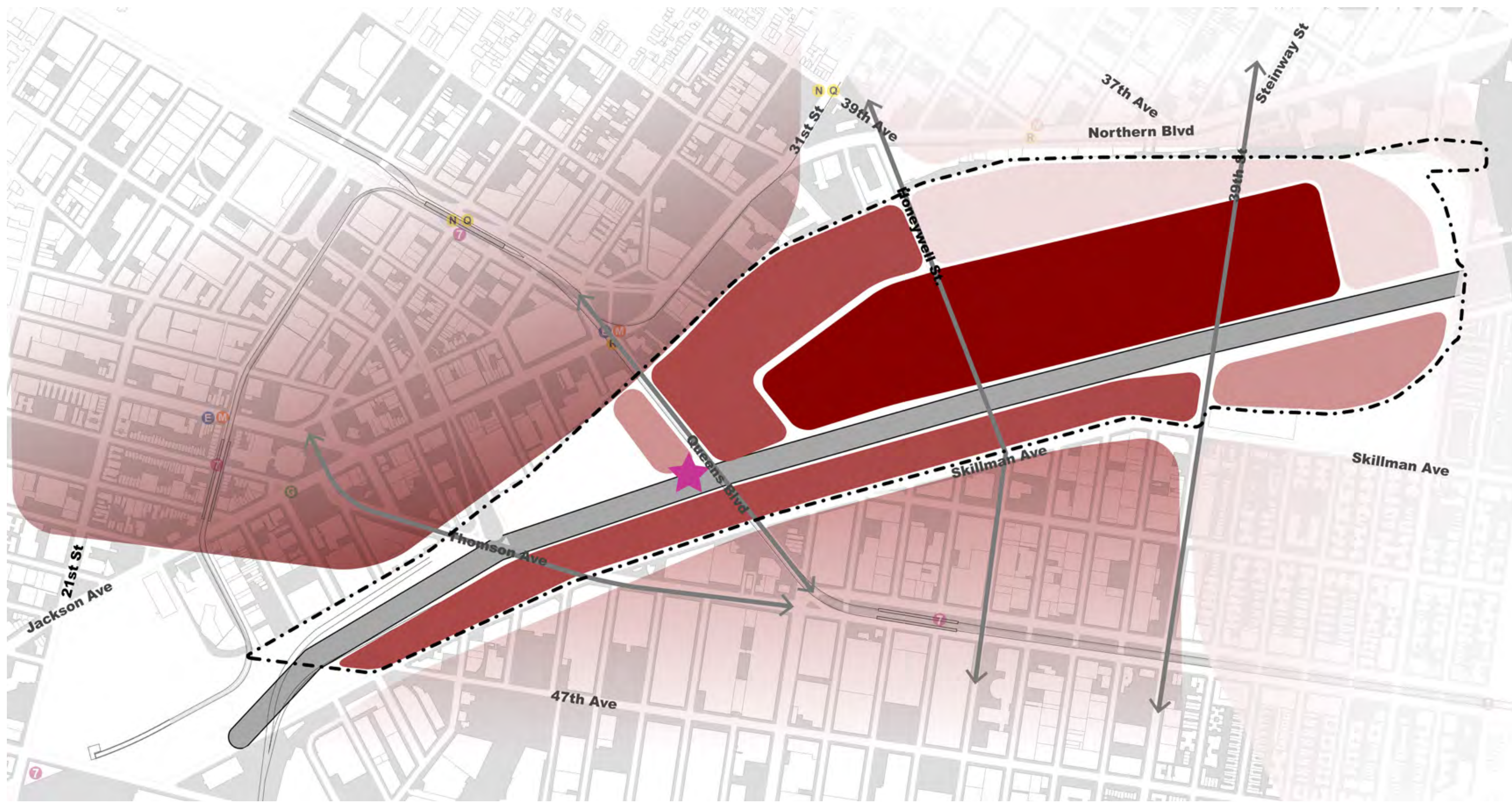


FIGURE 4.36: DENSITY

- High Density
- Medium/High Density
- Medium/Low Density
- Low Density
- Main Line
- High Density (Context)
- Medium/High Density (Context)
- Low Density (Context)

5. Create a sense of neighborhood within each new development zone by providing clear spatial focus and organization, by building on the character of surrounding neighborhoods, and by incorporating other placemaking techniques.

A comprehensive overbuild development of Sunnyside Yard will not result in a single unified district, with distinct identity and character. While it may be technically possible to deck over the heavily trafficked Main Line that cuts across the length of Sunnyside Yard, it is costly and presents challenges to railroad operations. Not decking over the Main Line creates a break in the continuity of the deck. Although mitigated by lightweight pedestrian bridges that connect its two sides, this gap nonetheless is likely to prevent an overbuild from feeling like a fully cohesive single neighborhood. The long-term build-out of the site also necessitates that construction will be phased.

An overbuild development would likely feel like a collection of diverse districts: some would feel like new neighborhoods, while others would seem like extensions of existing neighborhoods or transition areas at the edge of neighborhoods. Zones along Skillman Avenue, for example, might act like a "zipper" between existing uses south of Skillman Avenue and new uses on Sunnyside Yard. Similarly, the zone adjacent to Queens Plaza would emphasize the extension of Queens Plaza's commercial orientation and special focus. A generous and interconnected network of parks, plazas, and open spaces, including the pedestrian bridges over the Main Line, should connect each zone. (Figure 4.37)

It would be important that each phase of the project work and feel like a complete neighborhood district, with its own spatial focus and identity. A clear, legible, and complete organization, particularly of the public realm, will help to achieve this. Open spaces, civic focal points and streets with a strong identity and character should be part of each phase.

Each phase should strive to feel complete and not unfinished. The planning principles recognize that while each zone may be considered independently, the zones are inter-connected and inter-dependent.

The long-term build-out of Sunnyside Yard must be thought of holistically as the economic and urban design success of one zone will be influenced by development in other zones.

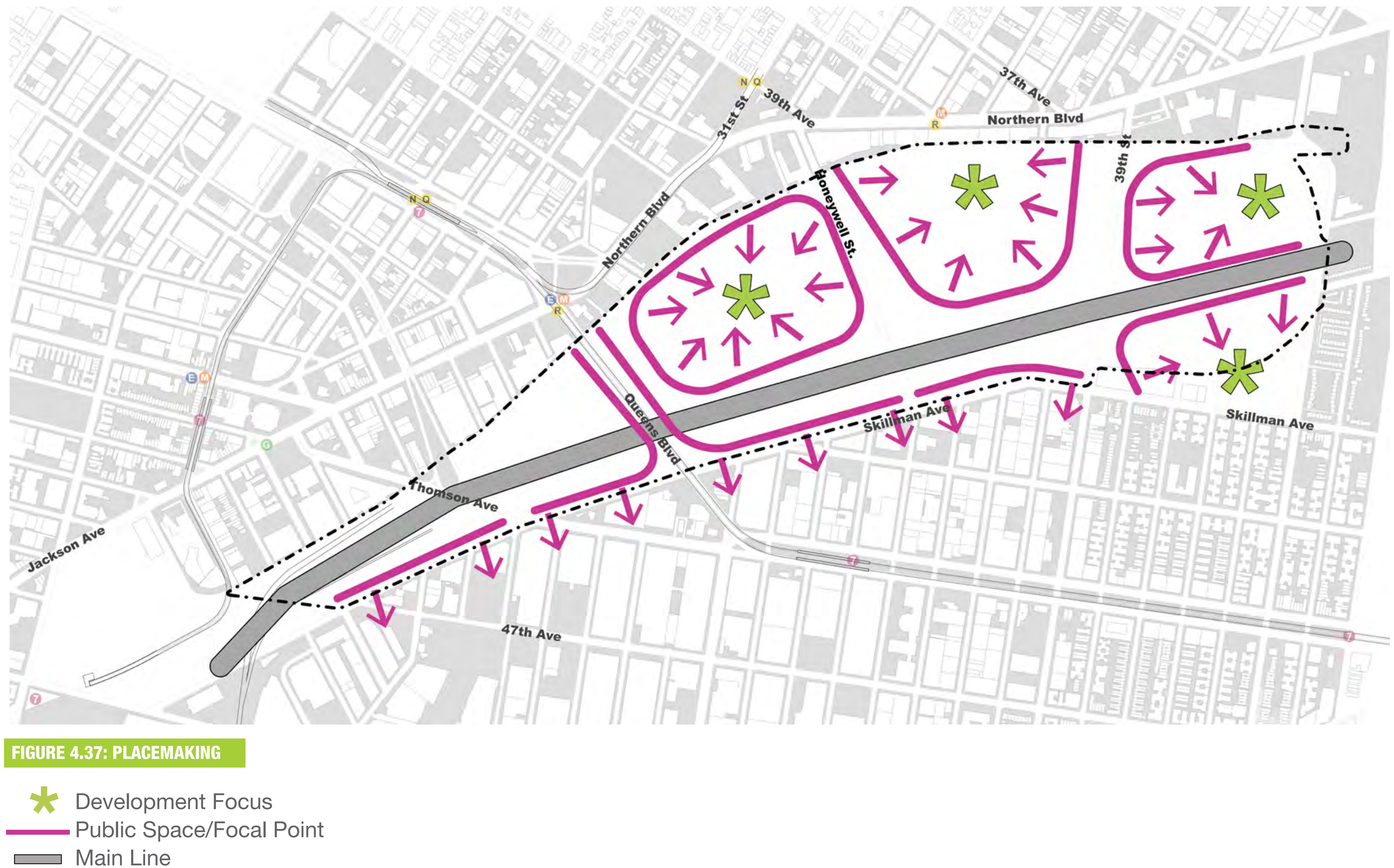


FIGURE 4.37: PLACEMAKING

C. Conclusion

This feasibility study describes a series of Overbuild Guidelines that provide strategies, principles, and general requirements for a potential overbuild development. The guidelines are based on constraints informed by structural and operational considerations, best practices for urban design, and optimizing the feasibility of an overbuild. The intent is to help future investigations of overbuild feasibility and the creation of a cohesive framework that enhances the form, scale, and character of overbuild development and its relation to the surrounding neighborhoods. These guidelines have established:

- Deck heights based on required rail clearances, and the need for localized relief from those clearance requirements to allow transitions to the bridges and activation of street frontages.
- A series of potential locations and strategies for accessing the deck from the surrounding neighborhoods.
- Guidelines for optimizing building and tower placement based on a defined set of building typologies.
- Block sizes and street network typologies and general character and placement.
- Standards and parameters used for testing feasibility for open space, schools, community facilities, neighborhood retail, and parking.
- Planning Principles that address:
  - Connectivity
  - Identity and placemaking
  - Use mix
  - Density and height
  - Spatial organization, focus, and character

These guidelines will contribute to the viability and quality of any overbuild. They help to create complete neighborhoods and a level of compatibility and consistency in planning and development of in the long term. More detailed development of these guidelines in the test cases is provided in the next chapter.

Chapter 5: Program Alternatives

Table of Contents

A. CHAPTER OVERVIEW

This feasibility study is only the first stage in a multi-step, multi-year, planning process that will be needed to realize a project of this scale and complexity. Future efforts would need to include more detailed analysis, master planning, and engineering. The key considerations and planning principles laid out in Chapter 4: Overbuild Guidelines, are intended to provide a foundation to assist future planners and decision-makers in addressing the challenges of developing Sunnyside Yard. This chapter offers a more detailed examination of the feasibility of overbuild, dividing Sunnyside Yard into smaller geographic sub-zones, each of which could be developed independently.

This study used three programmatic or land use themes to create “test cases”:

1. Residential
2. Live/Work/Play
3. Destination

The balance of uses in each test case was developed through an iterative process based on three analytical perspectives:

- Engineering - Rail operations and structural considerations;
- Economics - Market demand and real estate development parameters; and
- Urban Design - Surrounding communities and planning standards.

This iterative process was used to test strategies for minimizing impacts on railroad operations, improving financial feasibility, supporting mixed-use and integrated urban design, and achieving City public policy objectives.

While multiple options and scenarios were tested, the complex constraints considerably narrowed the range of alternatives. Three test cases are by no means the only solutions.

For this study Sunnyside Yard was divided into seven zones, “A” through “G,” based on relatively homogenous characteristics including ownership, railroad operations, physical landmarks and barriers, and construction constraints. Each zone was independently evaluated for feasibility. For the financial feasibility analysis, zones B and C were further subdivided into sub-zones (North and South).

This chapter describes the basic intent and character of each of the three test cases and gives a detailed description of each zone, its constraints, its configuration and its program. For some zones there is little or no variation between the test cases. The intent is that the zone-by-zone summaries would serve as a tool and a starting point for more detailed design and development of an individual zone. Lastly this chapter summarizes the methodology to evaluate the economic feasibility of each test case. To estimate project-wide feasibility, financial analysis was conducted to assess total project costs against total project revenues of each zone and test case. Also included in this section is an overview of horizontal costs, evaluation of possible sensitivities that could impact economic feasibility, and suggestions for possible phasing strategies.

B. Test Case Programs

The test cases were created to evaluate alternate development scenarios for Sunnyside Yard, determine how project goals can be met and maximized, and identify development strategies that can support project feasibility. The test cases have some significant similarities. For example, all have a large residential program and all assume that 30% of residential units will be permanently affordable per Mandatory Inclusionary Housing guidelines. The test case programs each achieve slightly different results, providing alternate scenarios for evaluation. (Figure 5.1) The test cases were analyzed as to their potential impact on railroad operations, ability to achieve economic feasibility within real estate market parameters, and urban design potential. The test cases are described in detail later in this chapter in Section C: Guidelines by Zone. The three test cases are:

Test Case 1 (Residential): A complete residential neighborhood that maximizes housing. Community facilities, parks, and neighborhood retail support the residential program. (Figure 5.2)

Test Case 2 (Live/Work/Play): A mixed-use district with a substantial residential component, a commercial office node comprised of Class A and creative office, and a higher education campus. Community facilities, parks, and neighborhood retail support the residential program. (Figure 5.3)

Test Case 3 (Destination): A mixed-use community, including residential, retail, community facilities, parks, neighborhood retail, entertainment, and cultural uses to support the residents, benefit the surrounding communities and attract visitors from across the city. (Figure 5.4)

	Test Case 1 Residential	Test Case 2 Live/Work/Play	Test Case 3 Destination
Residential	18.0 M – 24.4 M	14.2 M – 19.3 M	16.3 M – 22.0 M
Total # of Residential Units	18,000 – 24,000 units	14,000 – 19,000 units	16,000 – 22,000 units
30% Affordable Units**	5,400 – 7,200 units	4,200 – 5,700 units	4,800 – 6,600 units
Class A Office	0	3.5 M – 4.8 M	0
Creative Office	0	600 k – 800 k	0
Neighborhood Retail	700 k – 900 k	500 k – 700 k	600 k – 800 k
Mixed-Use	200 k – 300 k	110 k – 150 k	1.1 M – 1.5 M
Community Facilities/Schools	1.5 M – 2.0 M	1.0 M – 1.4 M	1.1 M – 1.5 M
# of Schools	13 – 19 schools	10 – 14 schools	10 – 14 schools
Higher Education	0	1.0 M – 1.4 M	0
Parking	700 k – 1.0 M	1.0 M 1.3 M	1.2 M – 1.6 M
# of Parking Spaces	2,400 – 3,300 spaces	3,300 – 4,500 spaces	3,900 – 5,300 spaces
Total Floor Area	**21.1 M – 28.6 M**	**22.0 M – 29.8 M**	**20.3 M – 27.4 M**
Open Space	38 – 52 acres	37 – 50 acres	31 – 42 acres

FIGURE 5.1: TEST CASE AREA COMPARISON*

* All numbers are in total square feet unless otherwise noted.
** Affordable housing follows MIH guidelines.

Test Case 1 (Residential)

Test Case 1 is a residential community that prioritizes housing and offers a mix of uses needed to create vibrant and desirable neighborhoods. In addition to a substantial amount of market rate and mixed-income affordable housing, the proposed development would include neighborhood retail, schools, cultural facilities, and community-focused open space.

Test Case 1 is advantageous in its ability to support a growing borough and City of diverse incomes. Compared to the other test cases, Test Case 1 has the largest quantity of residential use.

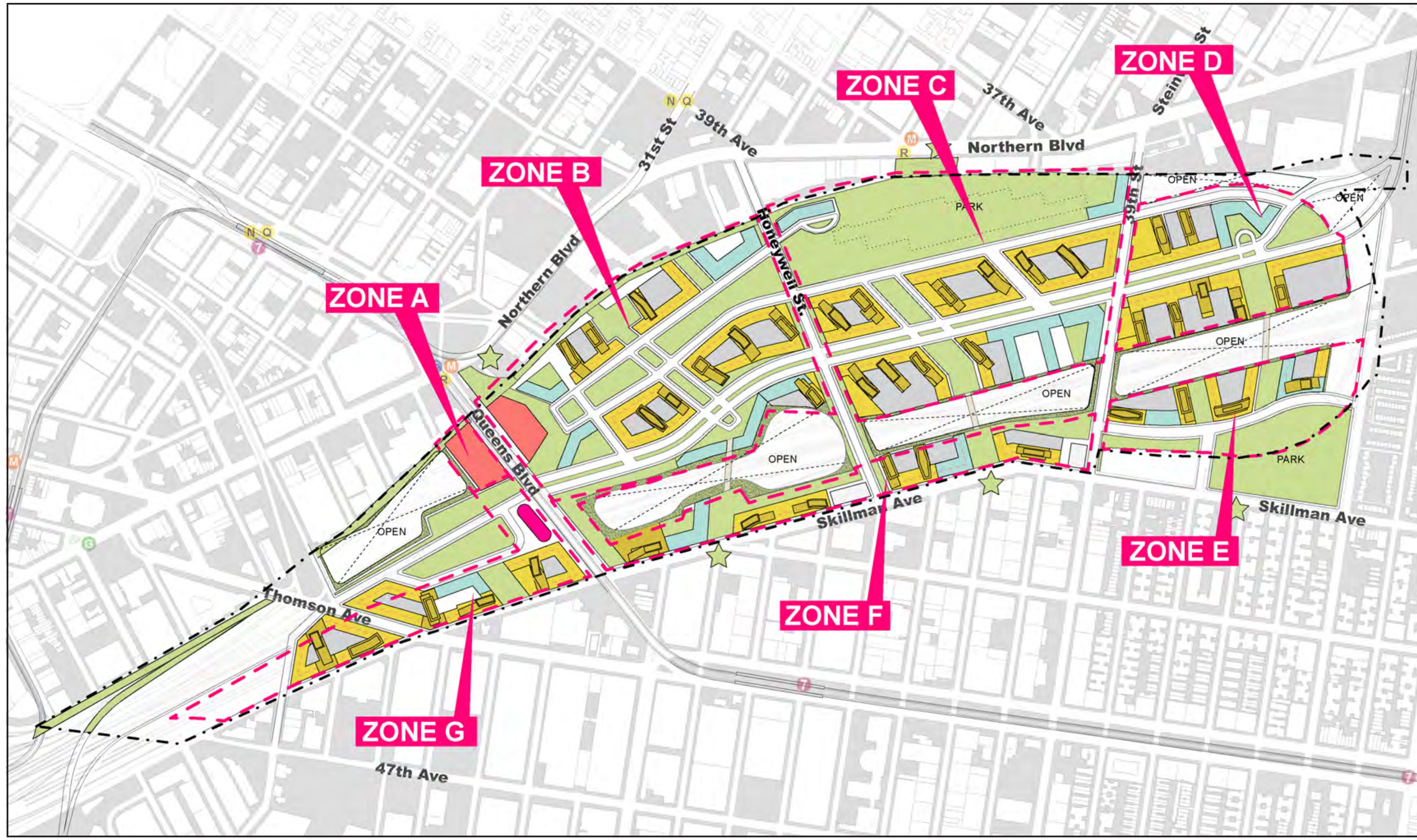


FIGURE 5.2: TEST CASE 1 - RESIDENTIAL

- Residential Podium
- Residential Tower
- Creative office
- Office Podium
- Office Tower
- Mixed-use
- School/Community
- Public Green Space
- Public Hardscape
- Landscape Buffer
- Parking
- Railroad Facilities
- Sunnyside Station

Test Case 2 (Live/Work/Play)

Test Case 2 has a balance of places to “live, work, and play.” Innovation thrives where uses blend together and informal collaboration can occur both at the park bench and at the lab bench. Test Case 2 is the only test case to offer office space and is designed to provide New York City’s modern workforce with best-in-class office space, nearby mixed-income residential opportunities, and an integration of production and consumption of goods and services.

The job creation potential of Test Case 2 is amplified through its mixed-use environment. Test Case 2 also accommodates a major higher educational campus, fostering entrepreneurial innovation and growing a stronger workforce.

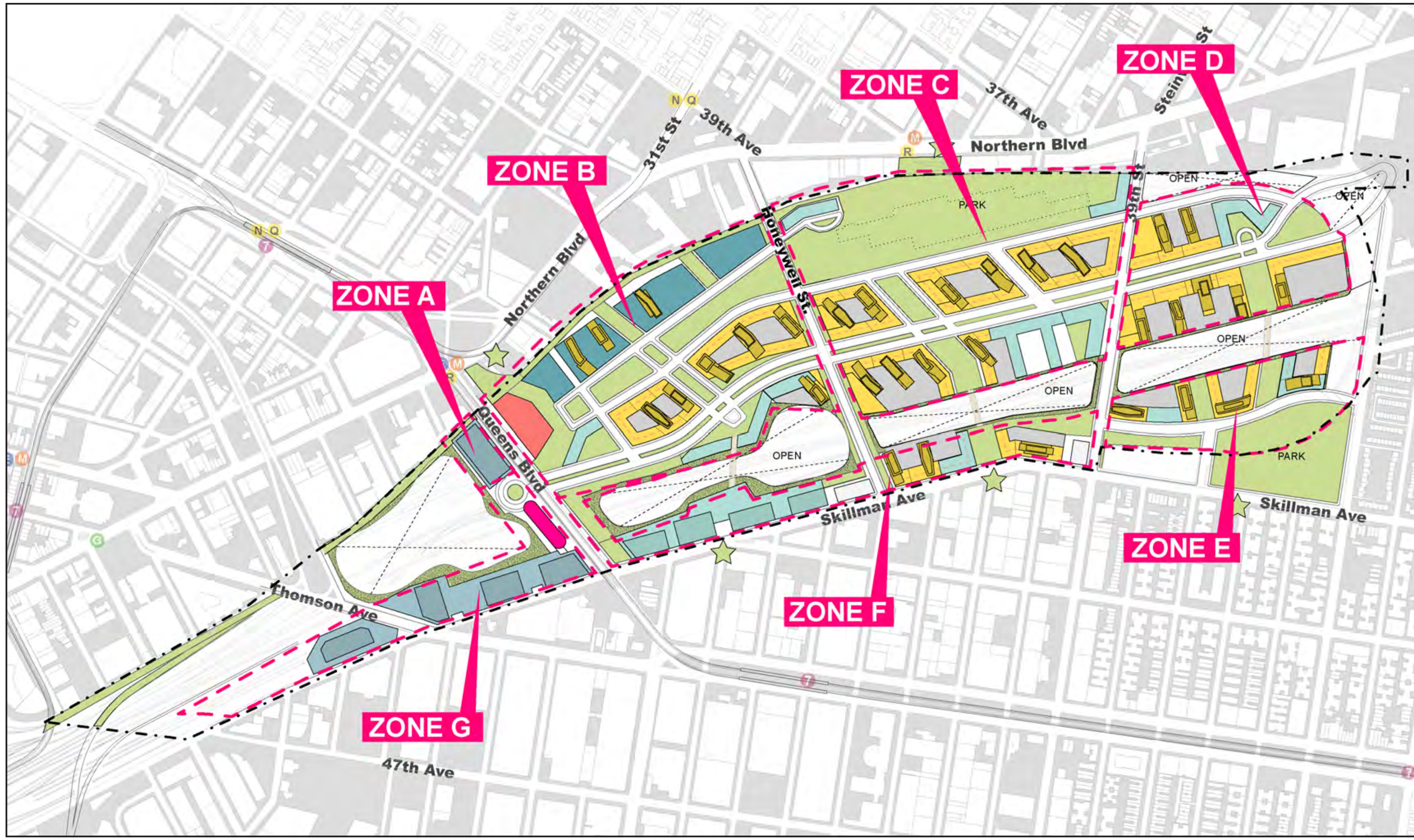


FIGURE 5.3: TEST CASE 2 - LIVE/WORK/PLAY

- Residential Podium
- Residential Tower
- Creative office
- Office Podium
- Office Tower
- Mixed-Use
- School/Community
- Public Open Space
- Public Open Space
- Landscape Buffer
- Parking
- Railroad Facilities

Test Case 3 (Destination)

Test Case 3 builds on the existing arts and cultural institutions in western Queens, and the strong demand for new retail options, within a walkable, urban mixed-use district. Test Case 3 creates a vibrant and dense destination comprised of cultural uses, shopping and signature open spaces integrated with a substantial amount of residential uses and community facilities.

The district would prominently feature signature open space and dynamic shopping options in a new urban mixed-use format to attract residents and tourists. As a new destination, Sunnyside Yard would be easily accessible to the commerce center of Manhattan, the residential hubs of Queens and Brooklyn, and New York's gateways to the rest of the country - LaGuardia and JFK airports.

The district would be comprised of multi-story, mixed-use retail in an urban shopping format, connected by open space, and served by an integrated parking structure. The parking structure could be wrapped with retail uses so it does not negatively impact the pedestrian experience.

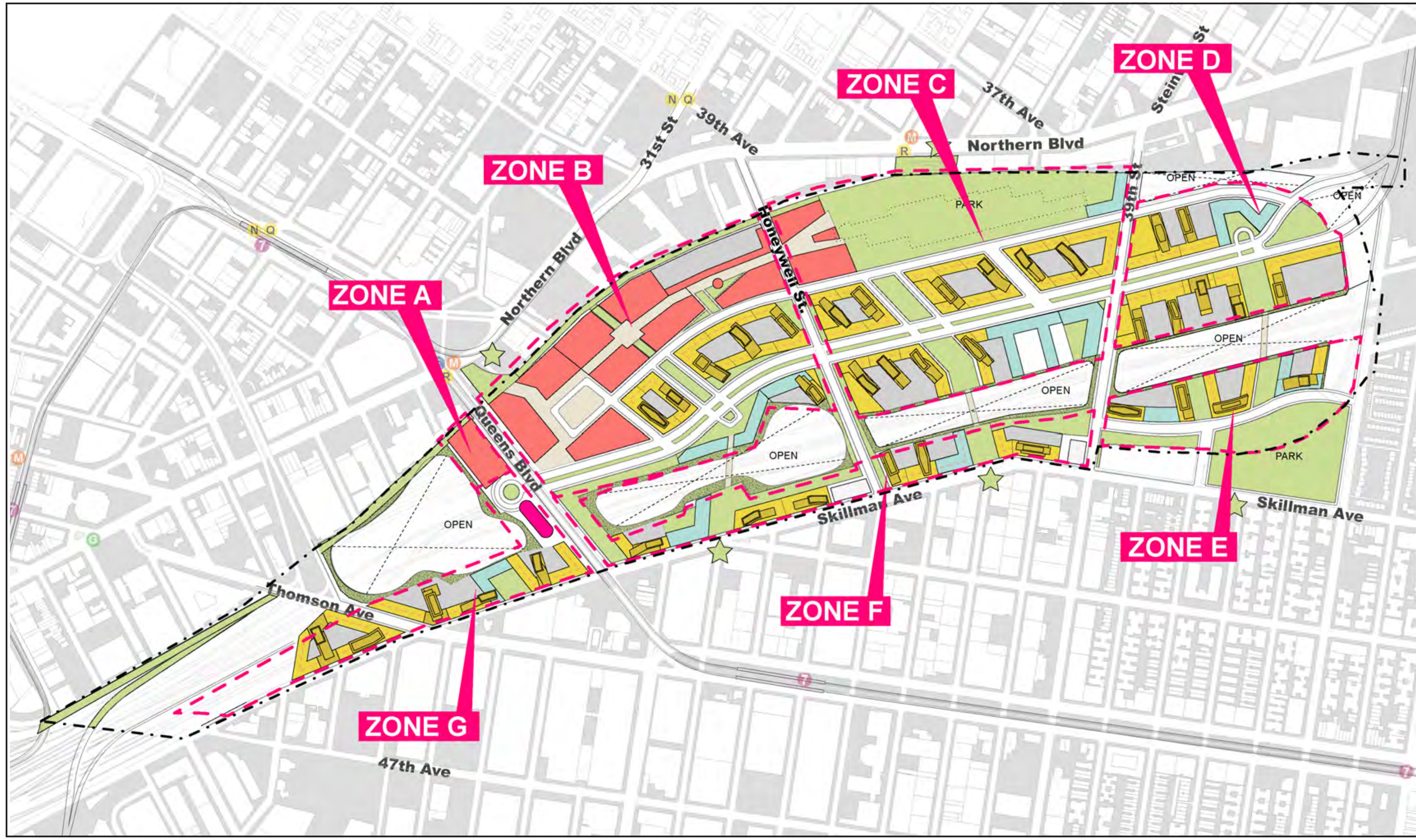


FIGURE 5.4: TEST CASE 3 - DESTINATION

Residential Podium	Office Podium	School/Community	Landscape Buffer
Residential Tower	Office Tower	Public Open Space	Parking
Creative office	Mixed-Use	Public Open Space	Railroad Facilities

C. Guidelines by Zone

The following section describes in detail the test scenarios arrived at through an iterative refinement process. Each zone, A through G, is described in terms of:

- Ownership,
- Planning parameters,
- Street grid and connections,
- Tower placement,
- Land uses, and
- Open spaces.

All three test cases are predominantly residential. For some zones the program and recommended configuration does not change between the different test cases, and residential-heavy zones tend to remain consistent between the test cases. The development programs for Zones D and E are the same in all of the test cases, while the development program for Zones A, B, C, F, and G reflect variations and sensitivities in the program mix.

The organization and layouts of the test cases, and the similarities or differences between them, are intended to highlight some possible outcomes and variations resulting from applying the Key Considerations and Principles in Chapter 4: Overbuild Guidelines, to the programmatic elements of each test case. Many such variants are possible, and what follows is intended to be descriptive, but not prescriptive.

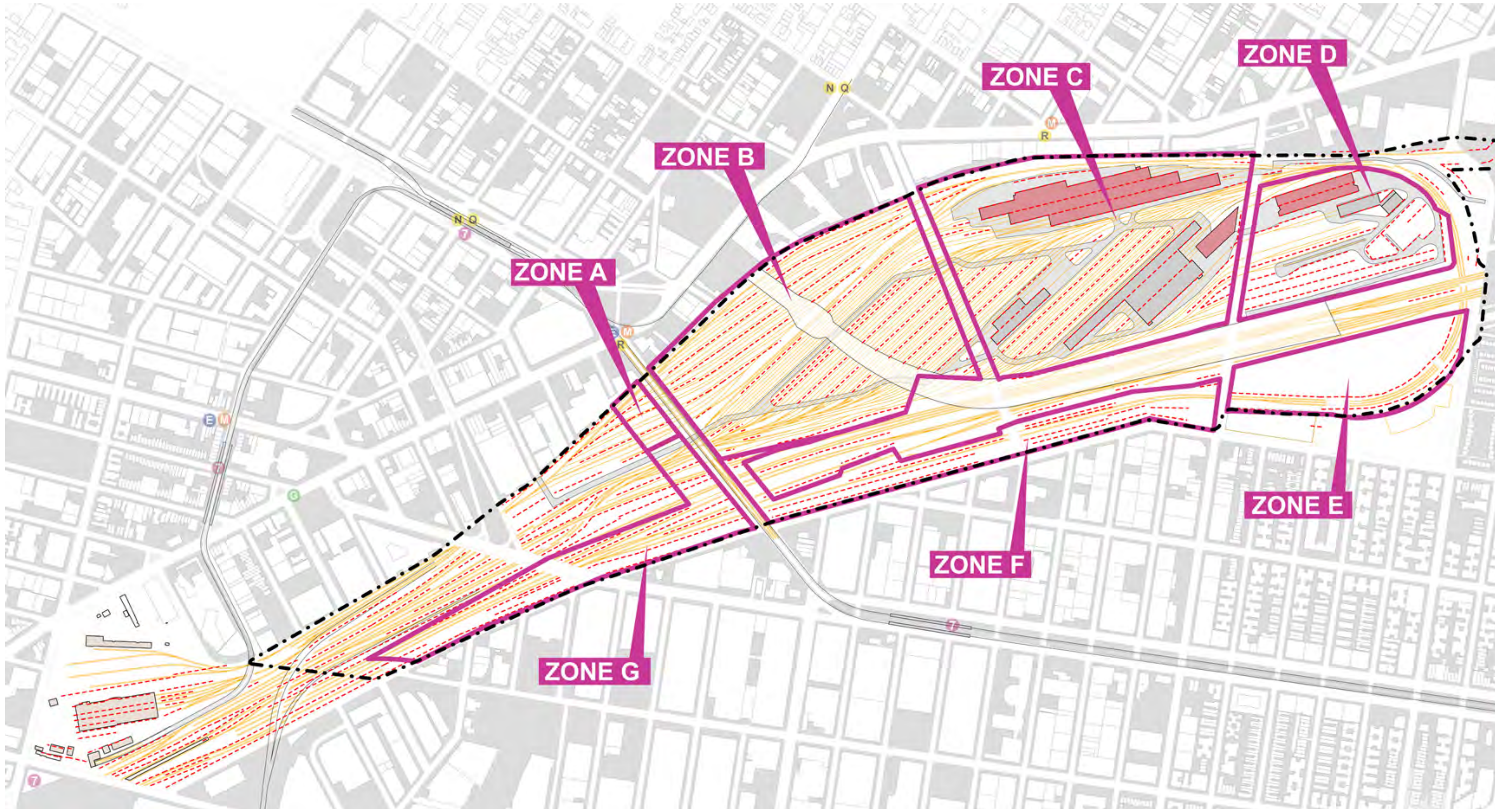
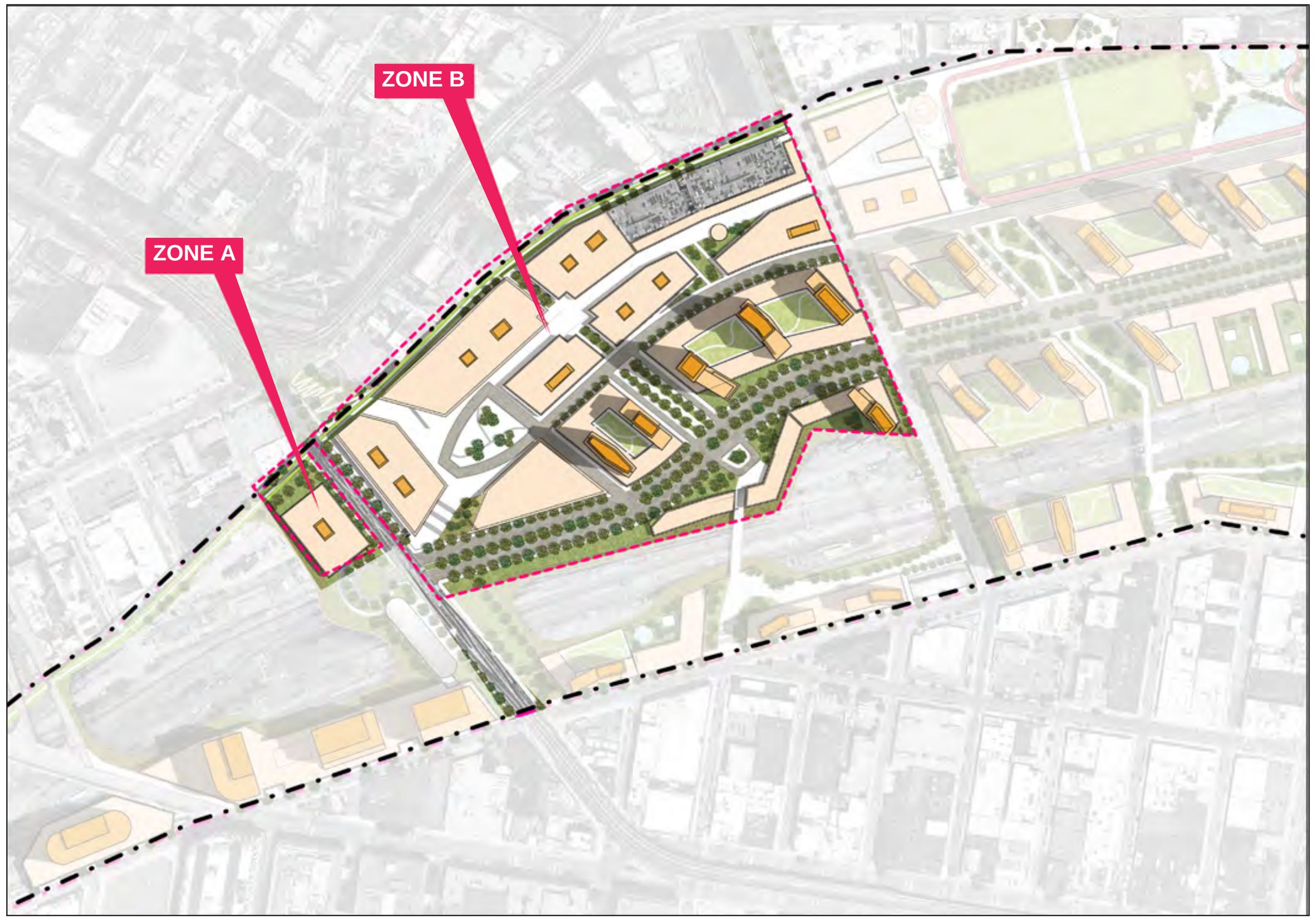


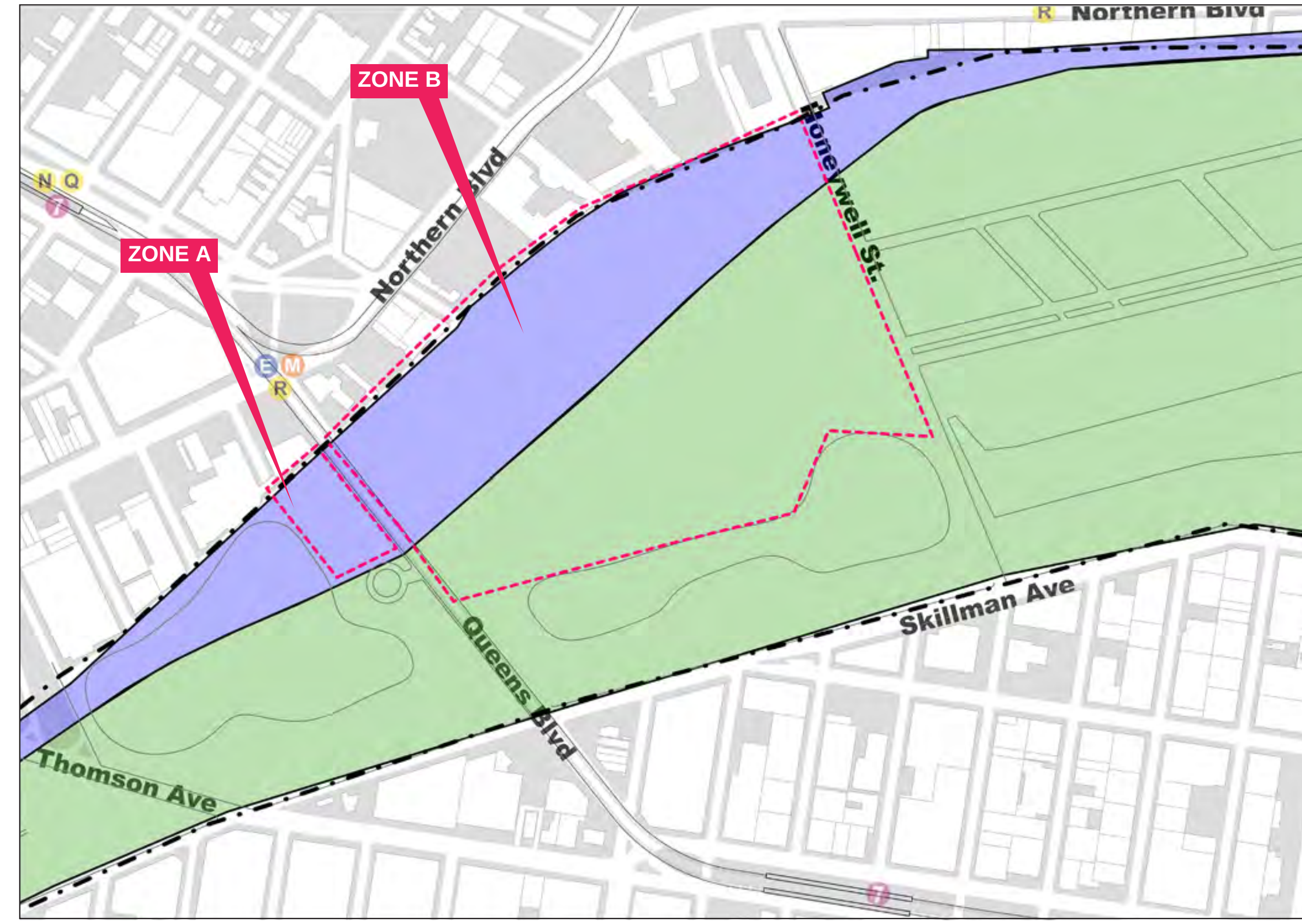
FIGURE 5.5: RAILROAD CONSTRAINTS AND ZONES

- Future Amtrak Buildings
- Future Amtrak Buildings which extend through proposed deck
- Future Amtrak driveways
- Existing MTA Buildings
- Future & Existing Tracks
- Proposed Column Centerlines
- Zone Boundaries

Zones A & B:



ZONES A AND B: ROOF PLAN/GRAPHIC PLAN

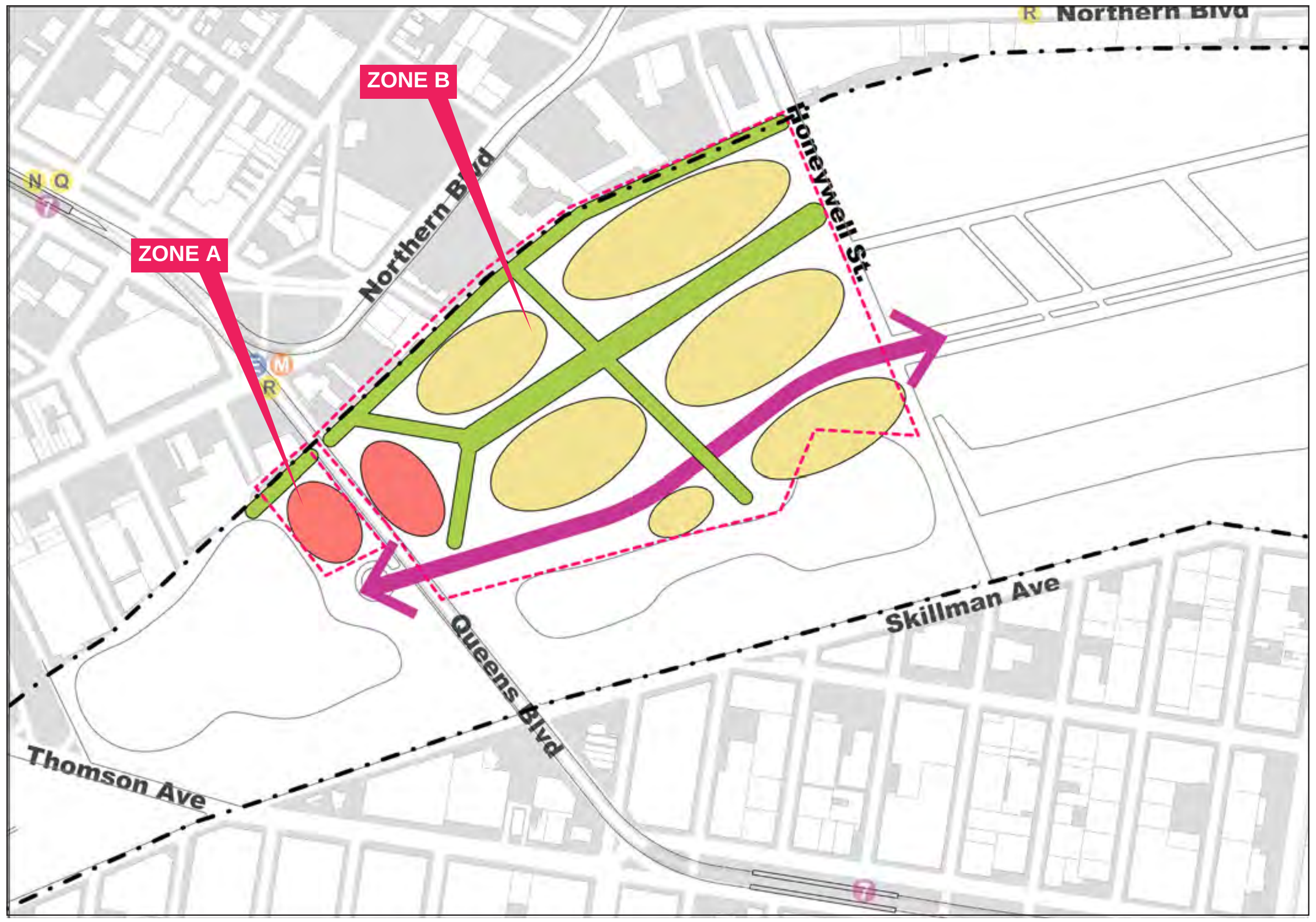


ZONES A AND B: OWNERSHIP

- Amtrak
- MTA

Zones A and B form a gateway at Queens Boulevard and, moving east, organize core development around an open space spine and Sunnyside Boulevard. Although the program differs in the three test cases, the general configuration and circulation patterns remain the same.

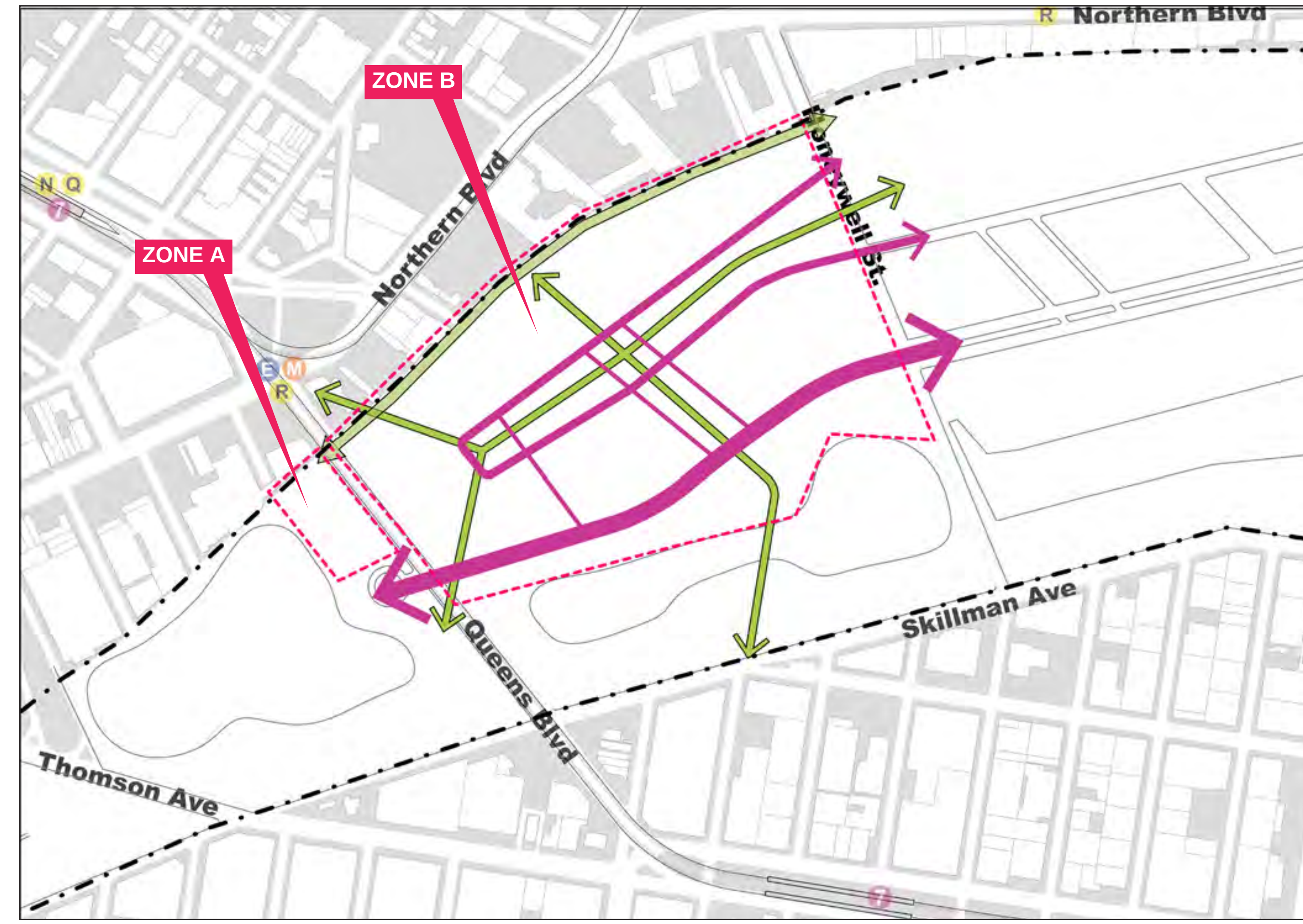
Zone A and the northern portion of Zone B are owned by the MTA. Development air rights are owned by the City of New York. The area is being developed by MTACC to form part of the LIRR mid-day storage yard. The southern portion of Zone B and development air rights are owned by Amtrak/Federal Agencies. The area accommodates Amtrak storage tracks that will be reconfigured when Amtrak implements its Master Plan.



ZONES A AND B: GENERAL ORGANIZATION

- Residential/Mixed-Use Development Zone
- Retail/Office Development Zone
- Public Space
- Primary Connection

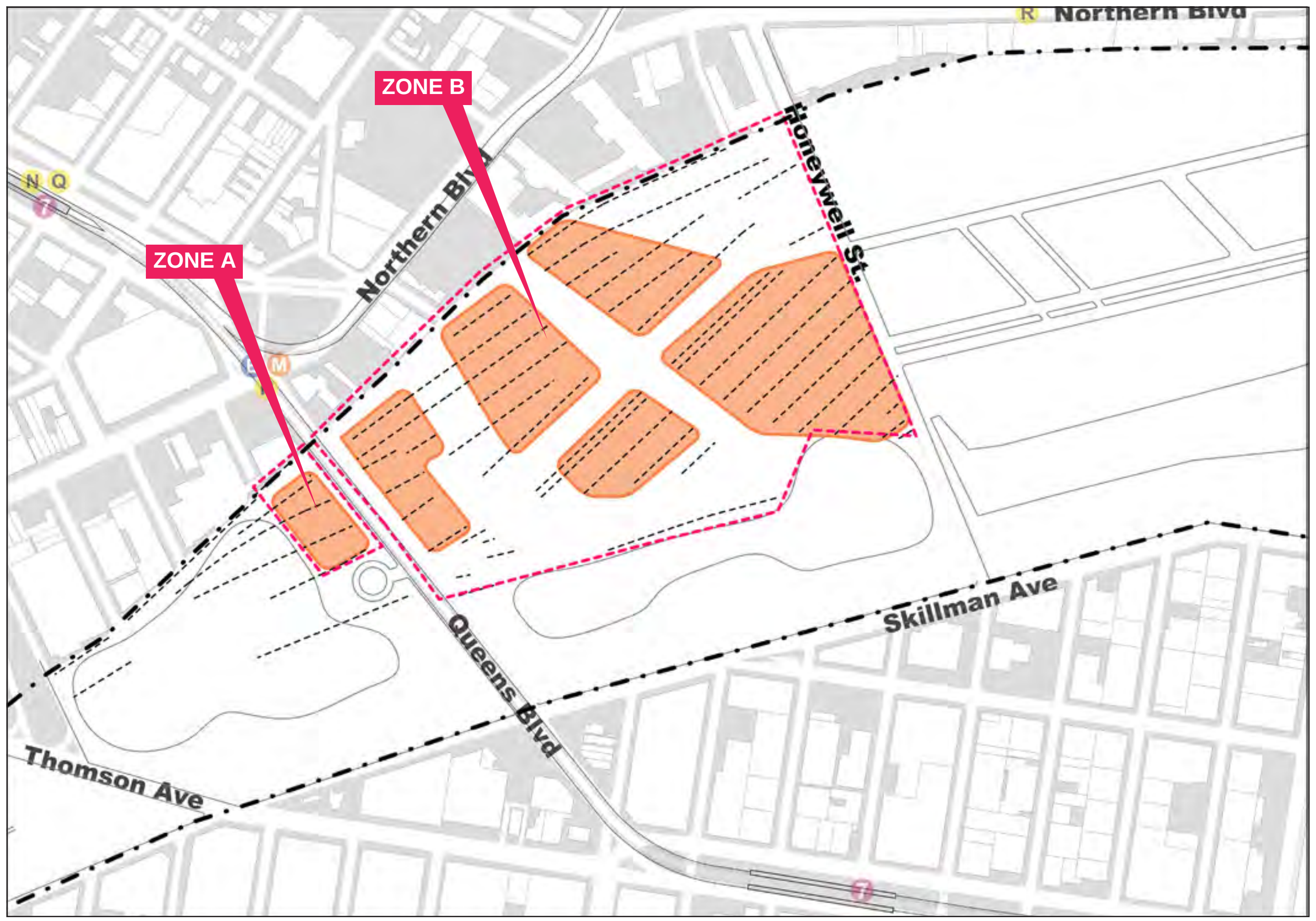
The plan reinforces and extends the commercial nature of Queens Plaza with commercial office and retail uses along Queens Boulevard. This mixed-use development includes residential, retail, or creative office space, depending on the test case. Heights and densities are generally lower in the northeast and southwest parts of Zone B. Zone A should activate both Queens Boulevard and the plaza in front of Sunnyside Station in Zone G to the south. Zone B is defined by a central spine of public space - parkway or pedestrian street depending on the test case - that connects the park on the eastern side of Honeywell Street in Zone C to Queens Plaza and Sunnyside Station on the west. Along the northern edge of Zones A and B, the "Sideline" linear park connects multiple zones and offsite destinations, and creates a buffer to adjacent existing development. A secondary open space and pedestrian route runs roughly perpendicular to and connects these longitudinal axes and Sunnyside Boulevard.



ZONES A AND B: CONNECTIVITY + STREET GRID

- Primary Connection
- Secondary Connection
- Pedestrian Connection

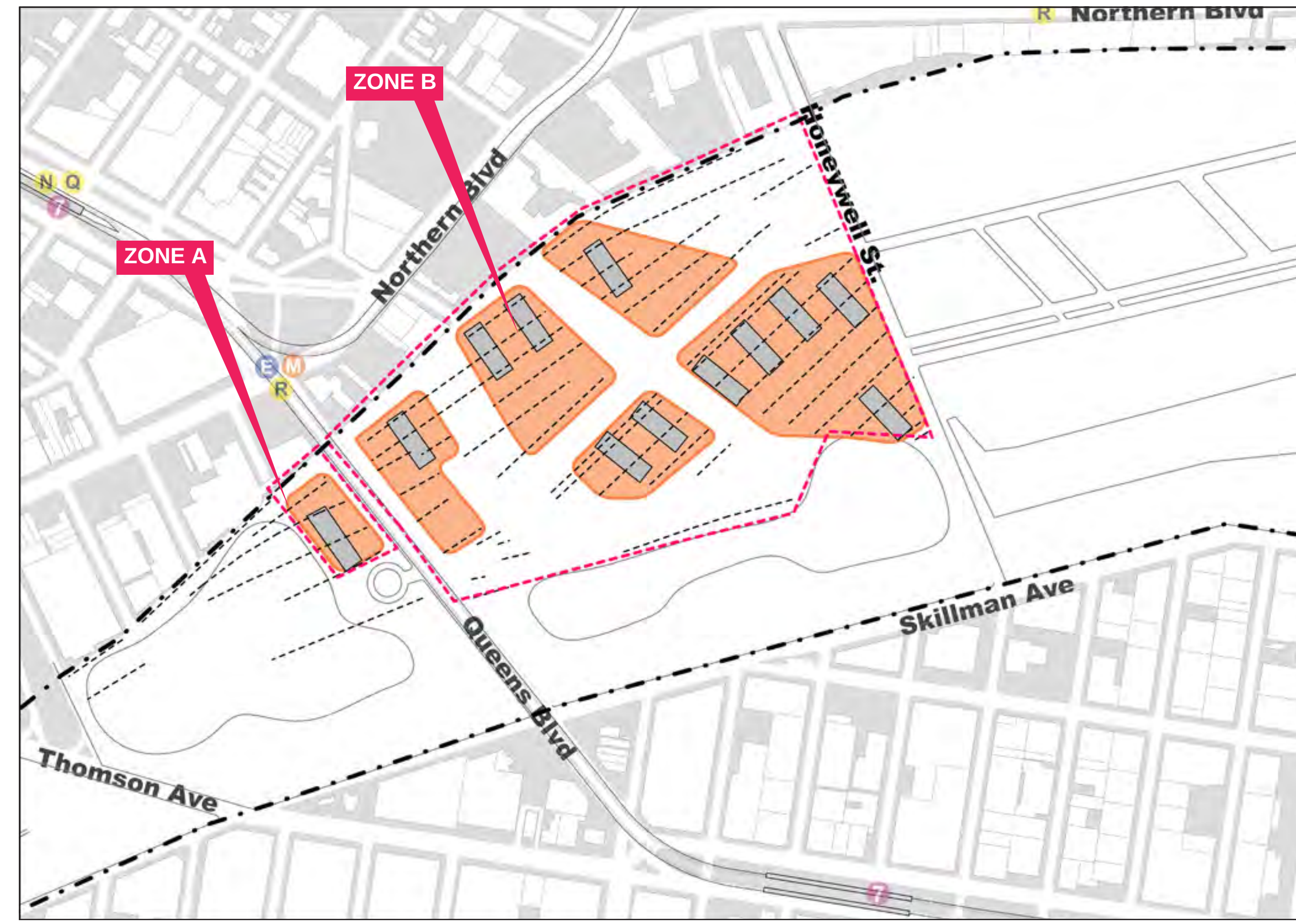
Sunnyside Boulevard runs east-west along the southern edge, connecting across the site, and transitions from a single loaded corridor on the west to a double-loaded central spine to the east. A series of roughly perpendicular secondary streets and pedestrian routes connect the parkway/open space and boulevard spines. A pedestrian bridge over the open Main Line cut extends one secondary cross-axis, connecting south to Zone F and Skillman Avenue. Pedestrian routes also connect the public space spine westwards to Sunnyside Station and Queens Plaza and Queensboro Plaza Subway Stations.



ZONES A AND B: COLUMN LOCATIONS + TOWER ZONES

Tower Zones
Column Lines

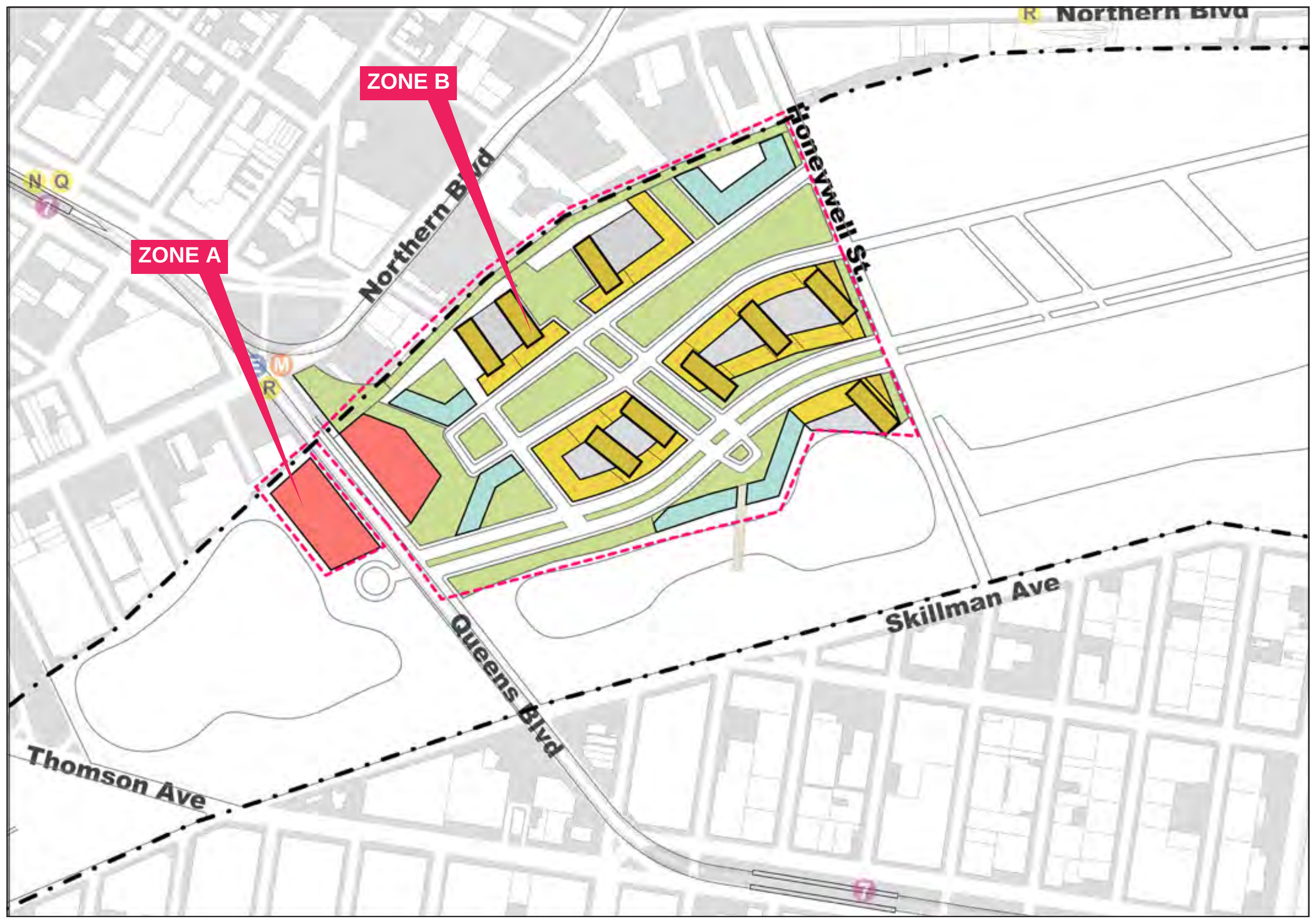
Zones A and B are located above parts of Sunnyside Yard that will have a relatively uniform track layout. This will allow support walls to be spaced between 40’ and 100’ apart. The zones also have areas in which support walls cannot be accommodated due to track switches, roads, and tunnels for the East Side Access project. In these areas, spans of up to 200’ will be necessary, which would limit the weight and height of any overbuild development.



ZONES A AND B: ILLUSTRATIVE TOWER LOCATIONS

Tower Zones
Illustrative Tower Locations
Column Lines

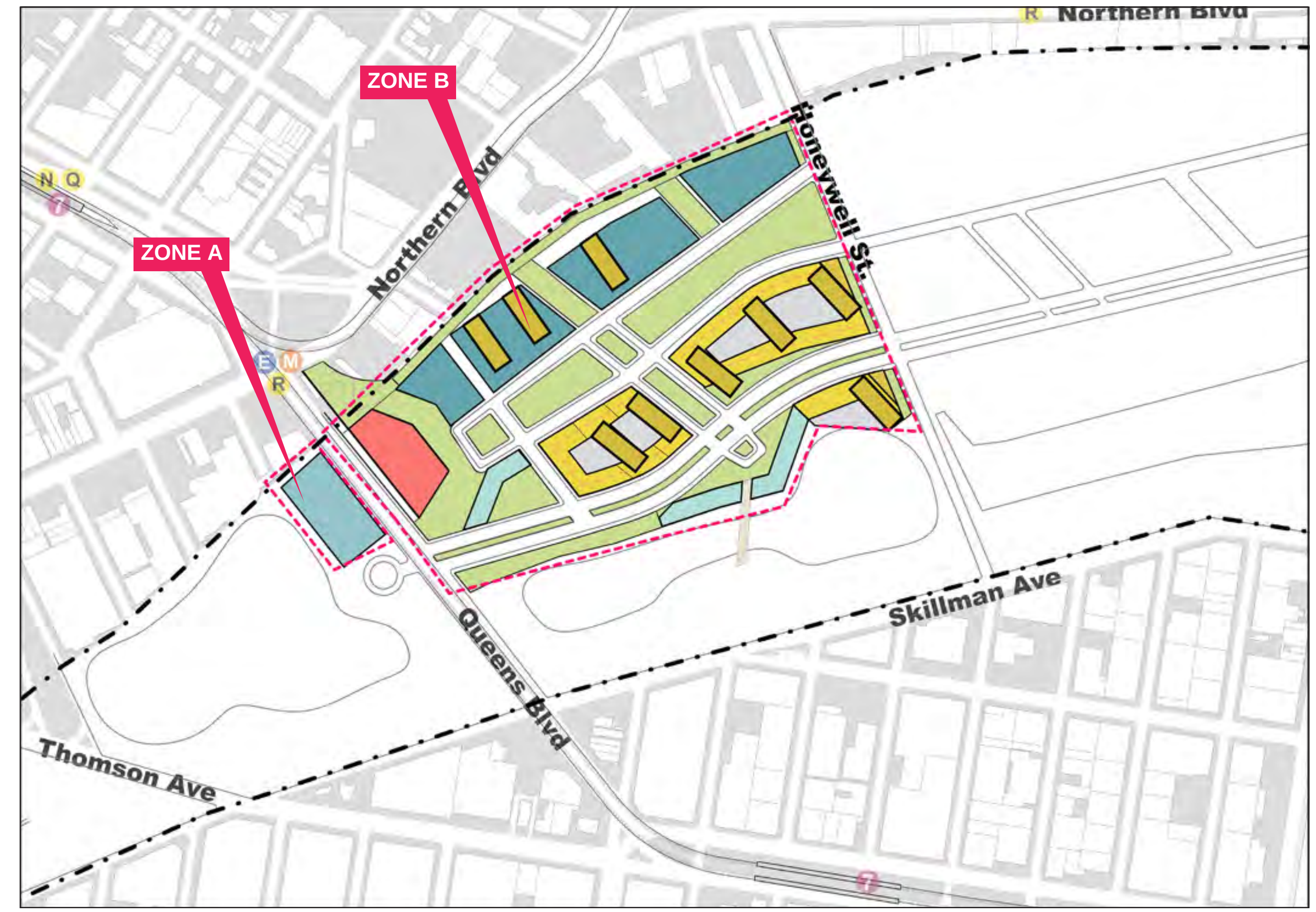
Zone A allows for only one residential tower of approximately 30 stories. Within Zone B there are five areas that will support a total of approximately 11 residential towers ranging from 45 to 69 stories. The test cases propose fewer towers than could be supported in order to provide sufficient spatial relief and porosity and avoid a “wall” effect.



ZONES A AND B: TEST CASE 1- RESIDENTIAL

- Residential Podium
- Residential Tower
- Creative office
- Office Podium
- Office Tower
- Mixed-Use
- School/Community
- Public Green Space
- Public Hardscape
- Landscape Buffer
- Parking
- Railroad Facilities

Two low-rise retail buildings front Queens Boulevard, reinforcing the commercial corridor connection to Queens Plaza. Park-like pedestrian routes negotiate grade differences to connect both Queens Plaza and Sunnyside Station to a central linear park or parkway that runs east to the park in Zone C. Residential towers, oriented roughly perpendicular to this park, line either side of it. Five school buildings occupy key locations marking the ends of the open space axes. The residential building podiums and schools create a strong street-wall condition that clearly defines the open spaces. Parking decks fill several of the block interiors.

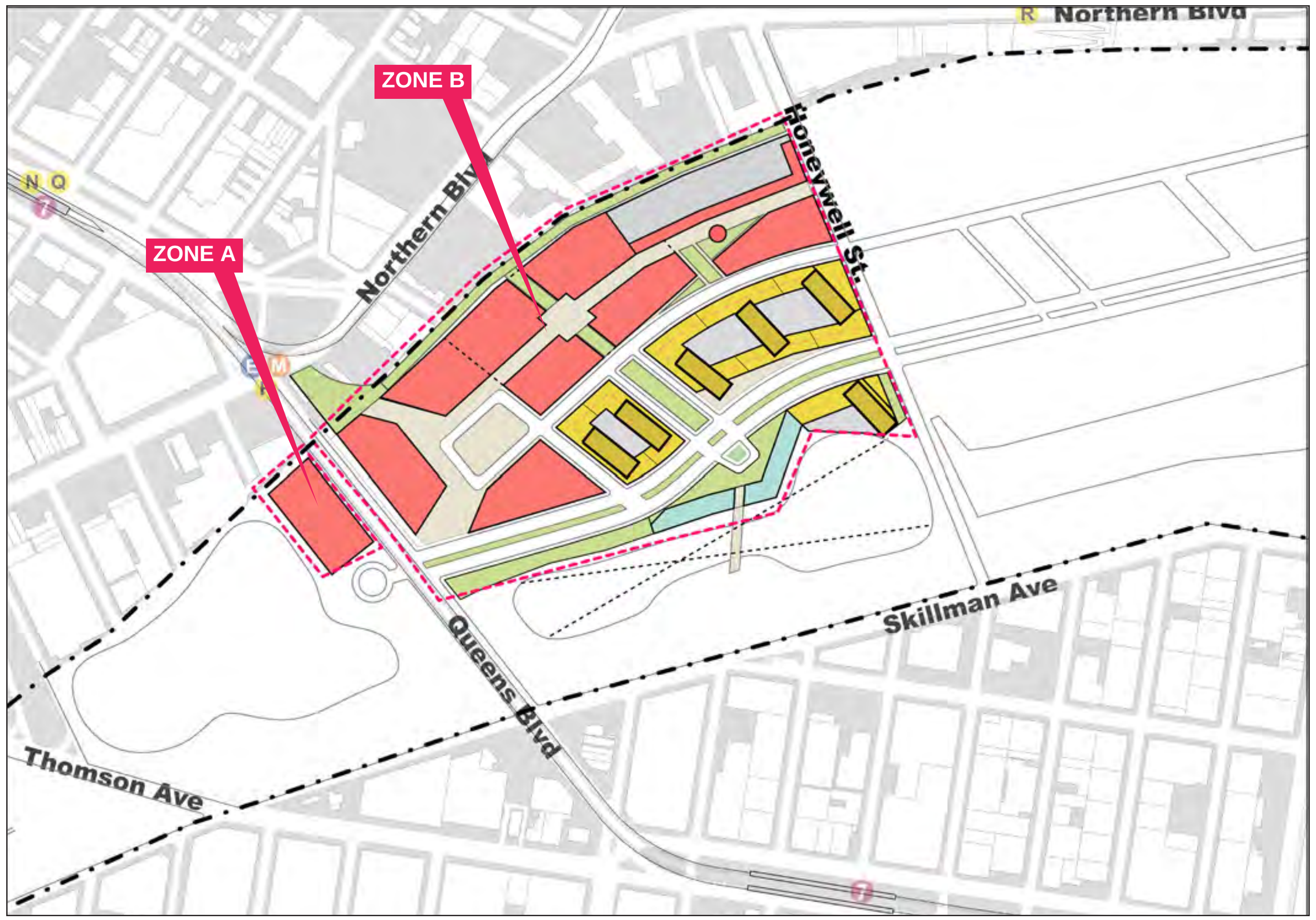


ZONES A AND B: TEST CASE 2- LIVE/WORK/PLAY

- Residential Podium
- Residential Tower
- Creative office
- Office Podium
- Office Tower
- Mixed-Use
- School/Community
- Public Green Space
- Public Hardscape
- Landscape Buffer
- Parking
- Railroad Facilities

This test case uses the same street and block configuration as the residential test case, but deploys a different set of uses and building typologies along the northern edge. In Zone A, a commercial office building with a retail base defines Queens Boulevard and the Sunnyside Station Plaza.

In Zone B, creative office buildings line the northern side of the central parkway. In some instances these creative office buildings are integrated with residential towers in a hybrid live-work building type. The commercial office space complements the commercial areas along Northern Boulevard immediately to the north. With the reduction in total residential from Test Case 1, the number of schools is also reduced.



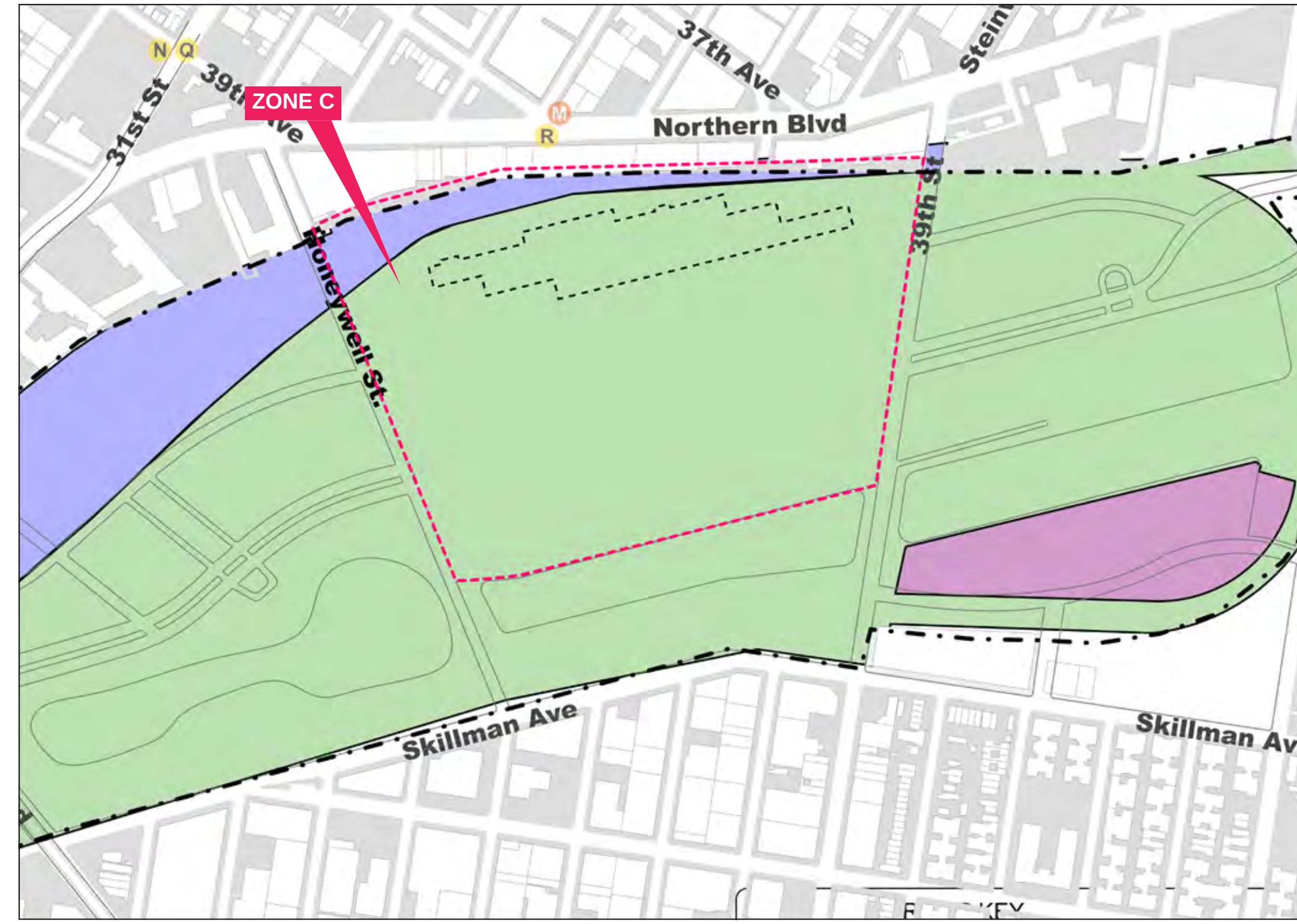
ZONES A AND B: TEST CASE 3- DESTINATION

Residential Podium | Office Podium | School/Community | Landscape Buffer
Residential Tower | Office Tower | Public Green Space | Parking
Creative office | Mixed-Use | Public Hardscape | Railroad Facilities

The Destination test case creates a retail and cultural district along the northern edge of Zones A and B. The urban mixed-use shopping component will draw upon a distinctive architectural approach characterized by enhanced pedestrian connectivity that guides shoppers and diners through a walkable and diverse mixed-use district where retailers are located in close proximity to residential and office uses. The central open space spine of the other test cases is narrowed to a pedestrian shopping street, allowing retail footprints of appropriate depth on either side. A plaza anchors the eastern end of the shopping street. At the northeast corner of the site a parking structure accommodates the additional parking required by retail, and is lined at ground level with shallower retail spaces. On the southern side of the retail district, near Honeywell Street, the irregular building shapes reflect the different land ownership and accommodate the potential for development by different entities.

Zone C:

ZONE C: ROOF PLAN/GRAPHIC PLAN

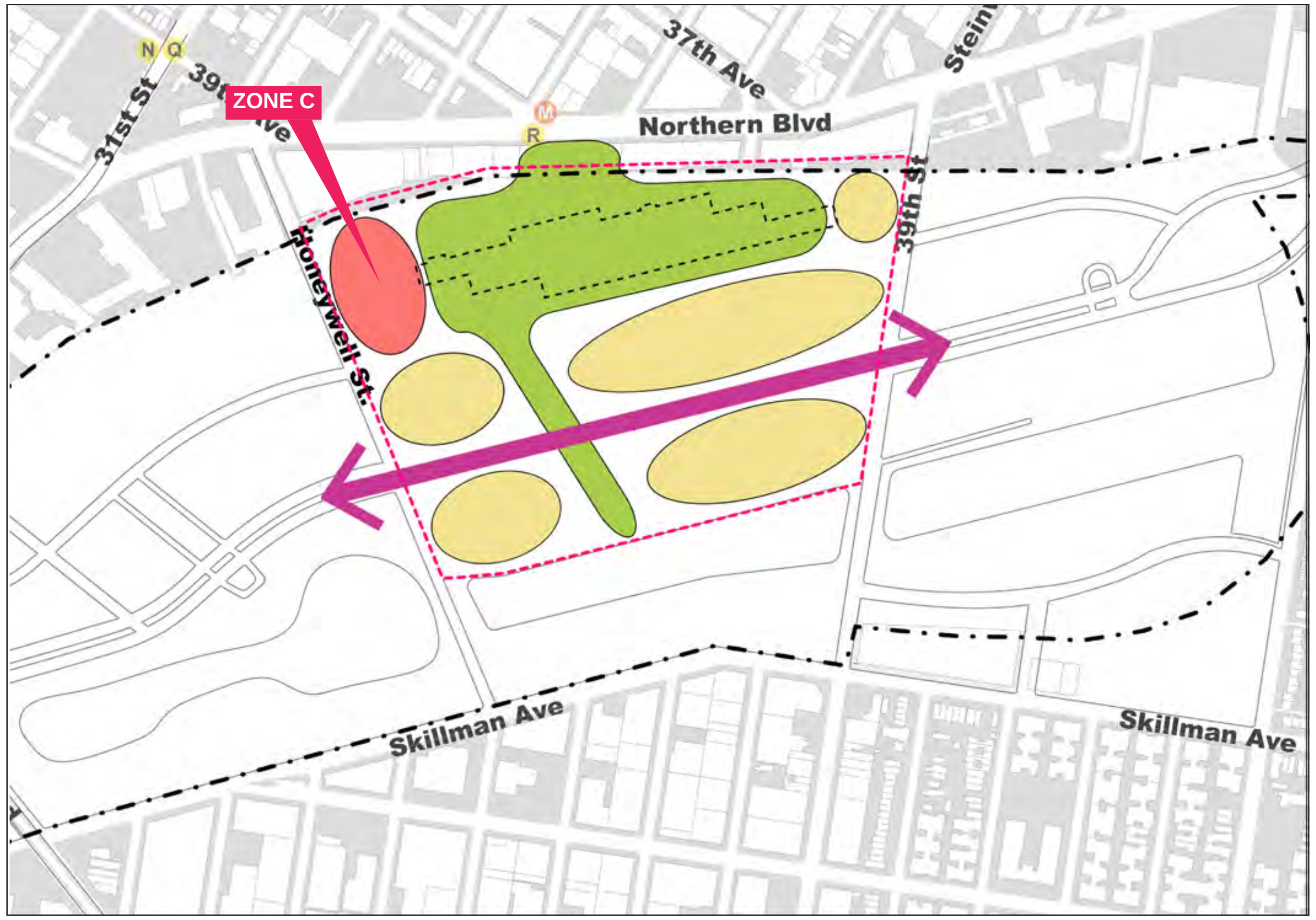


ZONE C: OWNERSHIP

- Amtrak
- MTA
- Private

Zone C is the residential core of Sunnyside Yard. It includes the largest area with regularly spaced tracks to support towers, and can achieve some of the highest densities. At the same time, large areas of structurally constrained deck ensure significant open space for amenities serving the residential development.

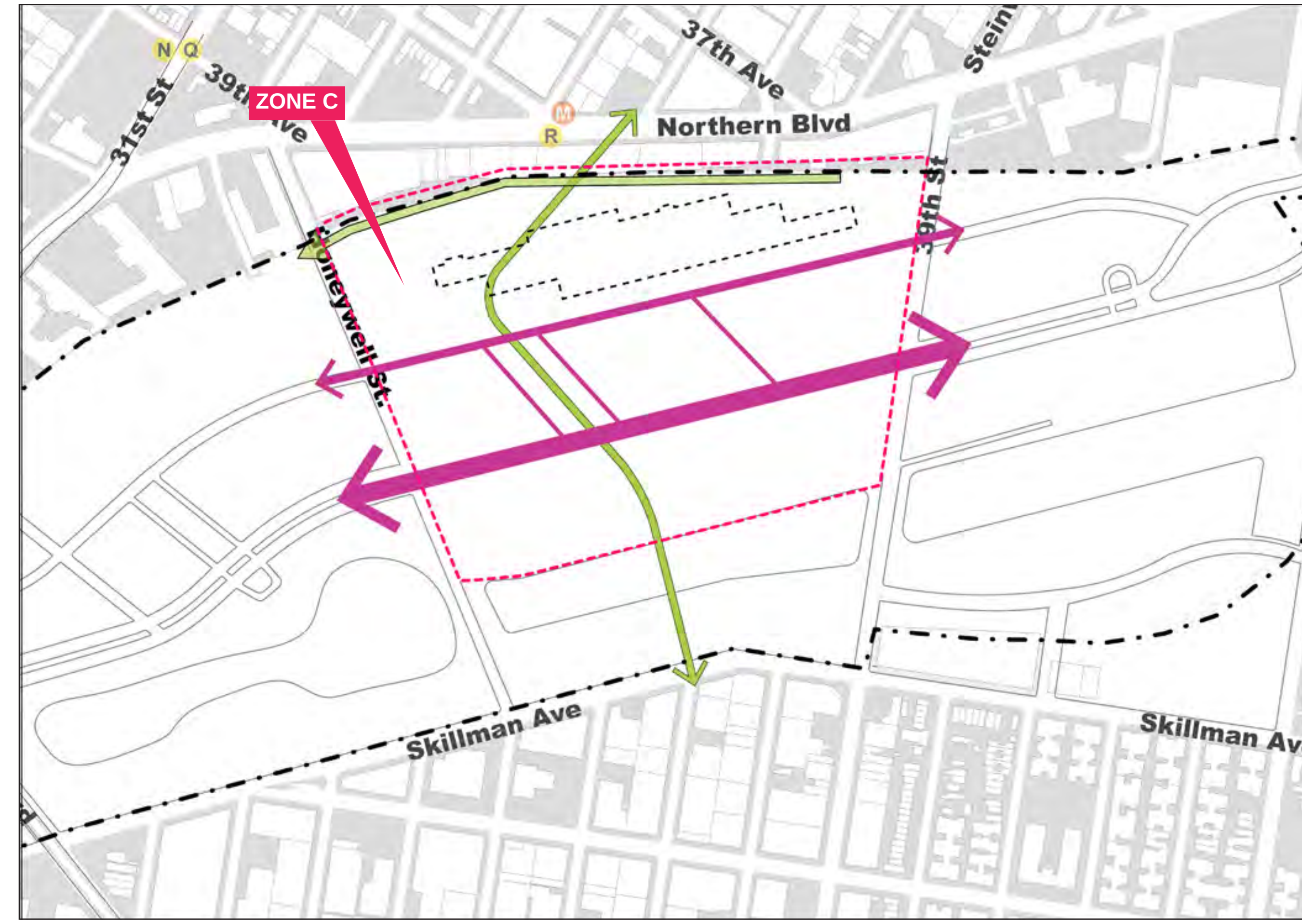
A sliver along the northern edge is owned by the MTA. The City of New York owns the development air rights. This property is being developed by MTACC to provide two access tracks into the LIRR Mid-Day Storage Yard. The remaining land, in Zone C, and the development air rights are owned by Amtrak/Federal Agencies. Most of the Amtrak portion contains storage tracks and maintenance buildings, functions that will remain but be reconfigured when Amtrak implements its Master Plan.



ZONE C: GENERAL ORGANIZATION

- Residential/Mixed-Use Development Zone
- Retail/Office Development Zone
- Public Space
- Primary Connection

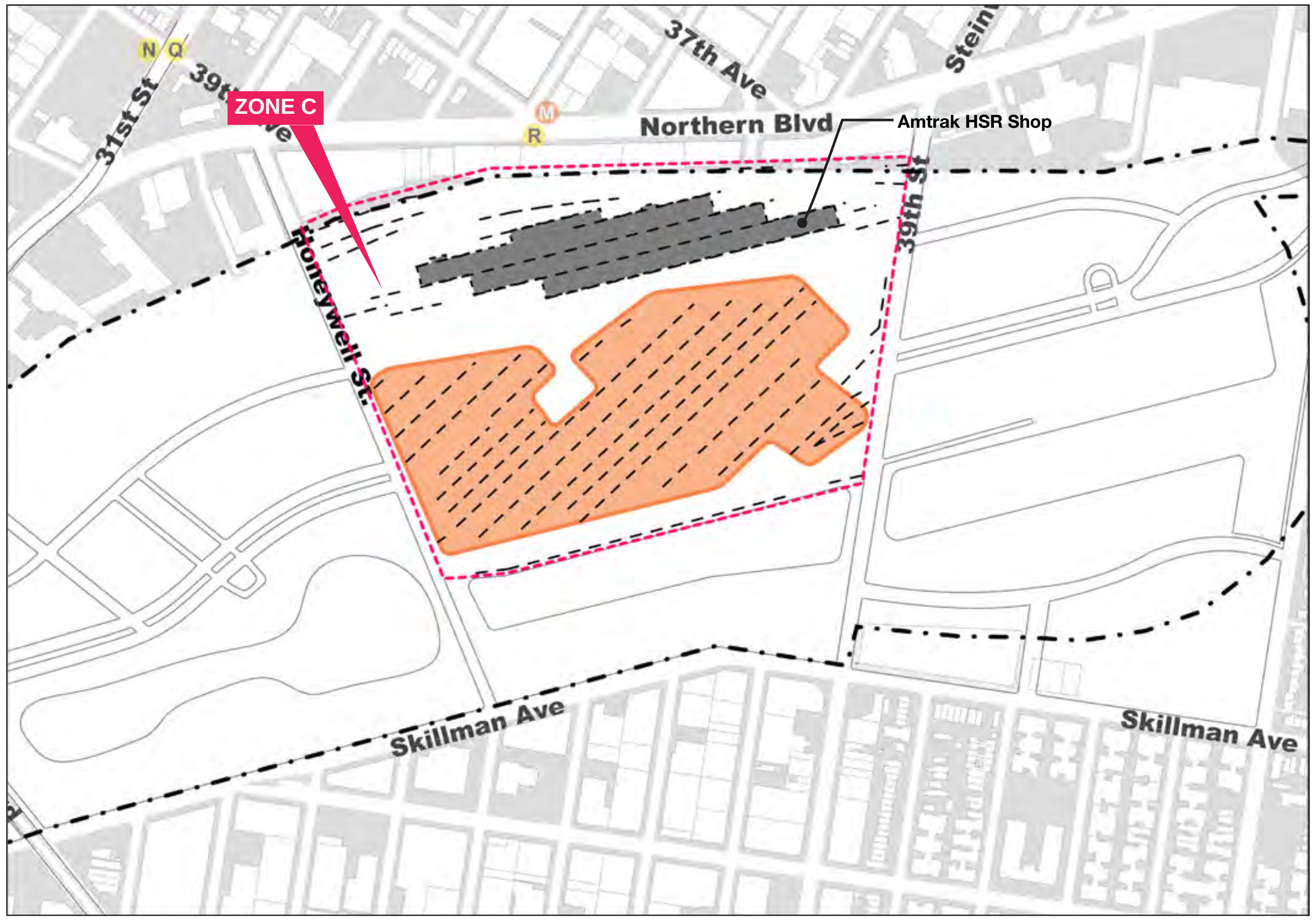
The northern edge of the planned Zone C overbuild development is dominated by a large open space, framed to the east and west by low-scale development. This active park provides a neighborhood focus and amenity for residents. The park is built over the planned Amtrak High Speed Rail Facility, and connects to Northern Boulevard, the 36th Street subway station, and adjacent communities. The development on the west side of the park along Honeywell Street terminates the open-space axis of Zone B. To the south of the open space, two largely residential development zones frame Sunnyside Boulevard as it connects Honeywell Street and 39th Street. A linear open space runs roughly perpendicular to the boulevard. The land uses throughout are predominantly residential, with some schools and limited retail.



ZONE C: CONNECTIVITY + STREET GRID

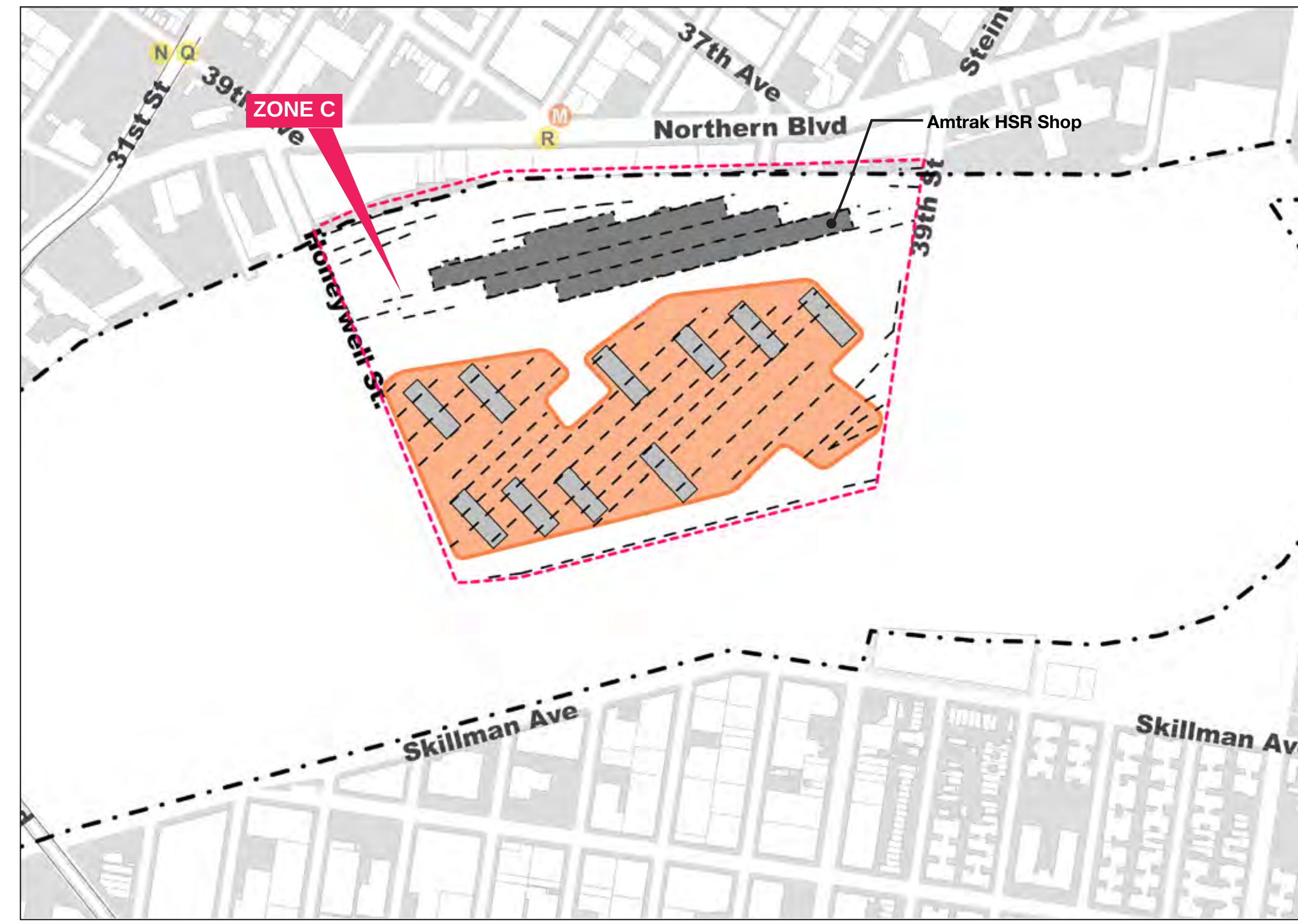
- Primary Connection
- Secondary Connection
- Pedestrian Connection

Sunnyside Boulevard serves as the east-west spine, connecting across the site, and providing one of the key identifying and organizing elements of the development. A parallel secondary road defines the southern edge of the park. Secondary streets and a parkway run roughly perpendicular to the Boulevard and connect north-south to the Park. A linear open space extends this parkway south of Sunnyside Boulevard to a pedestrian bridge over the Main Line and Skillman Avenue. To the north, a landscaped terrace descends from the park to Northern Boulevard and forges a pedestrian connection to the 36th Street subway station.



ZONE C: COLUMN LOCATIONS + TOWER ZONES

Tower Zones
Column Lines

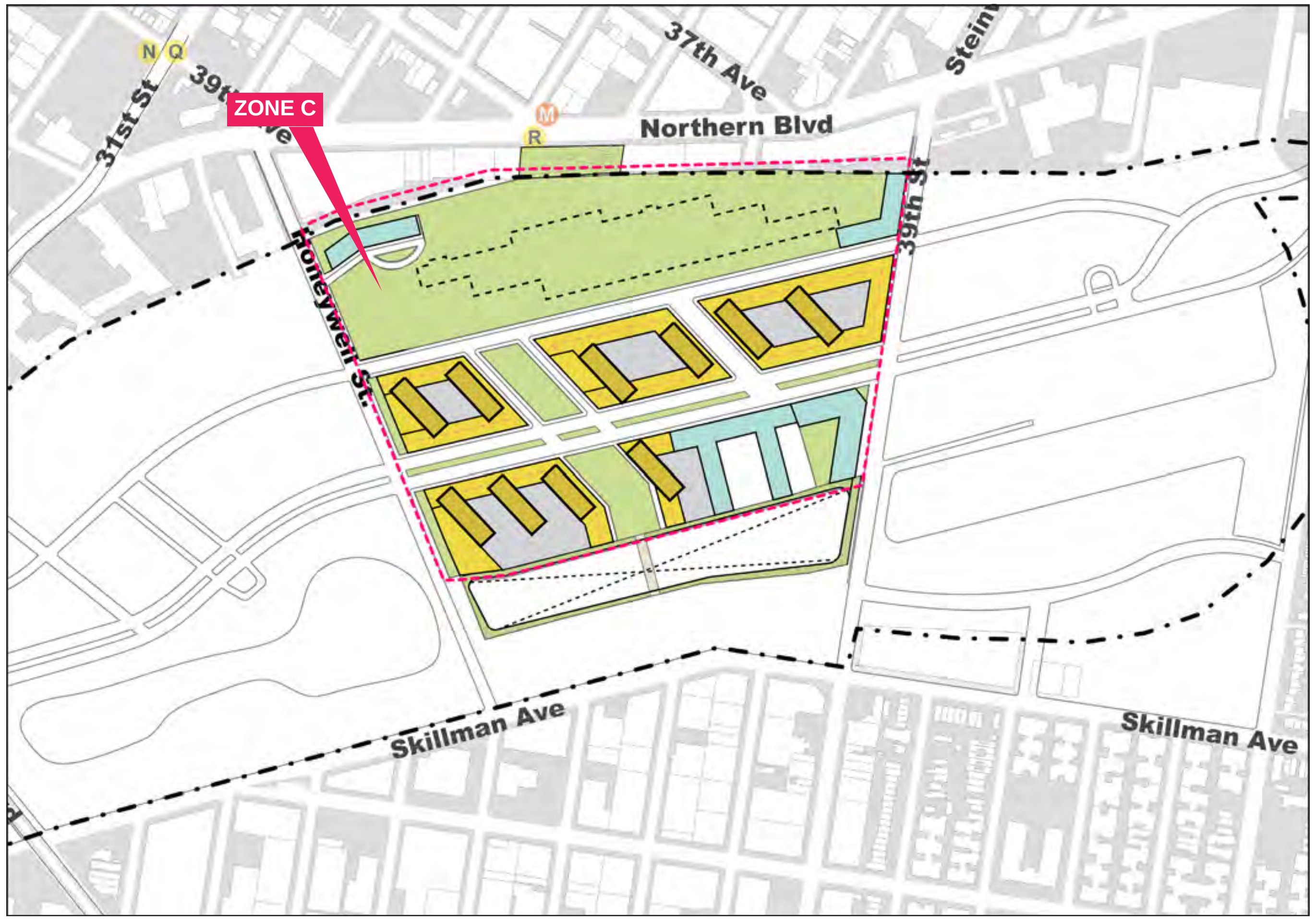


ZONE C: ILLUSTRATIVE TOWER LOCATIONS

Tower Zones
Illustrative Tower Locations
Column Lines

In the southern part of the zone, a large area of regularly spaced storage tracks with spans of between 70' and 90' creates a significant area that will permit the development of towers. To the north of this, the Amtrak High Speed Rail Facility severely limits overbuild. Although the maintenance facility has space between tracks for lines of support columns, required movement across these lines for maintenance operations does not permit the kind of near-continuous structural support walls required for taller overbuild development. Based on these limitations a park takes advantage of the limited structural capacity in this area.

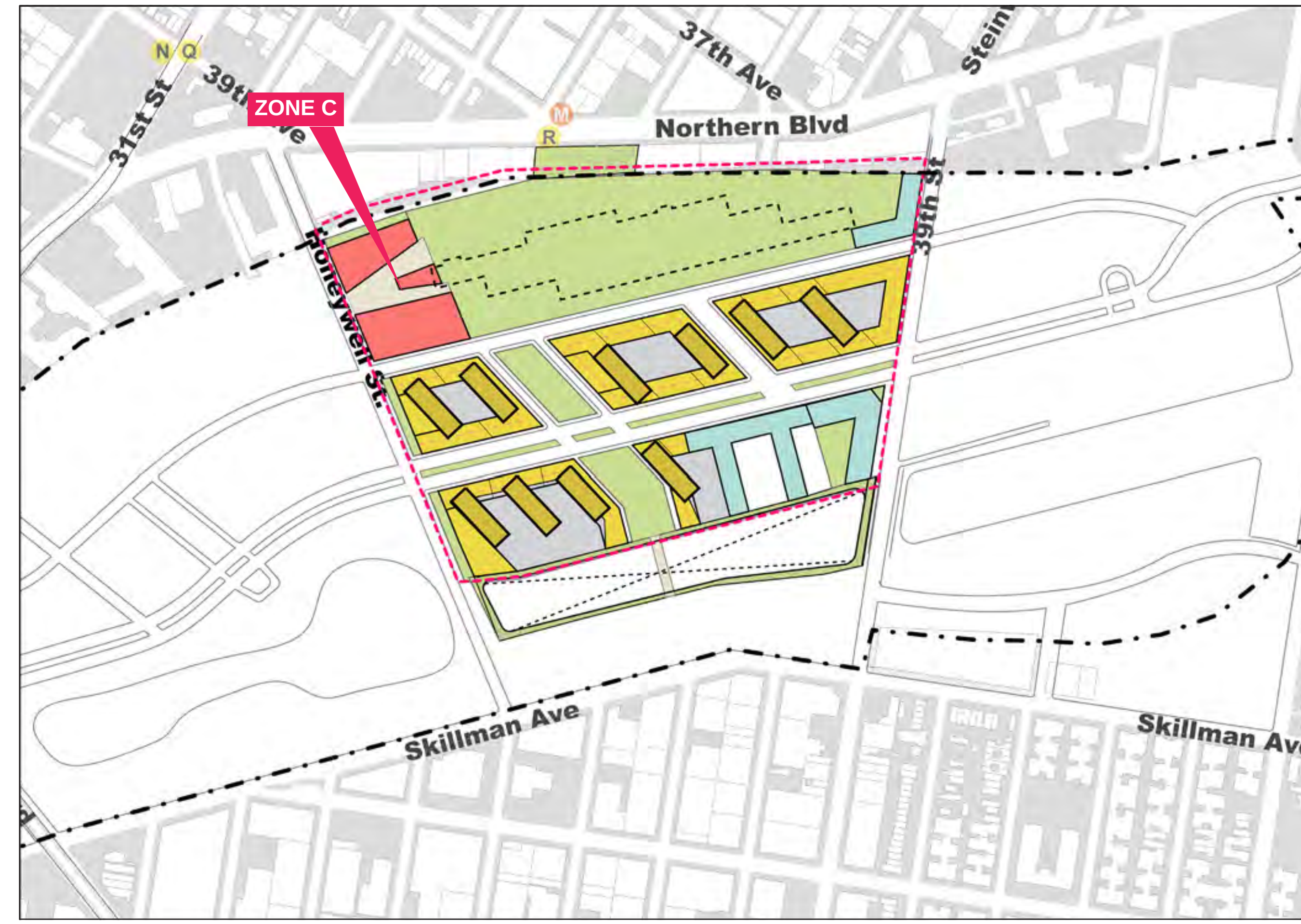
In the zones where towers are feasible, there is space for approximately 10 towers. The residential towers range from 30 to 69 stories, with the majority of towers at 45 stories.



ZONE C: TEST CASE 1- RESIDENTIAL & TEST CASE 2- LIVE/WORK/PLAY

Residential Podium	Office Podium	School/Community	Landscape Buffer
Residential Tower	Office Tower	Public Green Space	Parking
Creative office	Mixed-Use	Public Hardscape	Railroad Facilities

One of two large anchor parks proposed for Sunnyside Yard would be located in the north of the zone. The proposed park can be made compatible with Amtrak's High Speed Rail Facility below. The park would be connected to Northern Boulevard by a grand stair providing access to the 36th Street subway station. The Sideline is also accessible from the park. Two schools, one at either end of the park, take advantage of the actively programmed open space. South of the park is a dense cluster of high-rise residential towers that engage the park. The towers straddle both sides of Sunnyside Boulevard with the tower podiums creating a strong street-wall that frames the boulevard. Low-rise schools are located to the southeast where it is structurally more difficult to build towers. The area immediately to the south would be open to the Main Line below. A linear park system consisting of a parkway, pocket parks, and a pedestrian bridge over the open Main Line cut would extend a secondary open space cross-axis, connecting south to Zone F and Skillman Avenue.

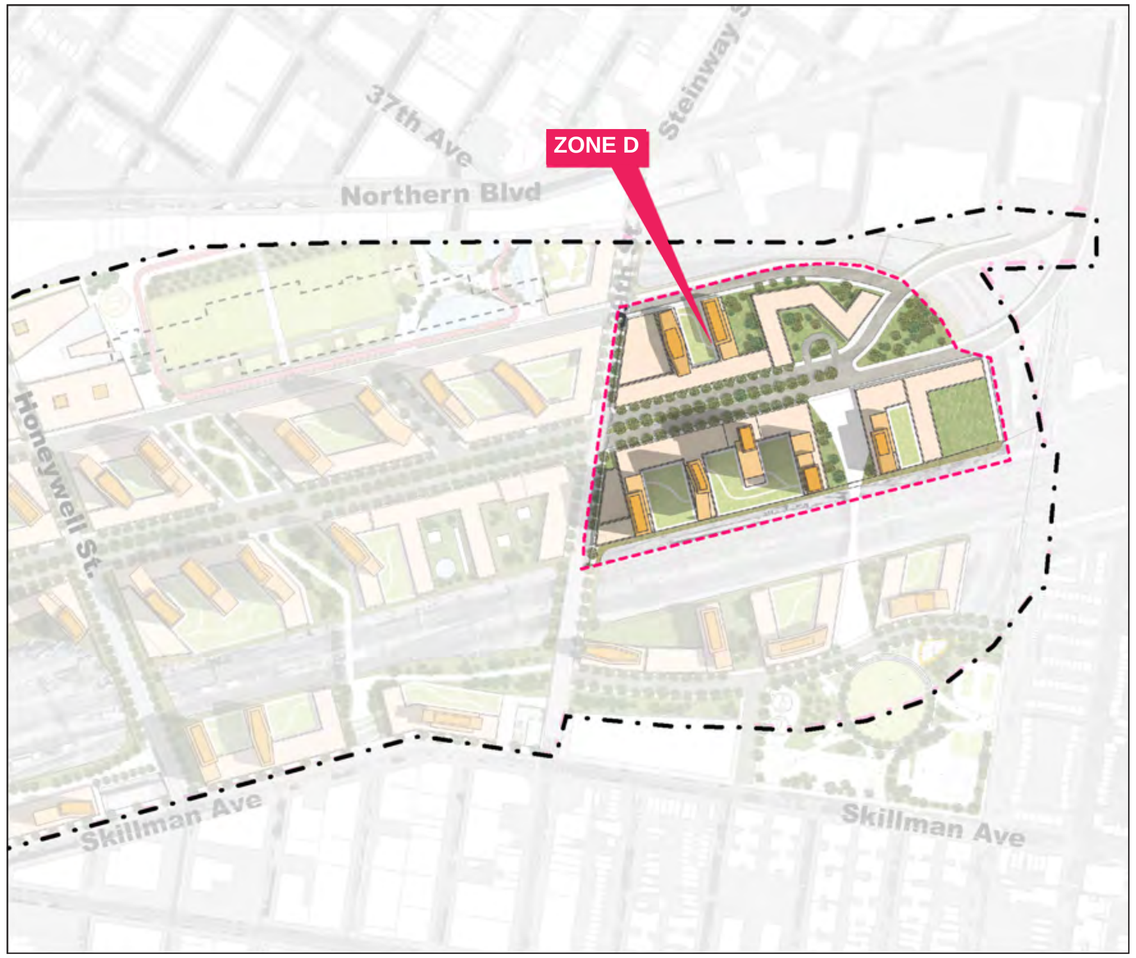


ZONE C: TEST CASE 3- DESTINATION

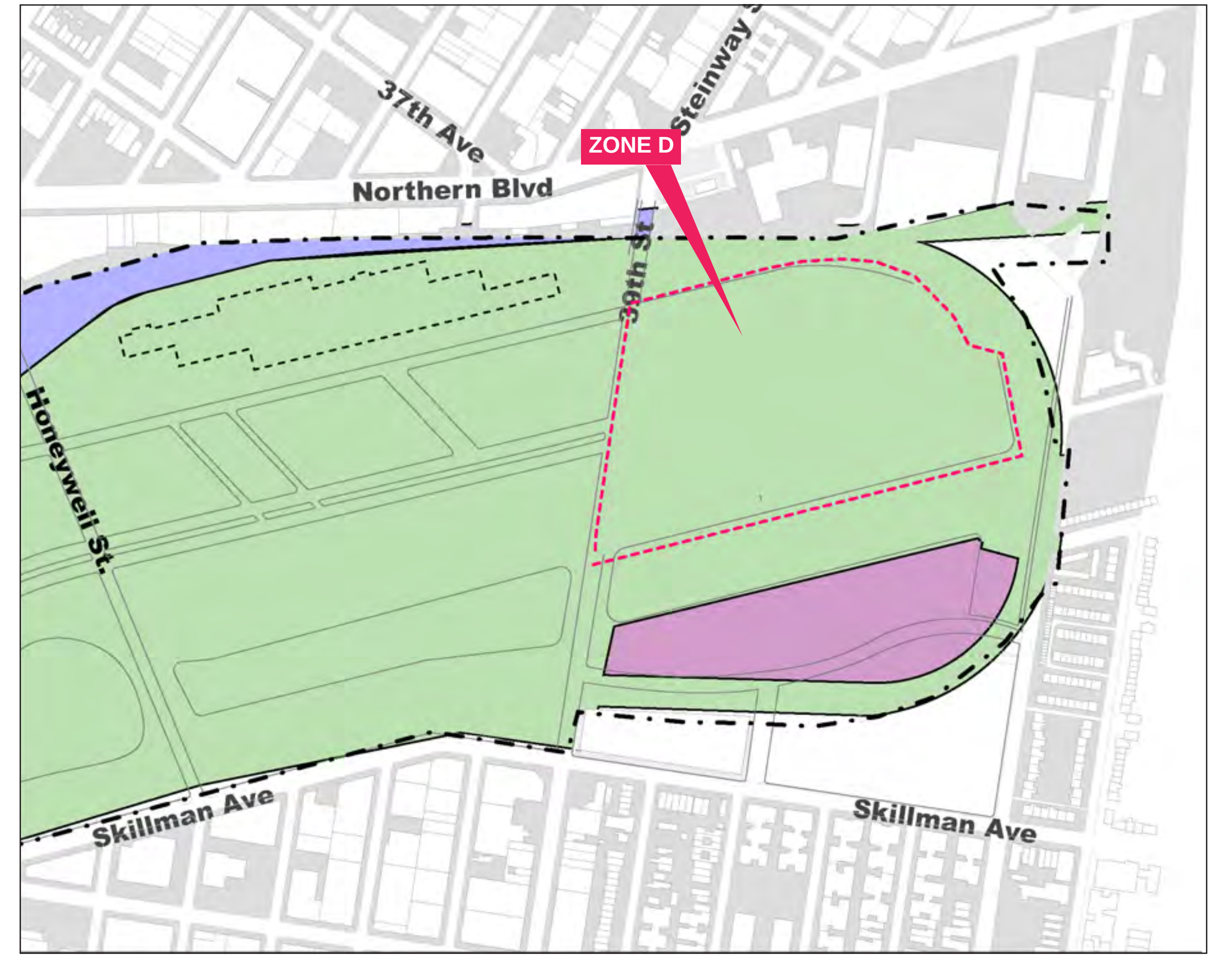
Residential Podium	Office Podium	School/Community	Landscape Buffer
Residential Tower	Office Tower	Public Green Space	Parking
Creative office	Mixed-Use	Public Hardscape	Railroad Facilities

The Destination test case is the same as the residential and Live/Work/Play test cases except for the configuration of the large park. In this test case, one of the schools would be replaced with a mixed-use urban shopping district. The retail at the west end of the park is an extension of the retail in Zone B and will be a gateway from the anchor park to the central retail pedestrian street in Zone B.

Zone D:



ZONE D: ROOF PLAN/GRAPHIC PLAN

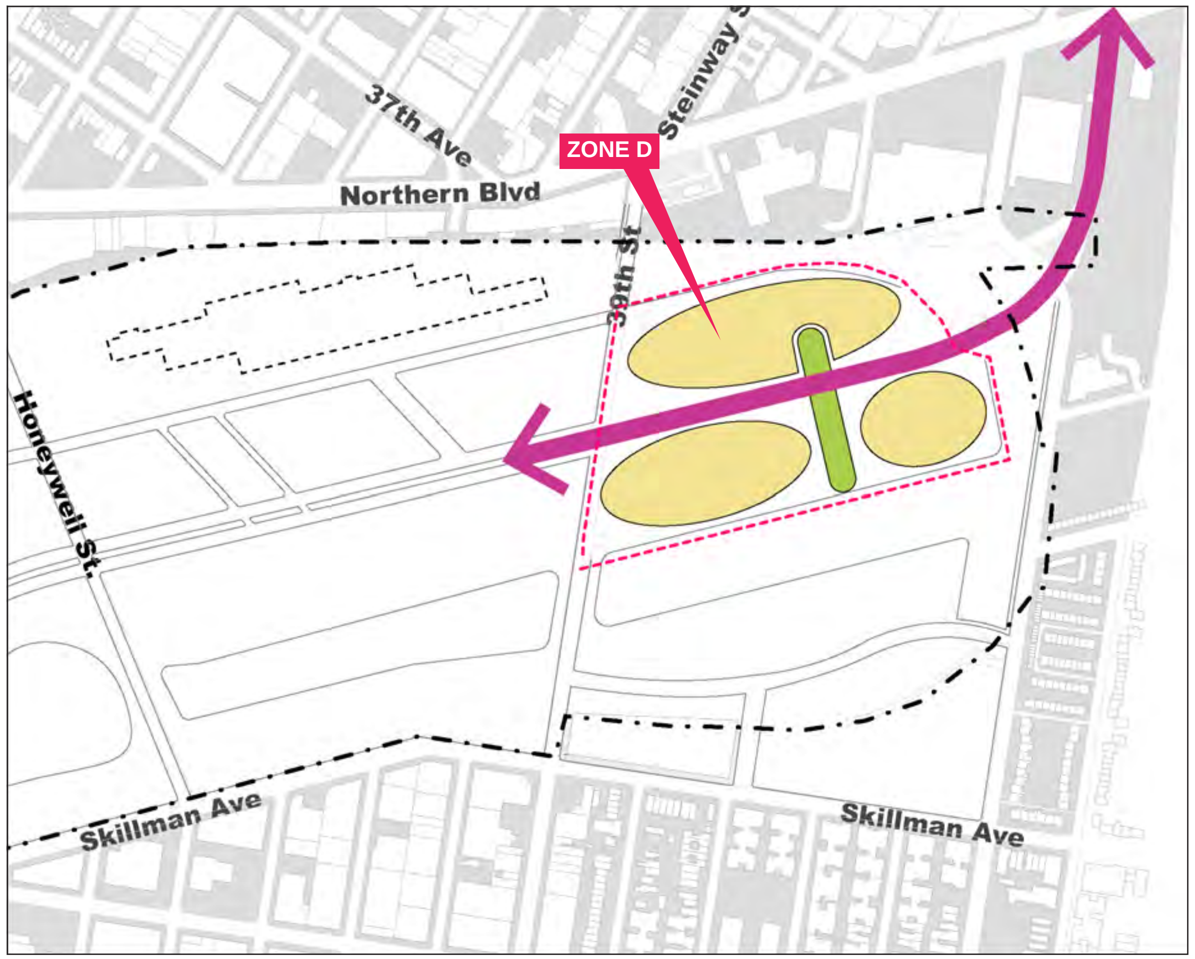


ZONE D: OWNERSHIP

- Amtrak
- MTA
- Private

With its connection to Northern Boulevard, Zone D is one of the few areas where vehicular access to the deck may be feasible from surrounding grade. It would act as a gateway to the core of Sunnyside Yard.

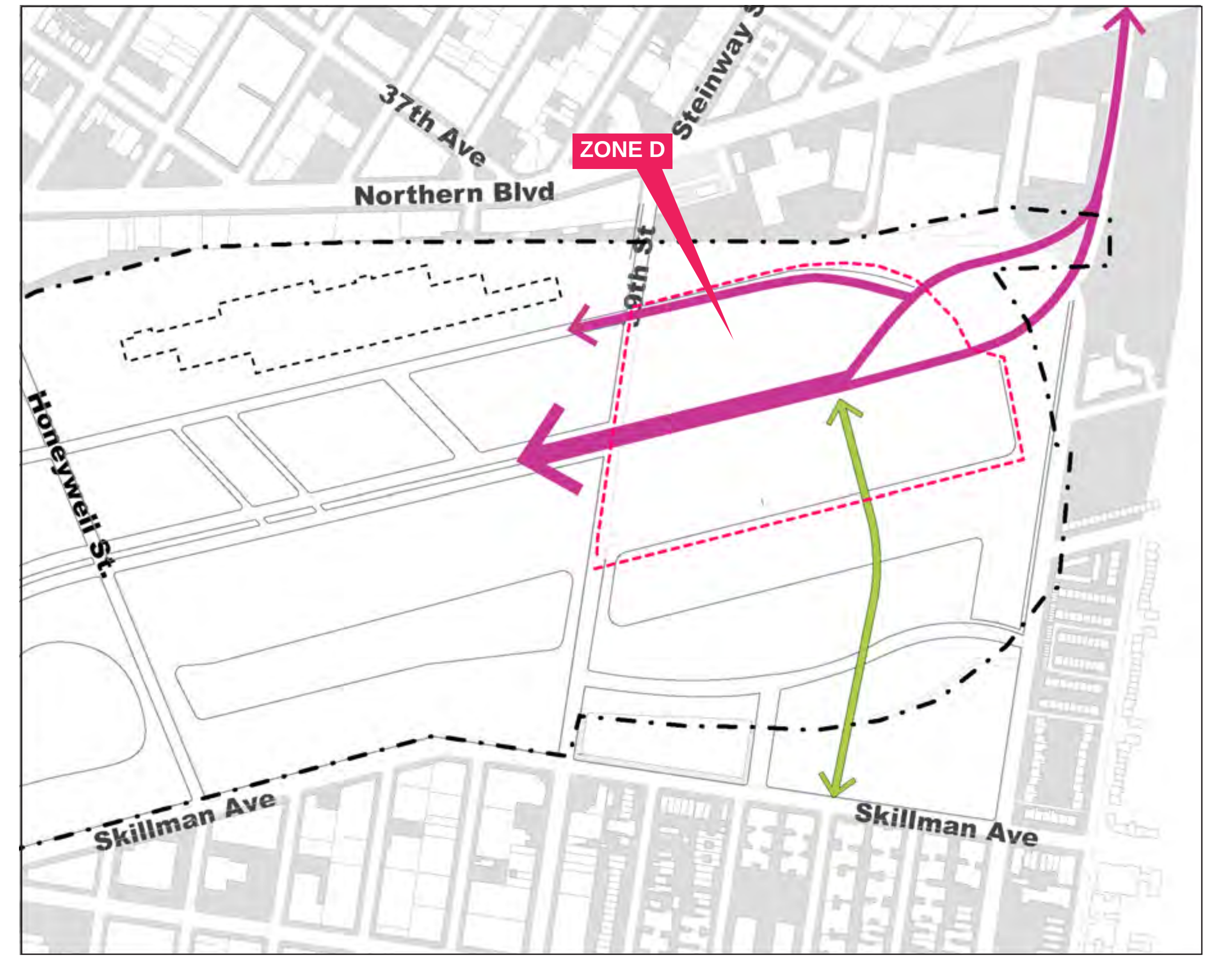
The zone and development air rights are owned by Amtrak/Federal Agencies. The zone includes the loop track and Amtrak facilities, including a transformer building. The proposed vehicular access would extend from the deck across 43rd Street.



ZONE D: GENERAL ORGANIZATION

- Residential/Mixed-Use Development Zone
- Retail/Office Development Zone
- Public Space
- Primary Connection

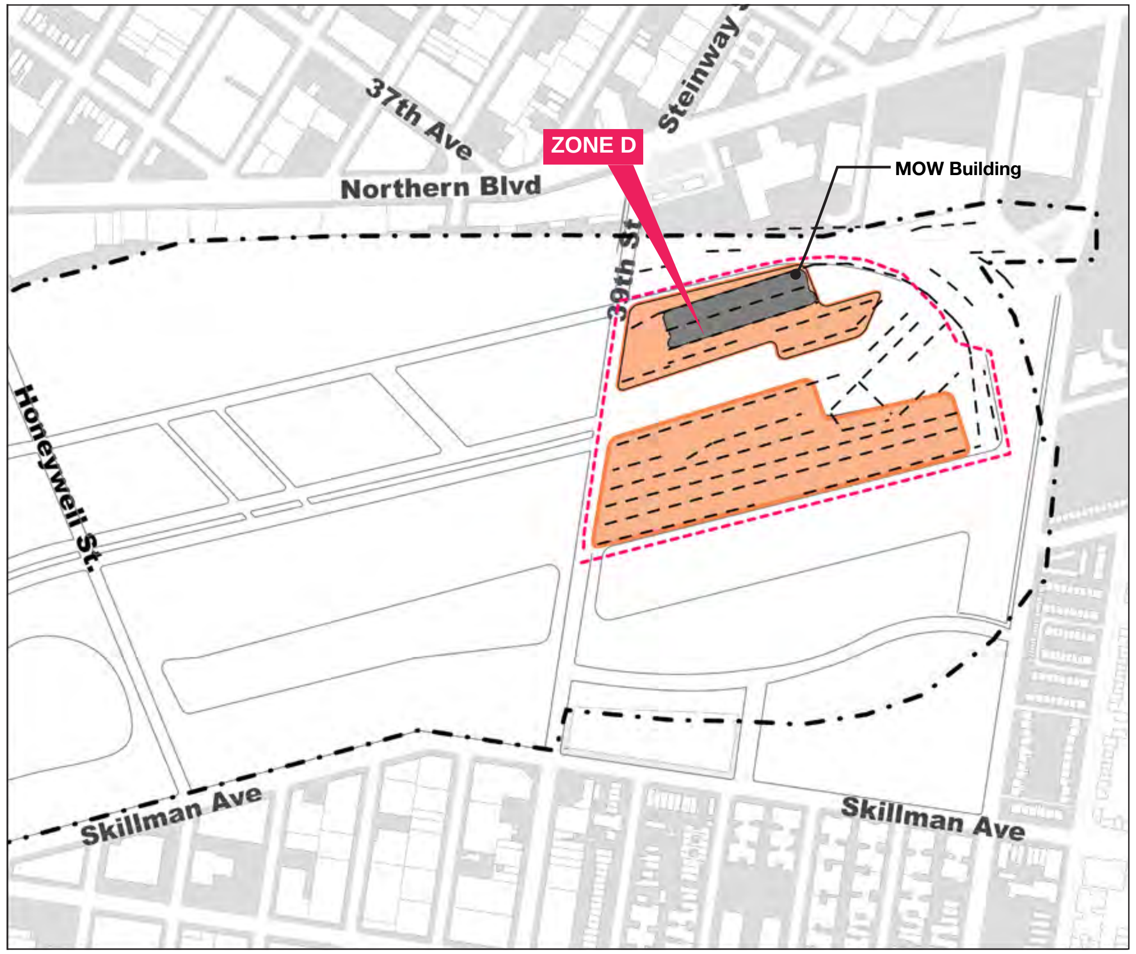
The zone would be a gateway for visitors coming from the east and features a landscaped green space to anchor the east end of Sunnyside Boulevard. The zone would be primarily residential with the development bisected by Sunnyside Boulevard. A neighborhood park and focal point for the residential uses provides a pedestrian connection to the south.



ZONE D: CONNECTIVITY + STREET GRID

- Primary Connection
- Secondary Connection
- Pedestrian Connection

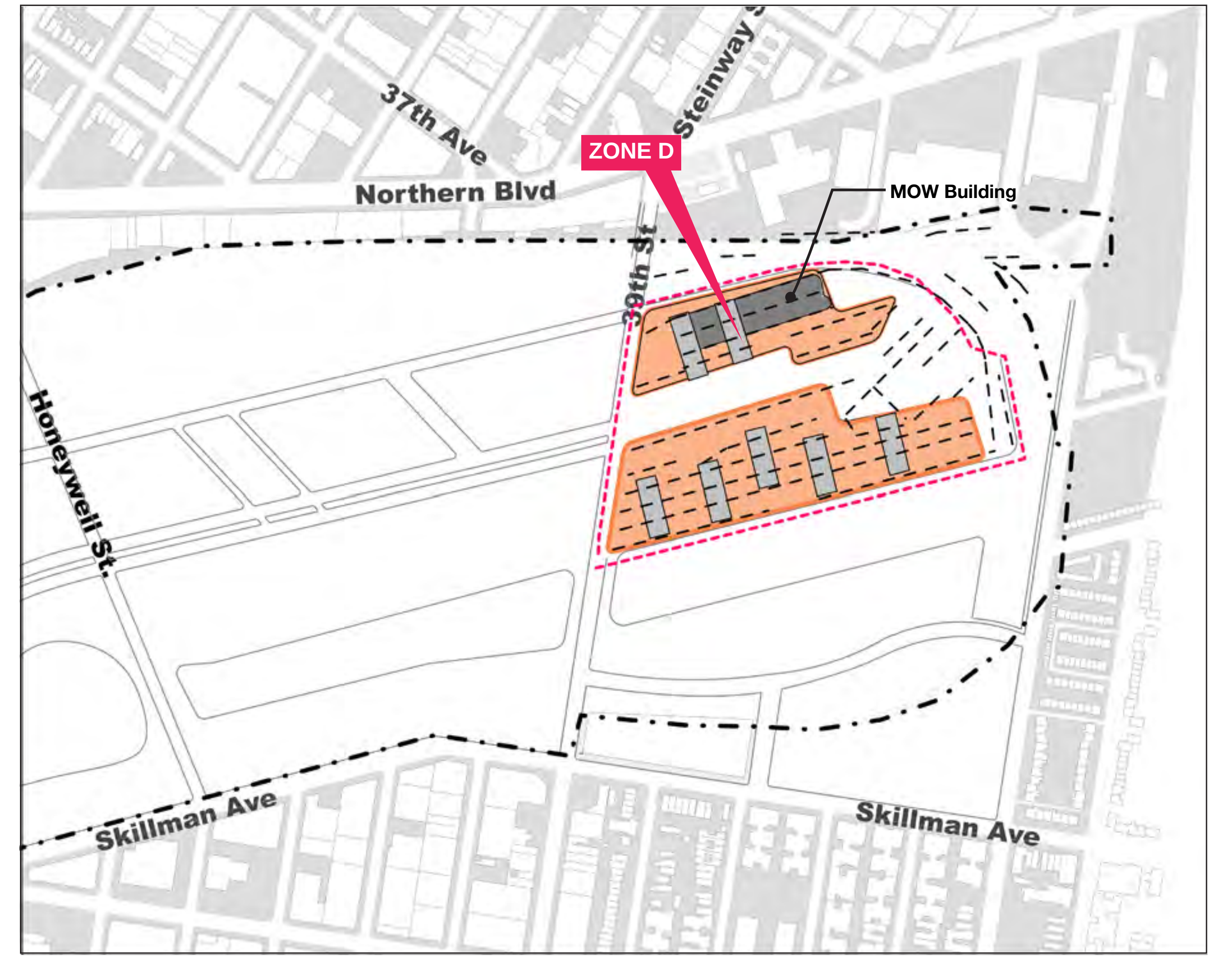
Sunnyside Boulevard runs east-west, connecting across the site, and continues east offsite connecting to Northern Boulevard. A secondary road would provide redundancy and additional access to development sites to the north of the boulevard. The boulevard would provide the primary access to development and access to Zone C from the east. A park would provide north-south connectivity across the zone, from Sunnyside Boulevard, with a pedestrian bridge over the open Main Line cut connecting south to Zone E.



ZONE D: COLUMN LOCATIONS + TOWER ZONES

Tower Zones
Column Lines

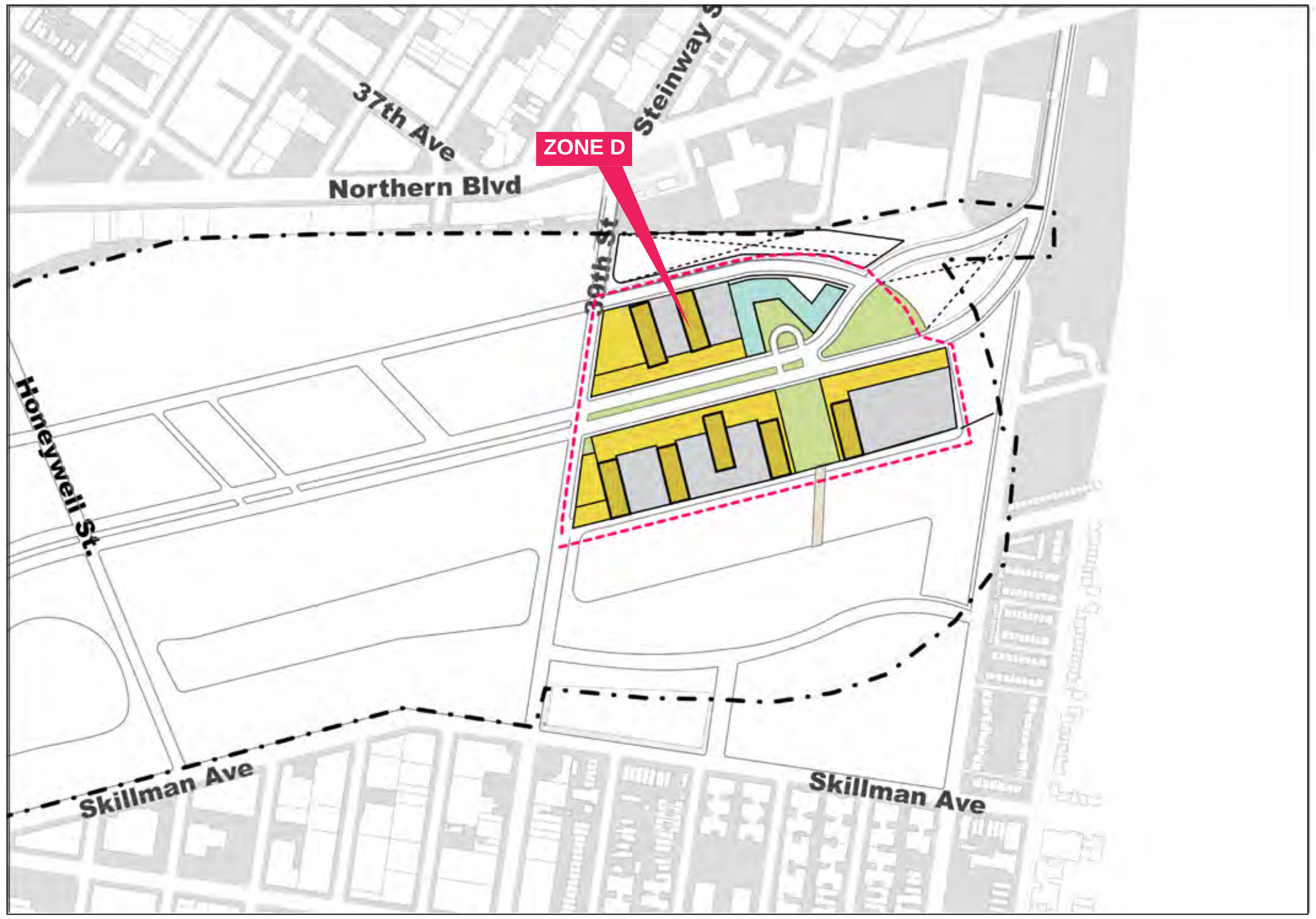
The northern and southern parts of Zone D have no existing or proposed tracks. This allows support columns to be located with few constraints, resulting in deck spans generally between 45’ and 60’. These are optimal locations for towers. The middle of Zone D is occupied, at grade, by Amtrak’s Maintenance of Way (MOW) facility, which requires open areas for moving materials and turning equipment. This leads to proposed support walls being widely spaced, with deck spans of up to 200’.



ZONE D: ILLUSTRATIVE TOWER LOCATIONS

Tower Zones
Illustrative Tower Locations
Column Lines

In the zones where towers are feasible, there is space for approximately seven towers. Because of the variability in the track spacing there is wide range of feasible tower heights. As residential towers, they can range from 15 stories to 69 stories.



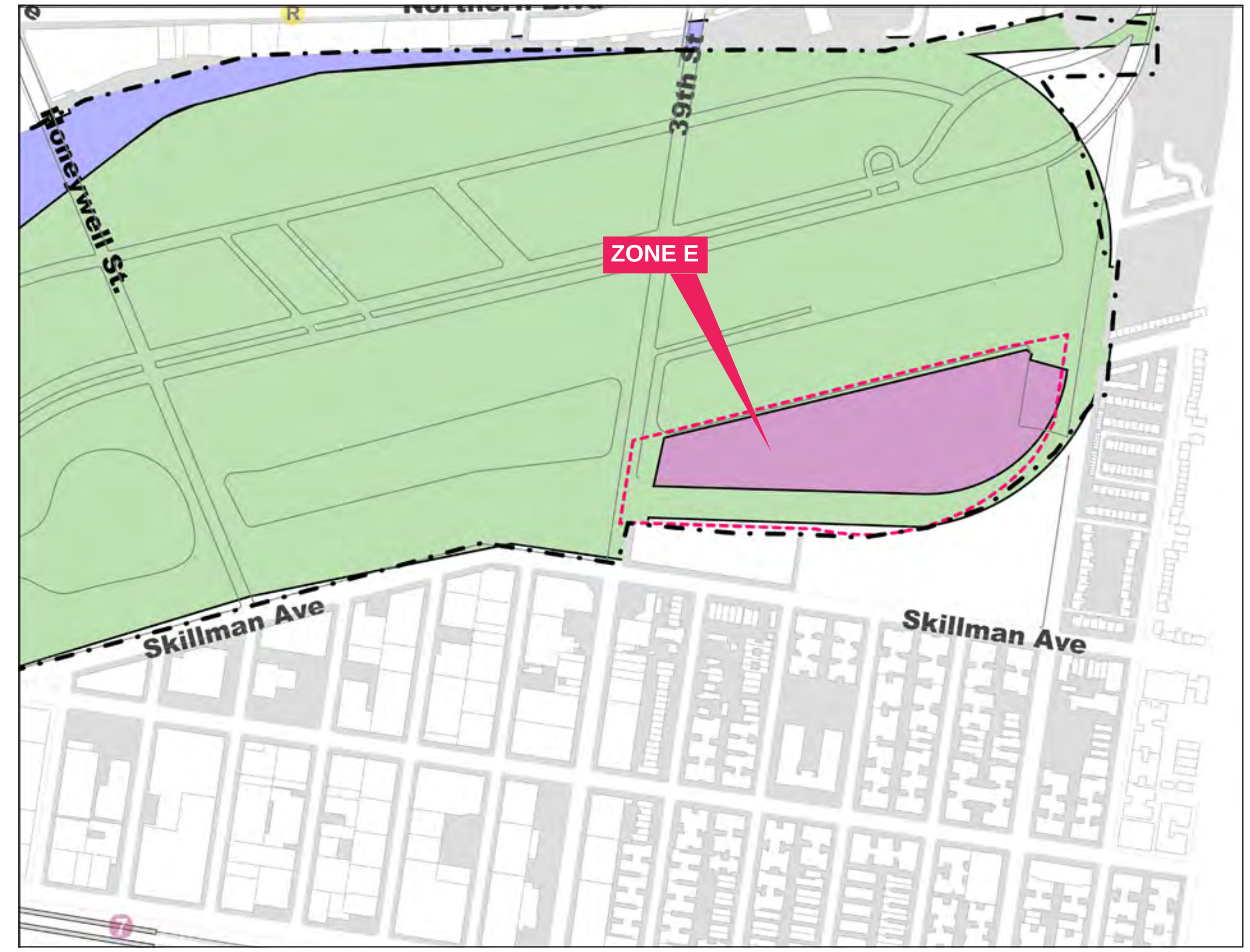
ZONE D: TEST CASE 1,2, & 3

- Residential Podium
- Residential Tower
- Creative office
- Office Podium
- Office Tower
- Mixed-Use
- School/Community
- Public Green Space
- Public Hardscape
- Landscape Buffer
- Parking
- Railroad Facilities

A gateway green space would signify the start of Sunnyside Boulevard, which roughly bisects the zone. The towers straddle both sides of Sunnyside Boulevard with the tower podiums creating a strong street-wall to frame the boulevard. A school would front the gateway green and terminate the visual axis of a neighborhood pocket park to the south. The neighborhood park would be part of a connected pedestrian network, which includes a pedestrian bridge over the undecked Main Line south to Zone E and the second anchor park in Sunnyside Yard.

Zone E:

ZONE E: ROOF PLAN/GRAPHIC PLAN

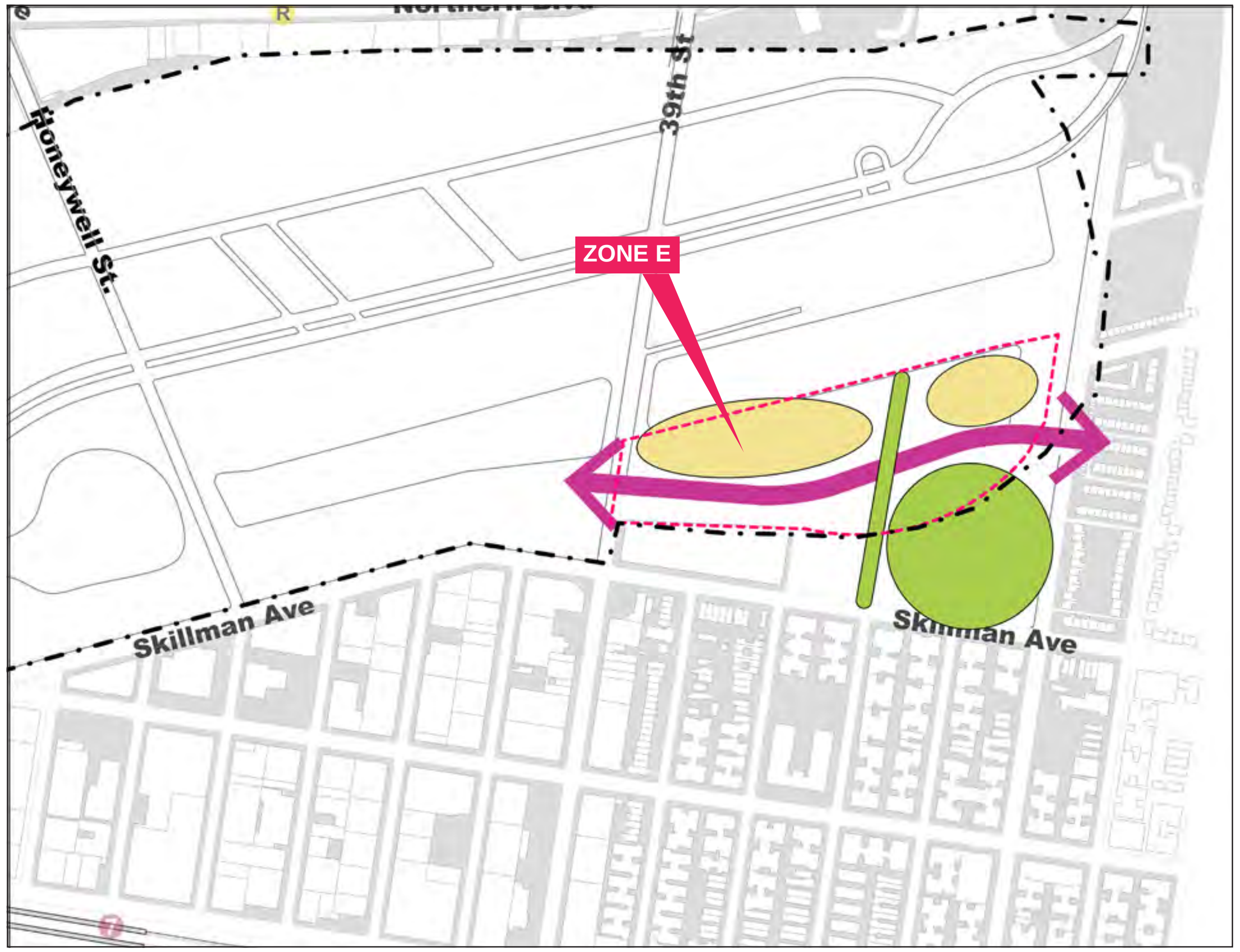


ZONE E: OWNERSHIP

- Amtrak
- MTA
- Private

While Zone E consists of largely non-rail, privately-owned land, it offers extensive terra firma and strong connections to existing neighborhoods and open spaces. Residential development here would be kept at a lower scale to create a transition to adjacent neighborhoods, with an expanded park to provide a buffer between new and existing development. Planning in this zone should consider additional strategies to buffer the Sunnyside Gardens Historic District.

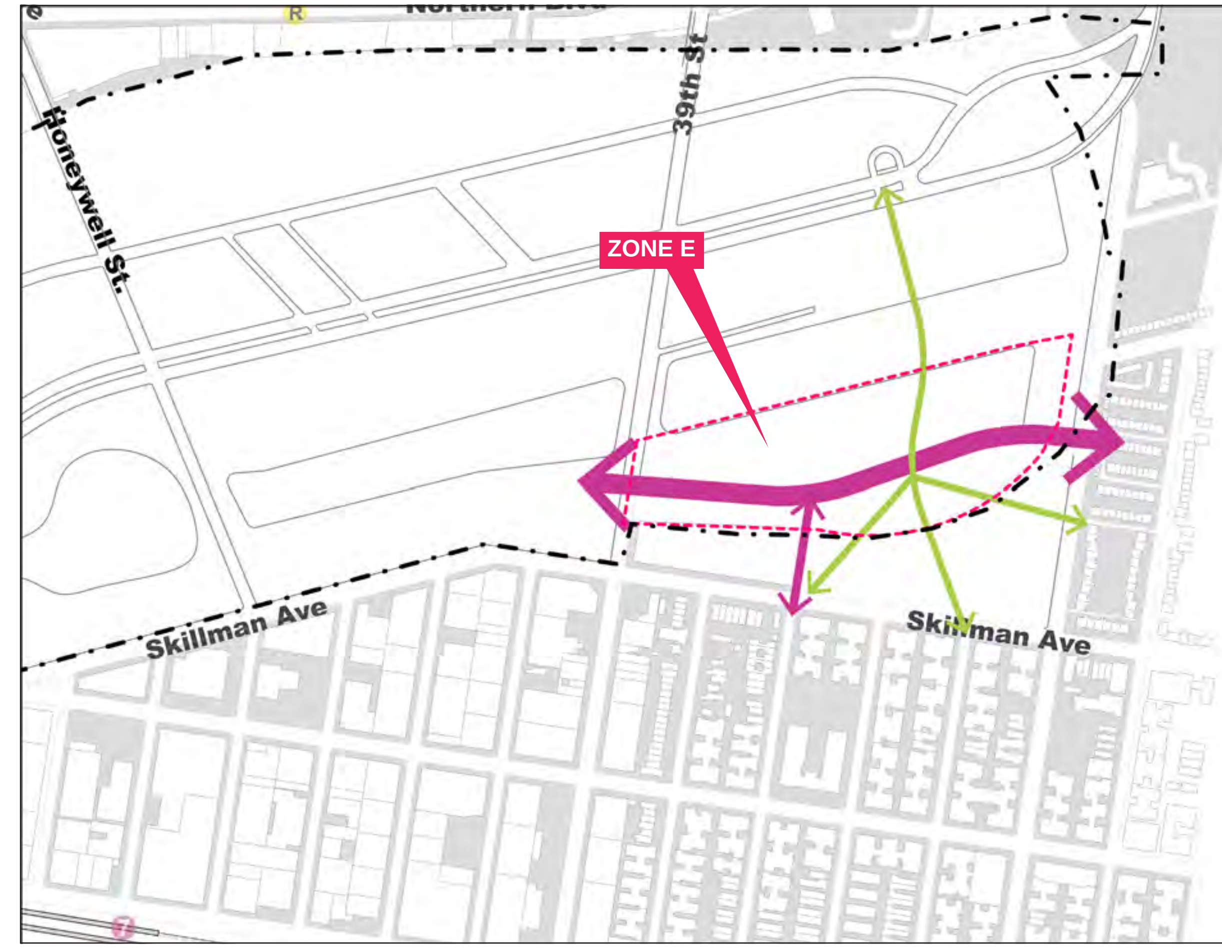
The zone is mostly under private ownership with development air rights also privately owned. The private ownership area is an island of land surrounded by railroad tracks. The tracks and associated development air rights are owned by Amtrak/Federal Agencies. The tracks to the north comprise the Main Line and the tracks on the other sides are part of the loop tracks.



ZONE E: GENERAL ORGANIZATION

- Residential/Mixed-Use Development Zone
- Retail/Office Development Zone
- Public Space
- Primary Connection

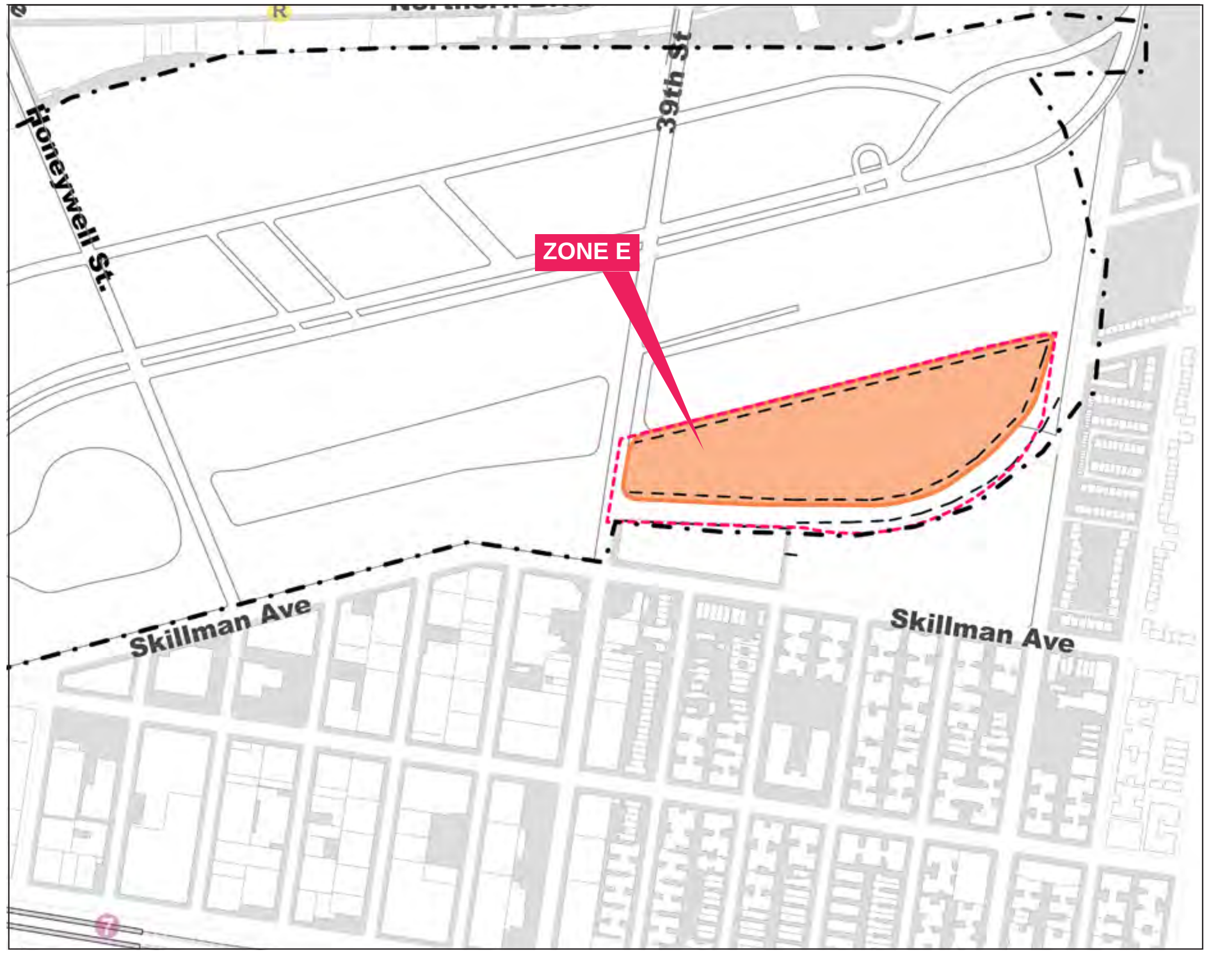
Development would be located on the north side of the zone, with the second anchor park to the south. The open space expands existing Lou Lodati Park. This active park buffers the adjacent Sunnyside neighborhood and historic district. It should be noted that the Main Line reaches its highest elevation within Sunnyside Yard here, just over +62', and may also require buffering or other considerations in terms of its relationship to new development.



ZONE E: CONNECTIVITY + STREET GRID

- Primary Connection
- Secondary Connection
- Pedestrian Connection

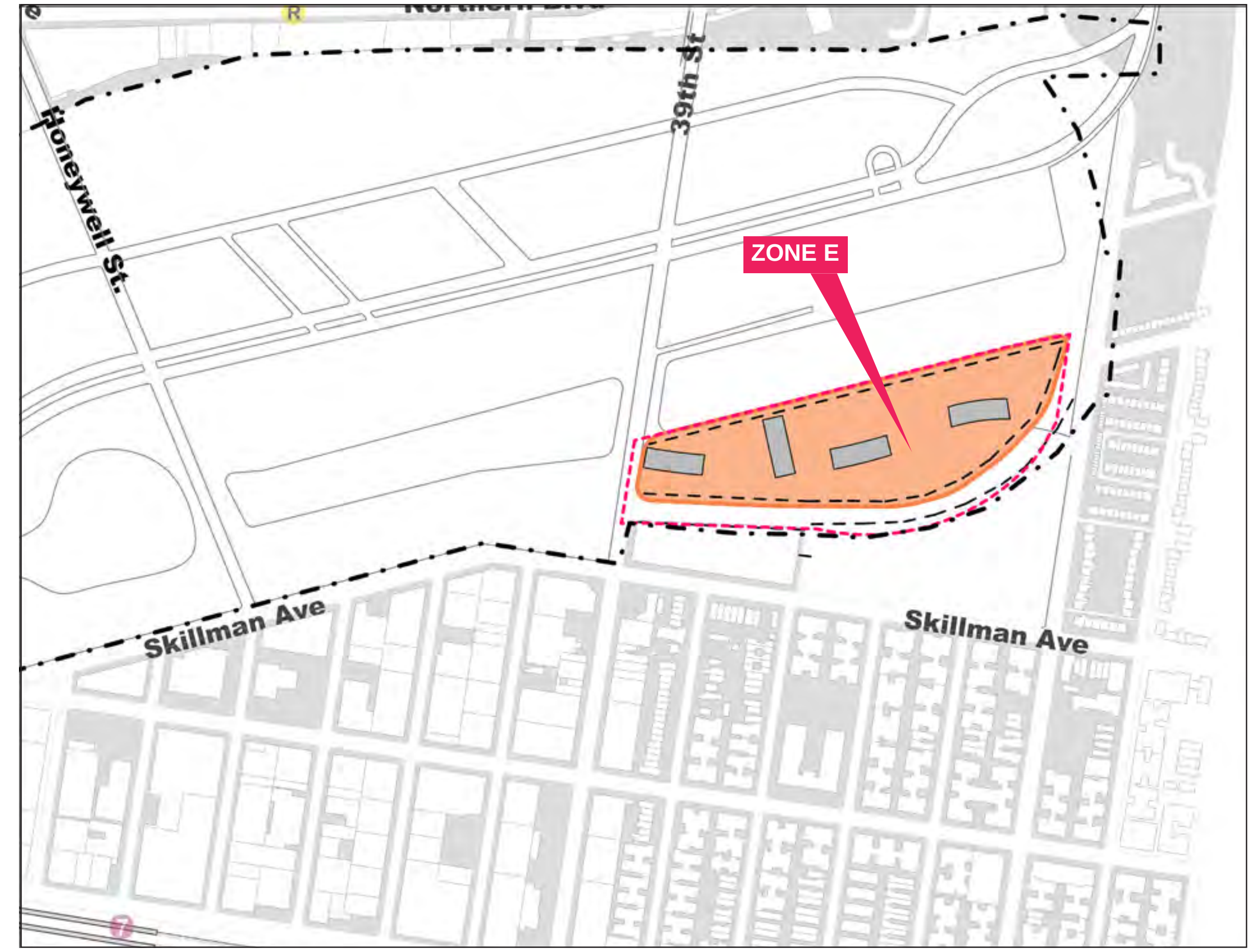
An east-west roadway connecting the 39th Street Bridge with 43rd Street would bisect this zone. This curvilinear secondary street would emphasize the presence of the park and the quieter residential character of the area. The anchor park would provide an at-grade pedestrian connection to Skillman Avenue and 43rd Street. A linear park would provide north-south connectivity north from the park with a pedestrian bridge over the open Main Line cut connecting to Zone D. An east-west linear park would provide landscaped pedestrian connections to the linear open space in Zone F to the west.



ZONE E: COLUMN LOCATIONS + TOWER ZONES

Tower Zones
Column Lines

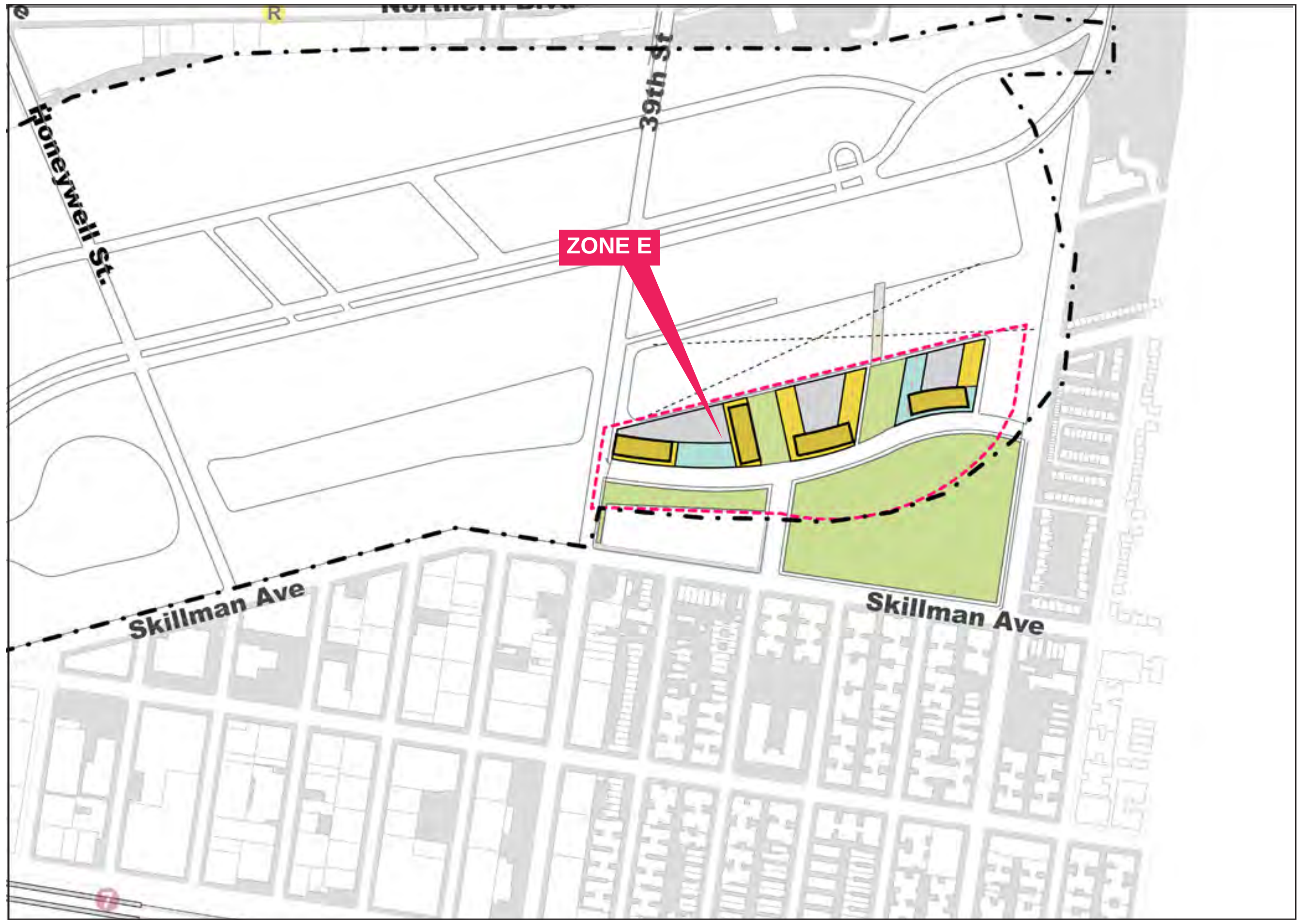
The southern boundary of this zone is occupied by the loop tracks, which comprise three railroad tracks in a cut. Constructing support walls on either side would allow for a deck span of approximately 75'. Most of the northern portion of the zone is terra firma, allowing for flexibility in the placement of towers.



ZONE E: ILLUSTRATIVE TOWER LOCATIONS

Tower Zones
Illustrative Tower Locations
Column Lines

Tower placement has been limited to four proposed towers. Given that this section of the Yard is located on terra firma, specific locations and dimensions of structures are especially flexible in this area. The placement above is for illustrative purposes only. The residential towers range from 10 to 30 stories, stepping down in height toward Sunnyside Gardens. Although tower heights are not limited because of structural constraints, they step down to be sensitive to the context of the adjacent low-rise Sunnyside Gardens Historic District.

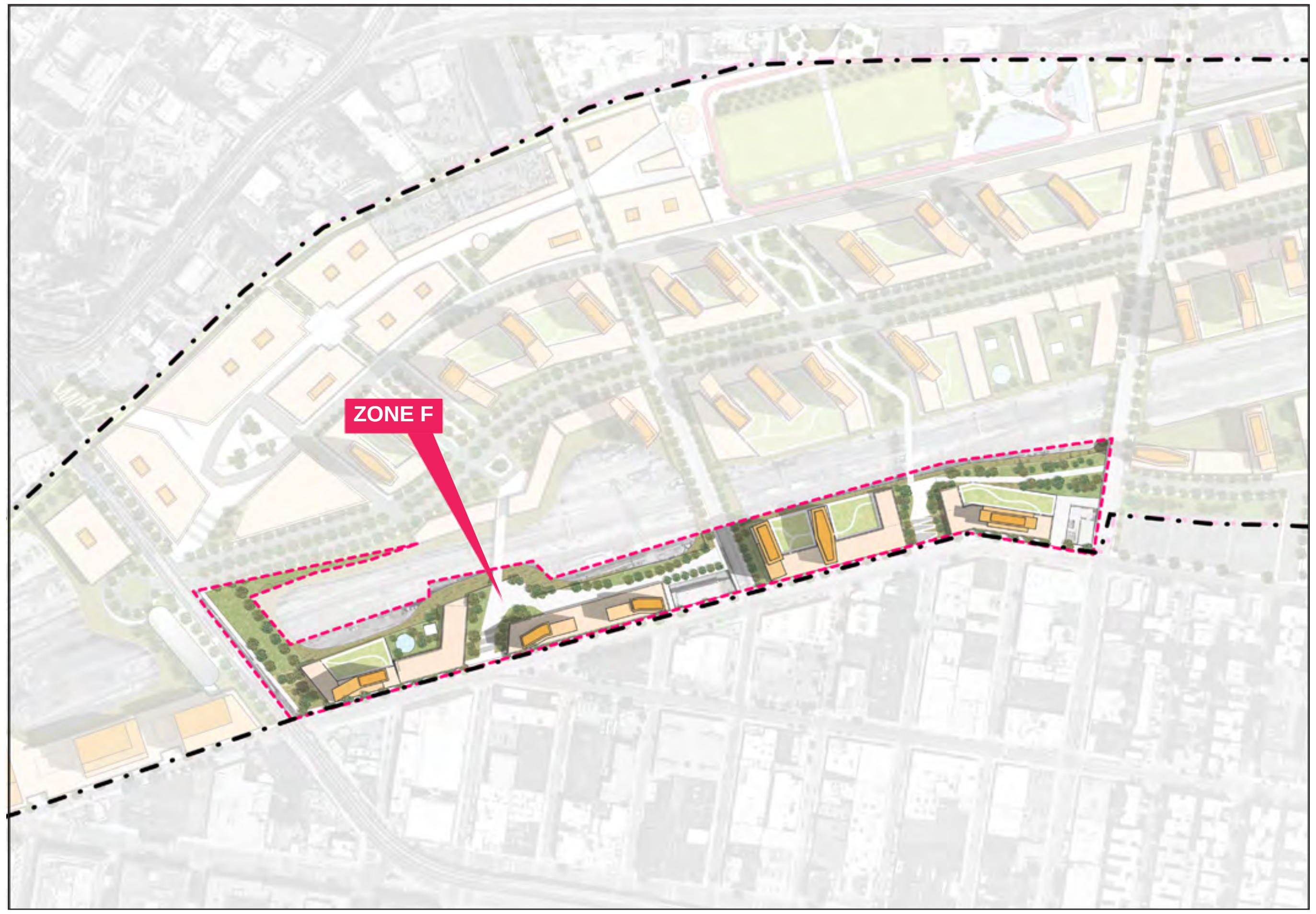


ZONE E: TEST CASE 1,2, & 3

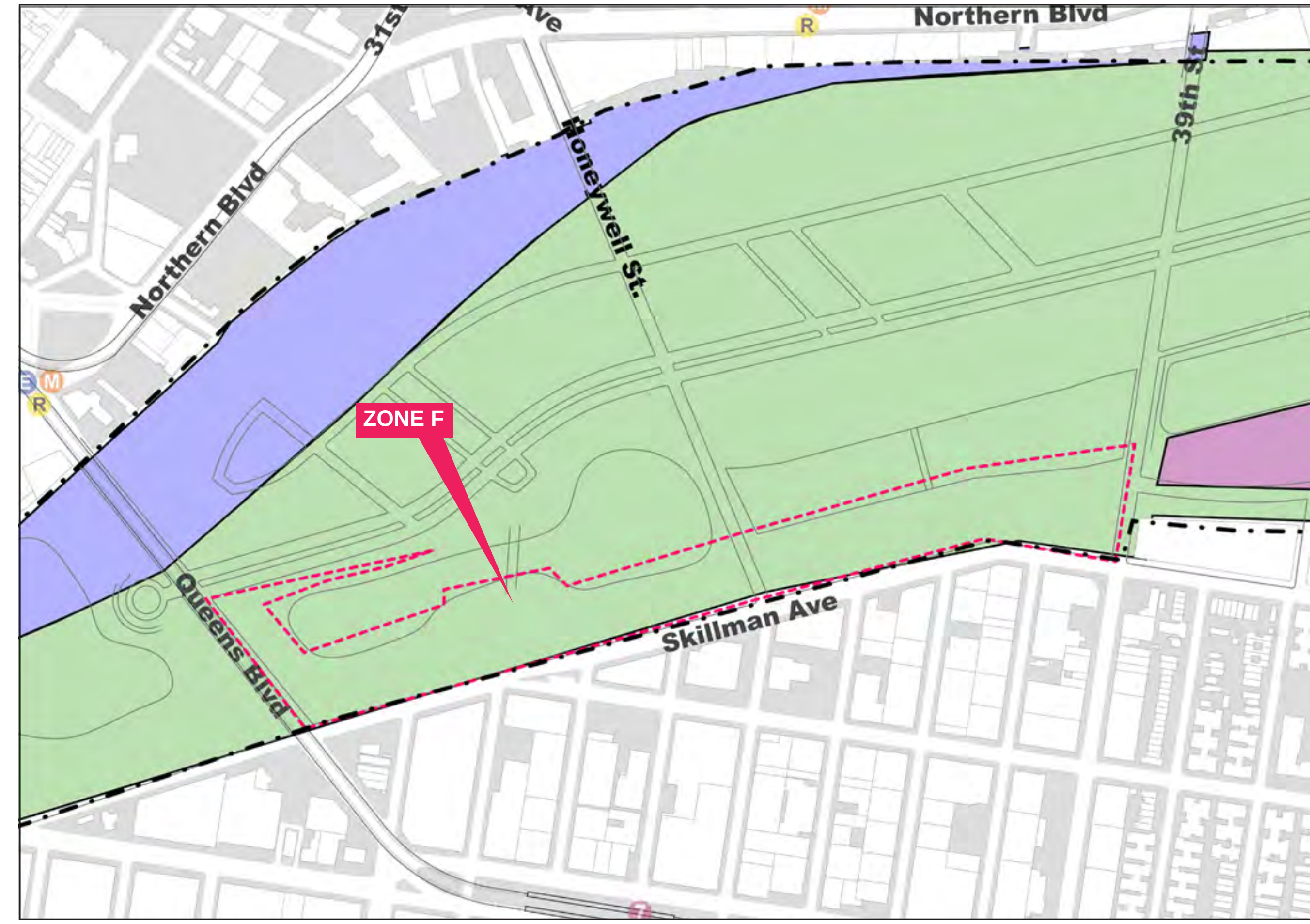
Residential Podium	Office Podium	School/Community	Landscape Buffer
Residential Tower	Office Tower	Public Green Space	Parking
Creative office	Mixed-Use	Public Hardscape	Railroad Facilities

Development is located to the north of the east-west access street to provide distance between the development and the historic district. The towers are located on terra firma, but tower heights are restricted to respect the low scale of nearby dwellings. The open space expands the existing Lou Lodati Park. This expanded, active park provides an amenity for new and existing residents and provides an additional buffer for the adjacent neighborhood.

Zone F:



ZONE F: ROOF PLAN/GRAPHIC PLAN

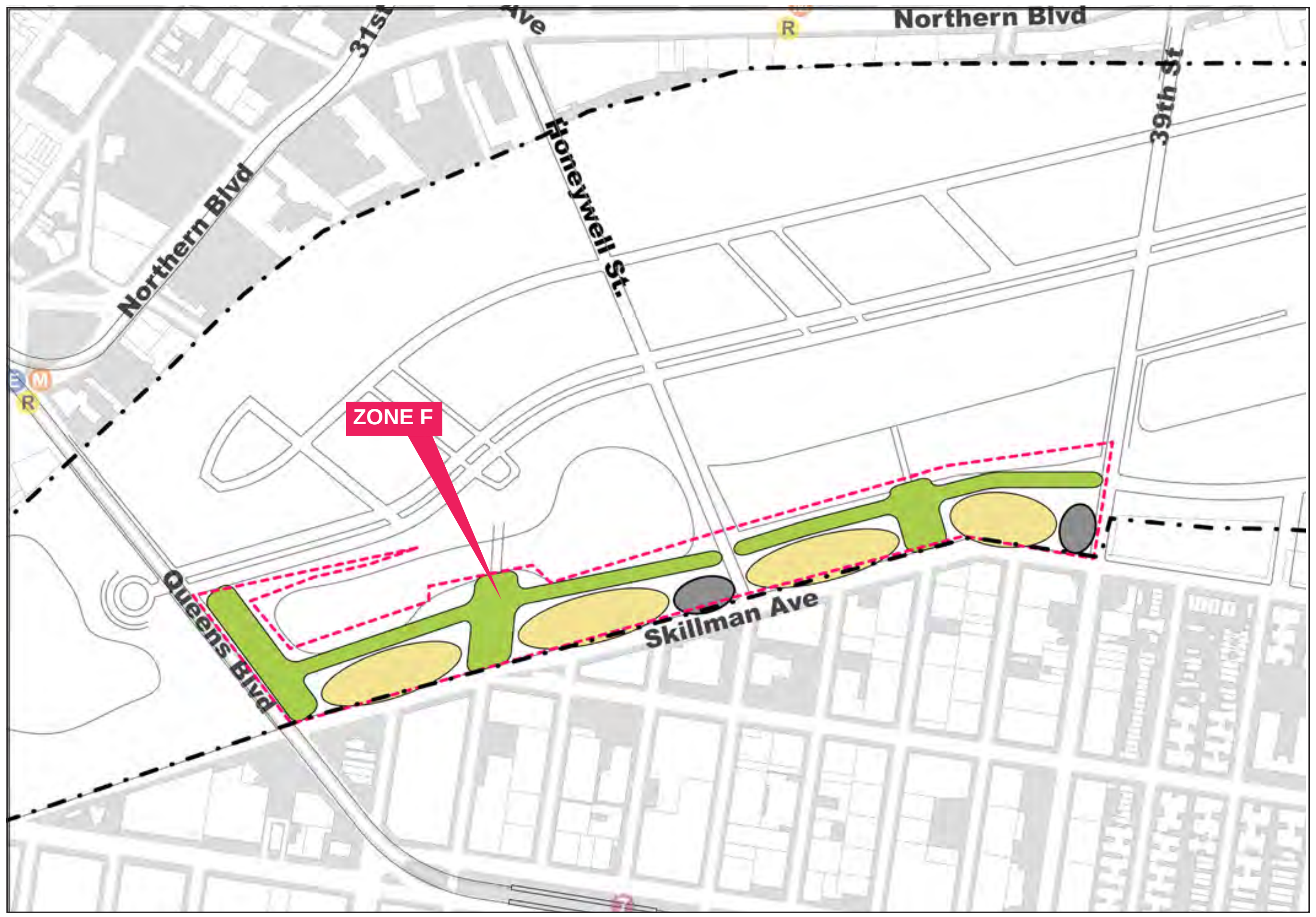


ZONE F: OWNERSHIP

- Amtrak
- MTA
- Private

The linear development zone reflects constraints due to the Main Line. The frontage along Skillman Avenue would define and activate the edge of an overbuild deck and negotiate the grade change to the full deck elevation. The area is suitable for commercial, creative office space, residential, or institutional floor plates. An outward, southward focus and limited connections to new development across the un-decked Main Line would make this zone feel more like an independent neighborhood.

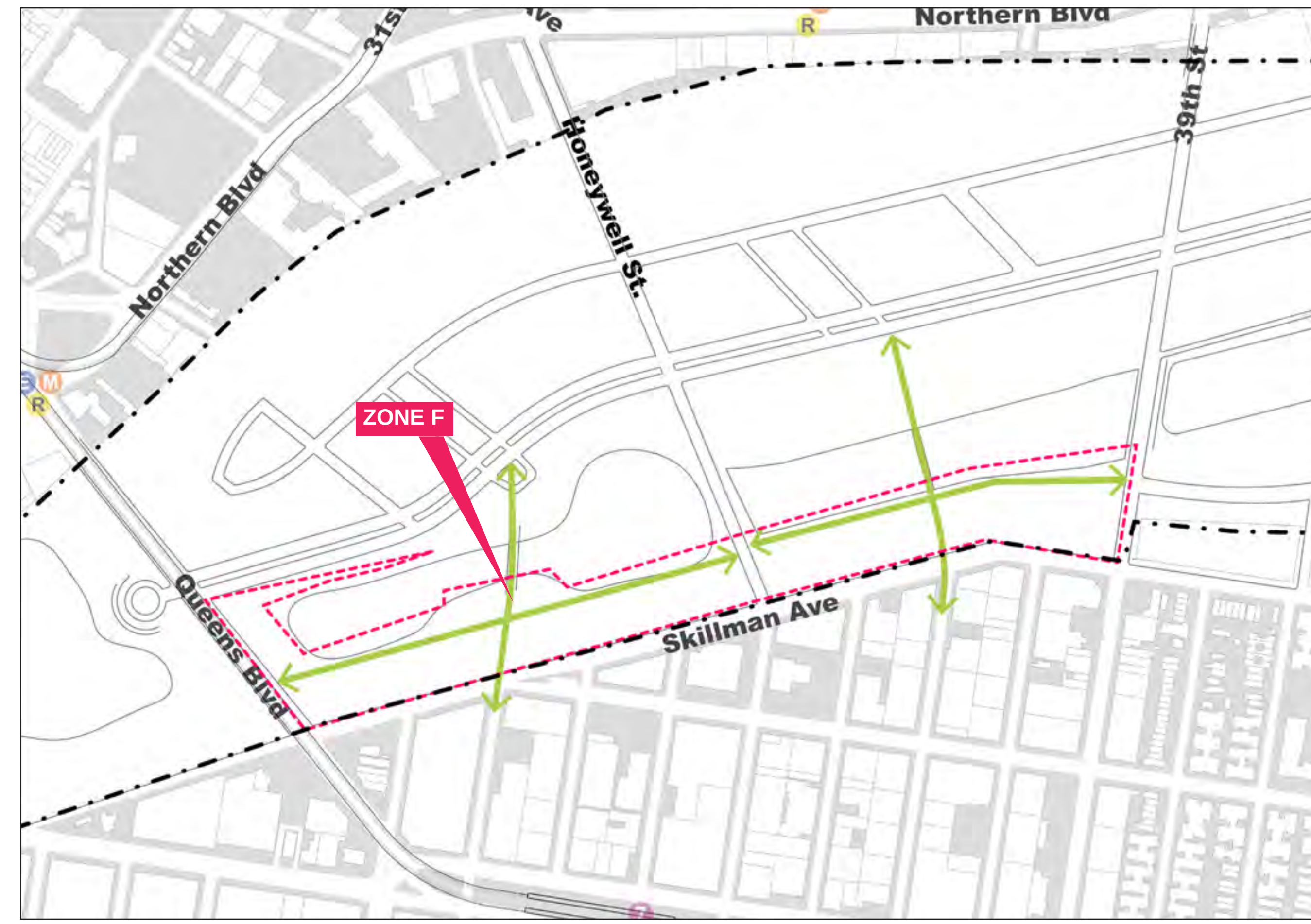
The zone and development air rights are owned by Amtrak/Federal Agencies.



ZONE F: GENERAL ORGANIZATION

Residential/Mixed-Use Development Zone
Public Space
Existing Sunnyside Yard Buildings
Primary Connection

Development in this zone would serve as a “liner” that conceals the overbuild platform and negotiates grade differences. The area to the north is open to the Main Line, so any development in this zone is likely to be oriented to Skillman Avenue and the adjacent LICIBZ. The narrow footprint between Skillman Avenue and the Main Line constrains development, so open space is provided in a series of plazas at deck level and in terraced connections down to Skillman Avenue.

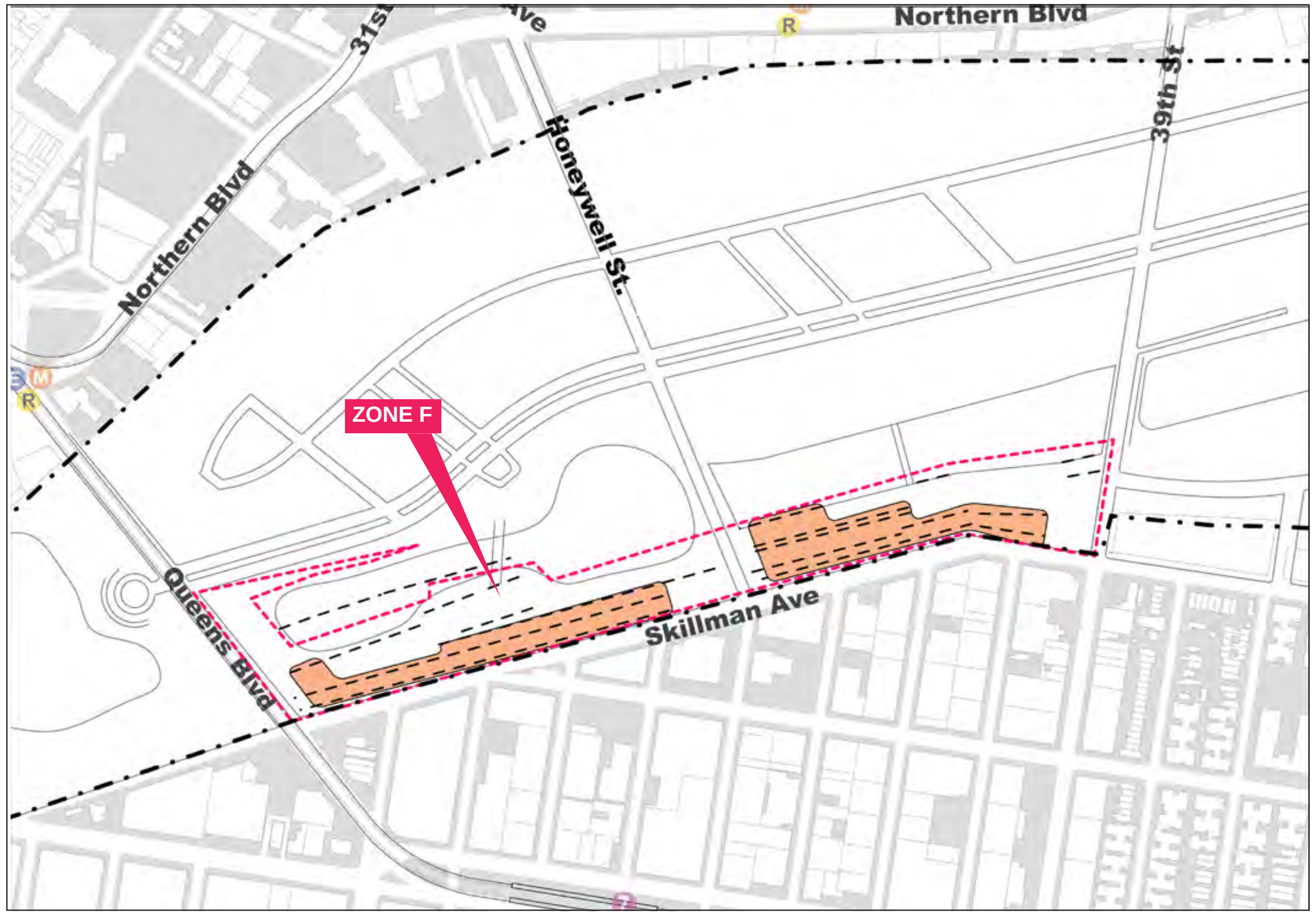


ZONE F: CONNECTIVITY + STREET GRID

Pedestrian Connection

The development would front on – and only be accessible from – Skillman Avenue. A narrow zone of terra firma along Skillman Avenue allows for at-grade building entrances, lobbies, and vertical circulation to deck level and buildings above. It is envisioned that buildings may have secondary entrances, lobbies, and public functions at the deck level to activate exterior public space. An elevated linear park would connect open spaces at the deck level, allowing pedestrian circulation along the deck edge.

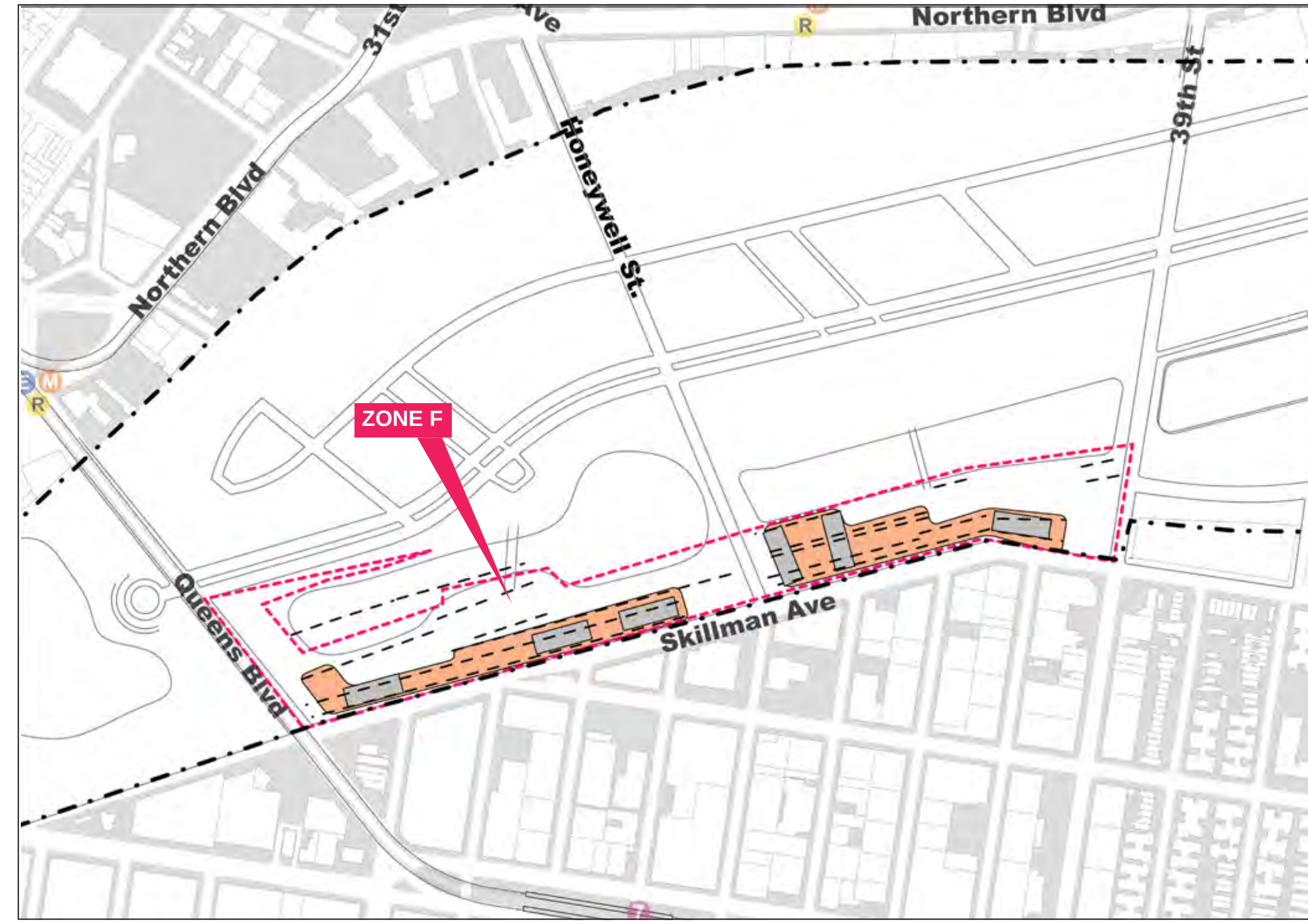
Two park/plaza areas each connect to a pedestrian bridge over the open Main Line cut, connecting north to Zones B and C. A linear park extending west from 39th Street would connect to the linear park in Zone E and enable a gradual transition to deck height. At the western edge, an open space along Queens Boulevard promotes pedestrian connections to Sunnyside Station from the south and from Sunnyside Boulevard to the north. It is envisioned that either an at-grade crossing or above-grade sky bridge connection would be needed across Queens Boulevard to provide direct pedestrian access to Sunnyside Station from the east side of Queens Boulevard.



ZONE F: COLUMN LOCATIONS + TOWER ZONES

Tower Zones
Column Lines

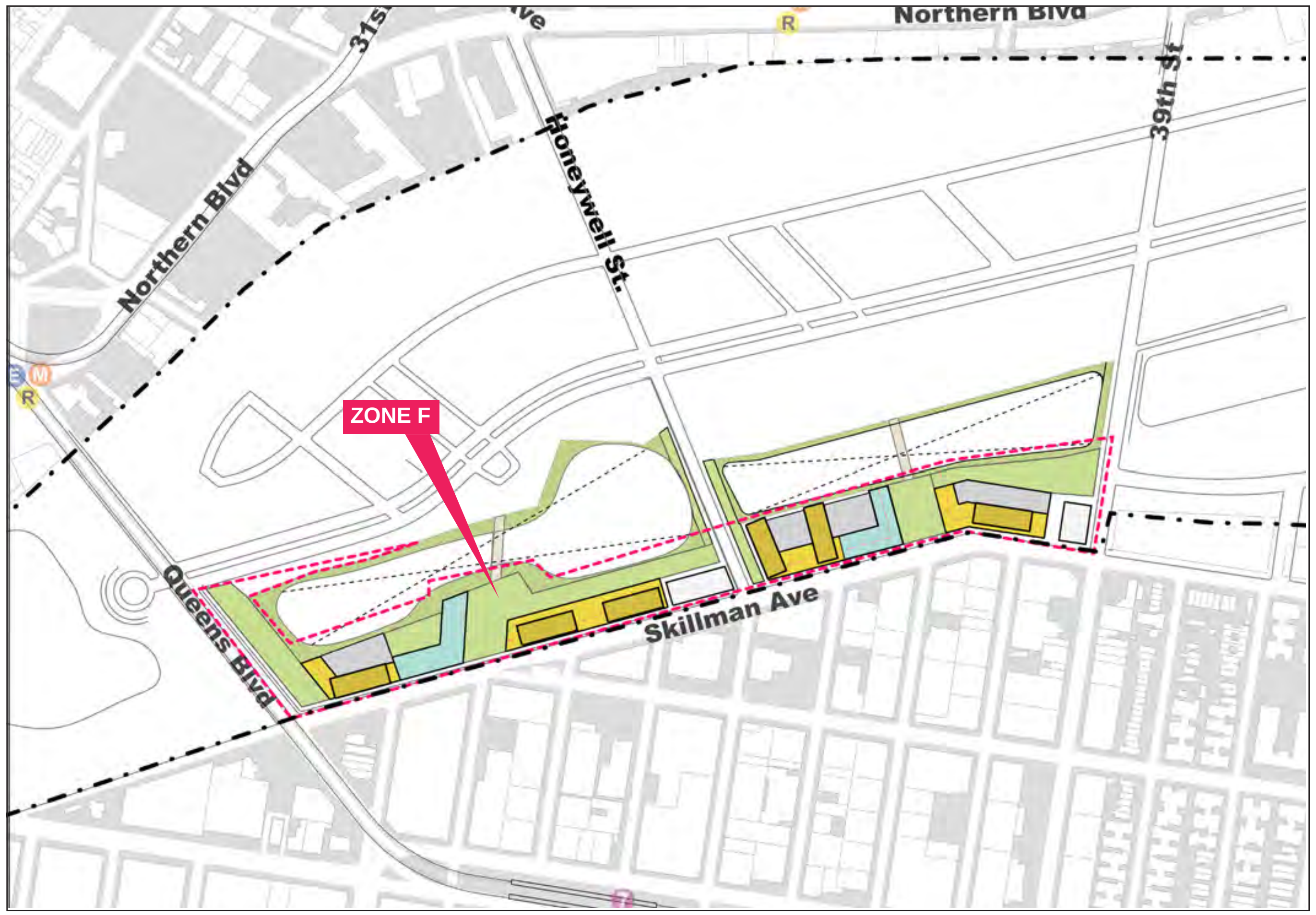
The tower zone is along Skillman Avenue. Within the tower zone tracks and touchdown points are irregularly spaced. The northern edge of the zone adjoins the Main Line and the loop tracks. The limited touchdown points constrain the area in which towers are feasible. A vehicular access road for railyard related vehicles is planned to run along this edge and may be incorporated into the base of buildings. Major railroad infrastructure buildings occupy the northwest corners of Skillman Avenue, Honeywell Street, and 39th Street, and do not allow for development in these areas.



ZONE F: ILLUSTRATIVE TOWER LOCATIONS

Tower Zones
Illustrative Tower Locations
Column Lines

Because of the narrow depth of this zone, it is not always possible to orient towers perpendicular to the track and column lines, so potential height is limited. Based on these limitations optimal tower heights range from 25 to 40 floors in six towers.

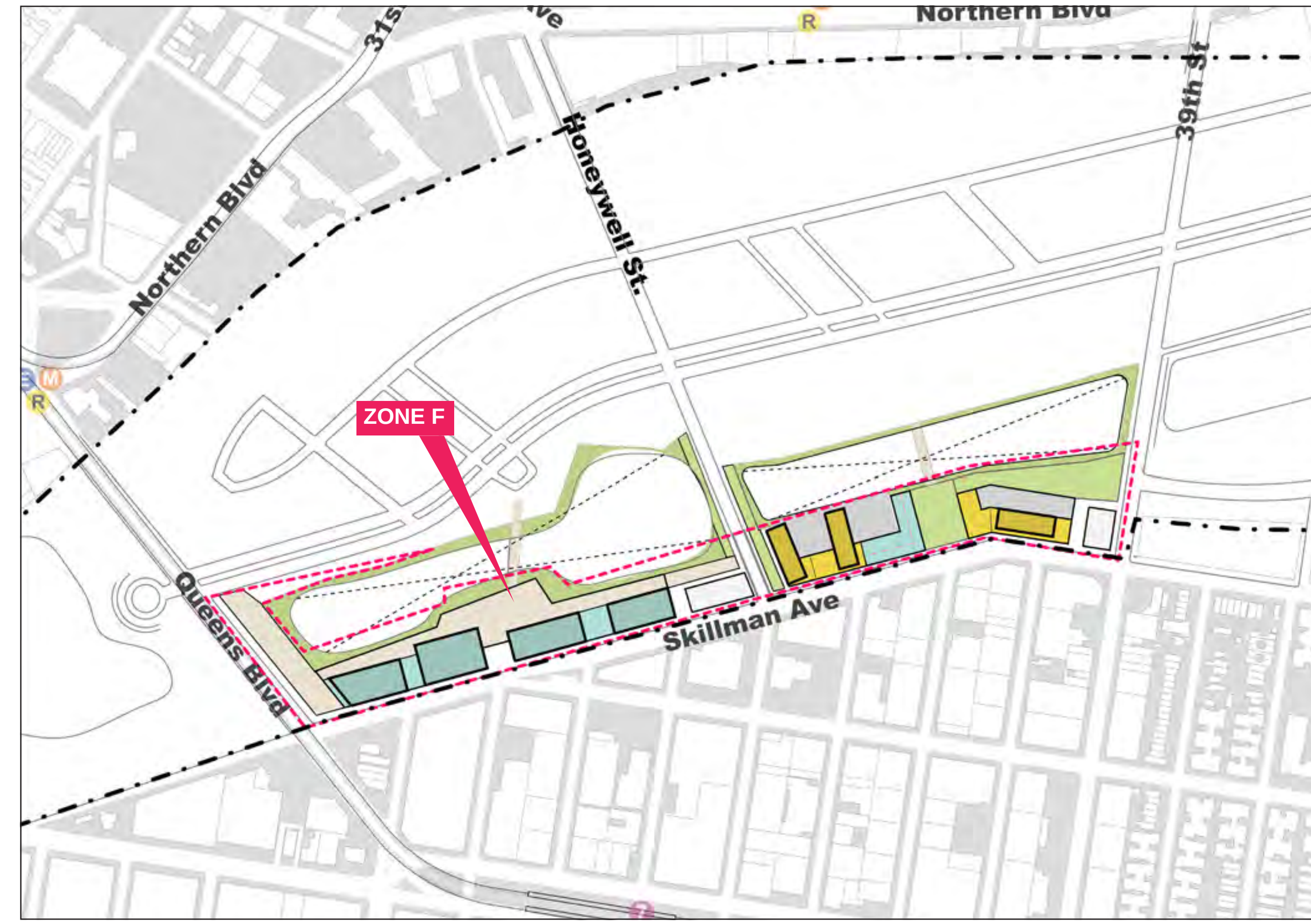


ZONE F: TEST CASE 1- RESIDENTIAL & TEST CASE 3- DESTINATION

Residential Podium
Residential Tower
Creative office
Office Podium
Office Tower
Mixed-Use
School/Community
Public Green Space
Public Hardscape
Landscape Buffer
Parking
Railroad Facilities

The area between Honeywell Street and 39th Street would consist of residential uses in towers over a podium. Existing MTA tunnel egress at 39th Street would need to remain. Elevated parks would be located at podium level and step down toward 39th Street to meet the linear park that connects to Lou Lodati Park in Zone E.

The area between Queens Boulevard and Honeywell Street is mostly residential, but also includes a school. The residential uses are in towers over a podium. Existing MTA substation infrastructure near Honeywell Street would need to remain. Elevated parks are located at podium level providing for pedestrian connections.

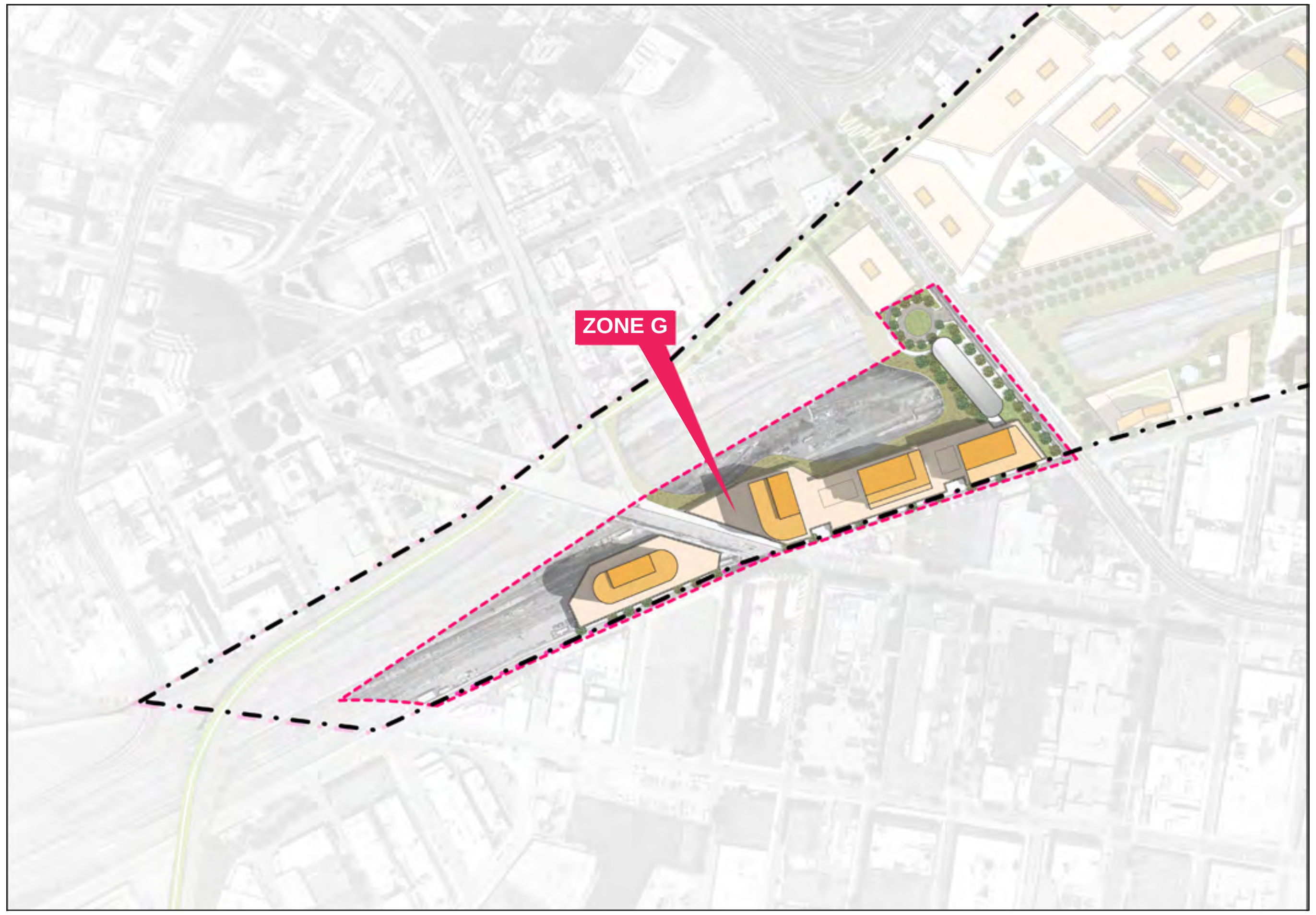


ZONE F: TEST CASE 2- LIVE/WORK/PLAY

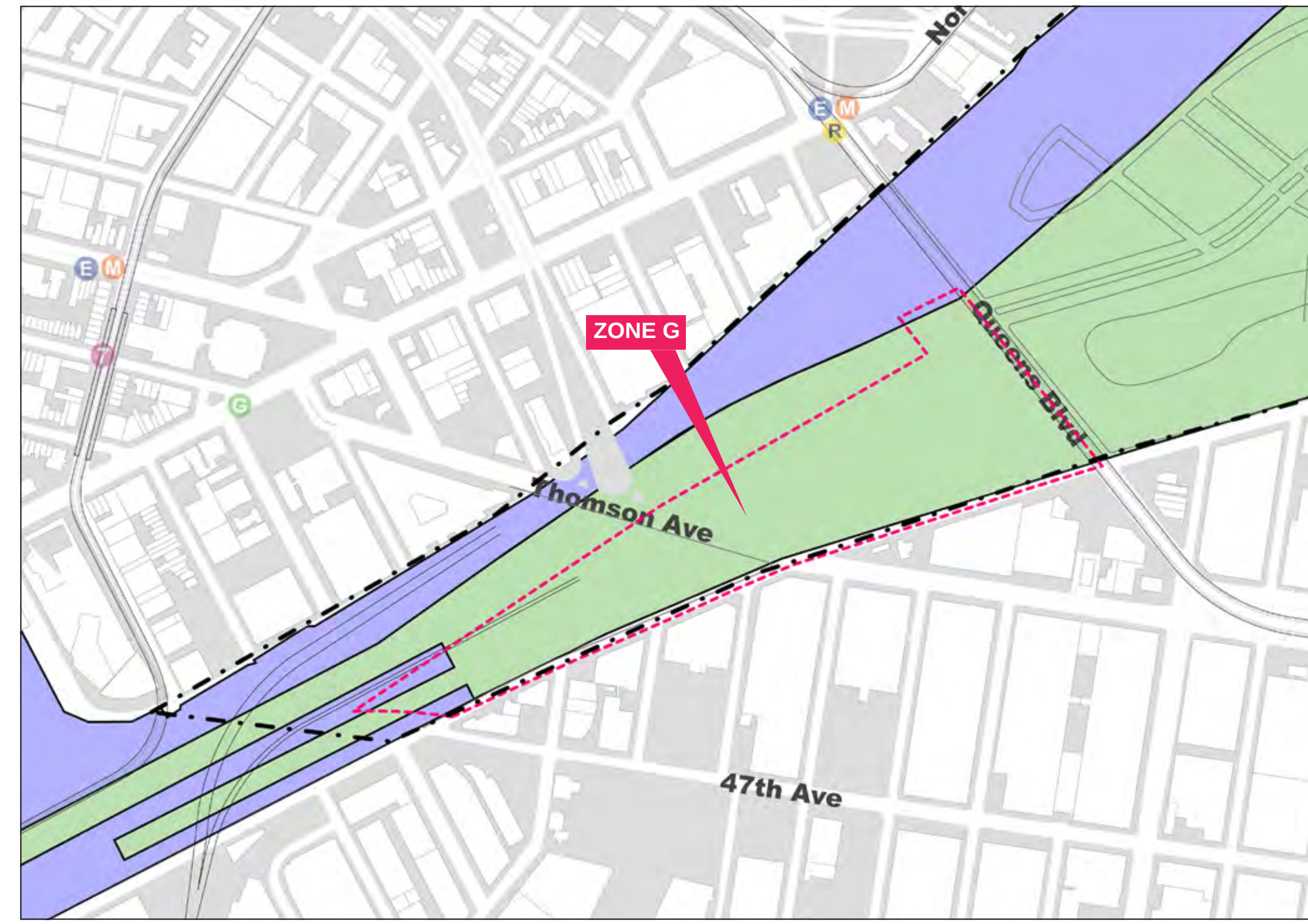
Residential Podium
Residential Tower
Creative office
Office Podium
Office Tower
Mixed-Use
School/Community
Public Green Space
Public Hardscape
Landscape Buffer
Parking
Railroad Facilities

The area between Honeywell Street and 39th Street would be the same as in the Residential and Destination test case programs. The area between Queens Boulevard and Honeywell Street is seen as suitable for creative office space or higher education uses. This location would build on the proximity to LaGuardia Community College and the existing uses within the adjacent LICIBZ. The scale of creative office space and academic buildings works well as a transition, and can be used to negotiate the grade difference between Skillman Avenue and the overbuild deck. The deck level could be configured as a linear campus of buildings and connected open spaces.

Zone G:



ZONE G: ROOF PLAN/GRAPHIC PLAN

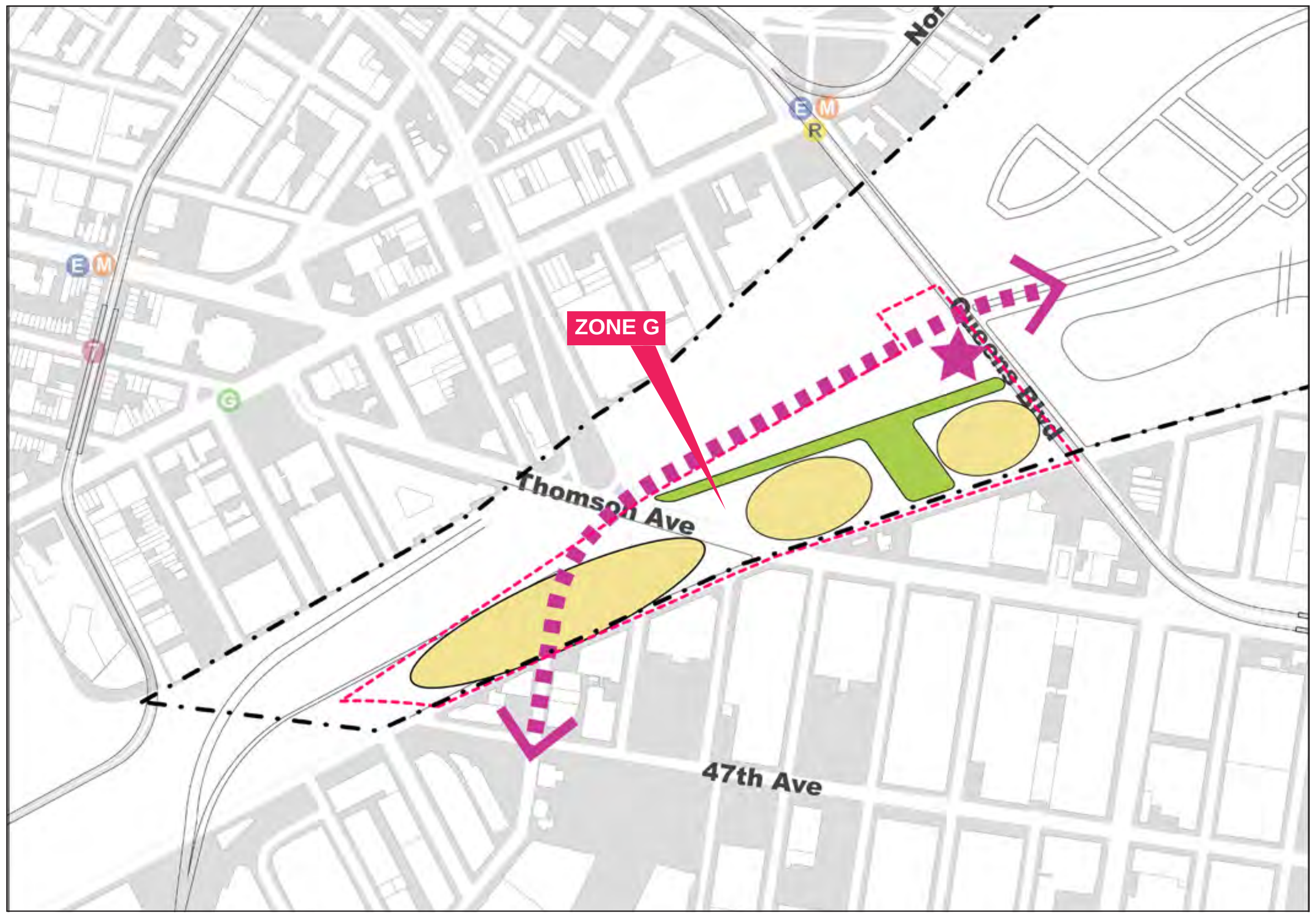


ZONE G: OWNERSHIP

- Amtrak
- MTA
- Private

Zone G would extend the character of Zone F – an active linear edge condition – to the west. However, its proximity to Queens Boulevard and the presence of Sunnyside Station creates additional program opportunities and gives it a gateway role for the entire development.

Most of the zone and development air rights are owned by Amtrak/Federal Agencies. A small portion (with development air rights) is owned by the MTA.

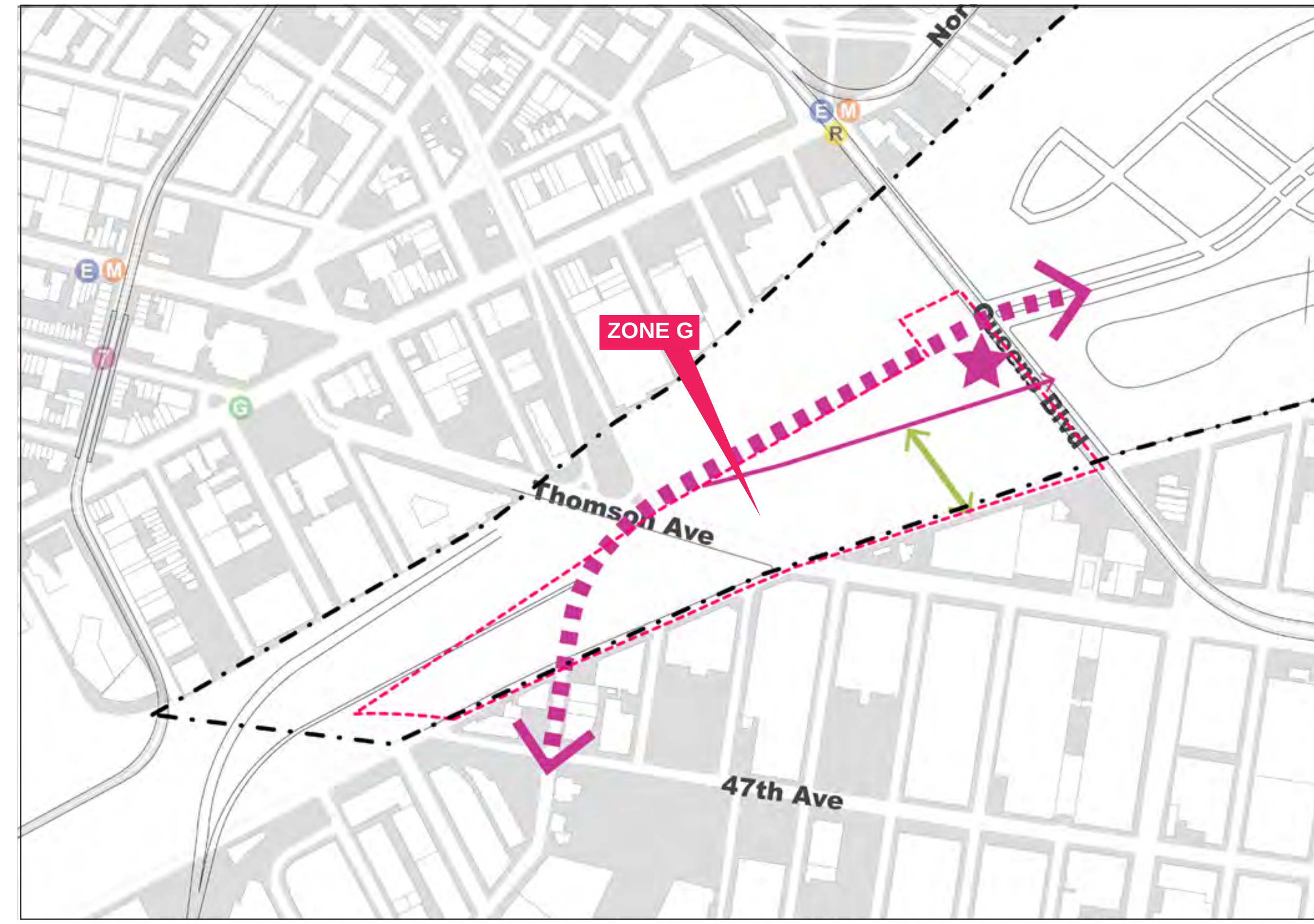


ZONE G: GENERAL ORGANIZATION

- Residential/Mixed-Use Development Zone
- Retail/Office Development Zone
- Public Space
- Primary Connection
- Sunnyside Station

This L-shaped zone extends along Skillman Avenue and Queens Boulevard. Along Skillman Avenue the development would serve as a "liner" to conceal the overbuild platform and to negotiate grade differences. A narrow zone of terra firma along Skillman Avenue would allow for at-grade building entrances, lobbies, and vertical circulation to deck level and buildings above. Sunnyside Station has frontage along Queens Boulevard and acts as a gateway to the entire development. A plaza north of the station would emphasize that gateway role, and provide a visual terminus for Sunnyside Boulevard.

Elevated open space would be provided at deck level. It is envisioned that buildings may have secondary entrances, lobbies, and public functions at the deck level to activate exterior public space. In the Residential test case additional deck area with additional open space would be provided west of the station as an amenity for residents.

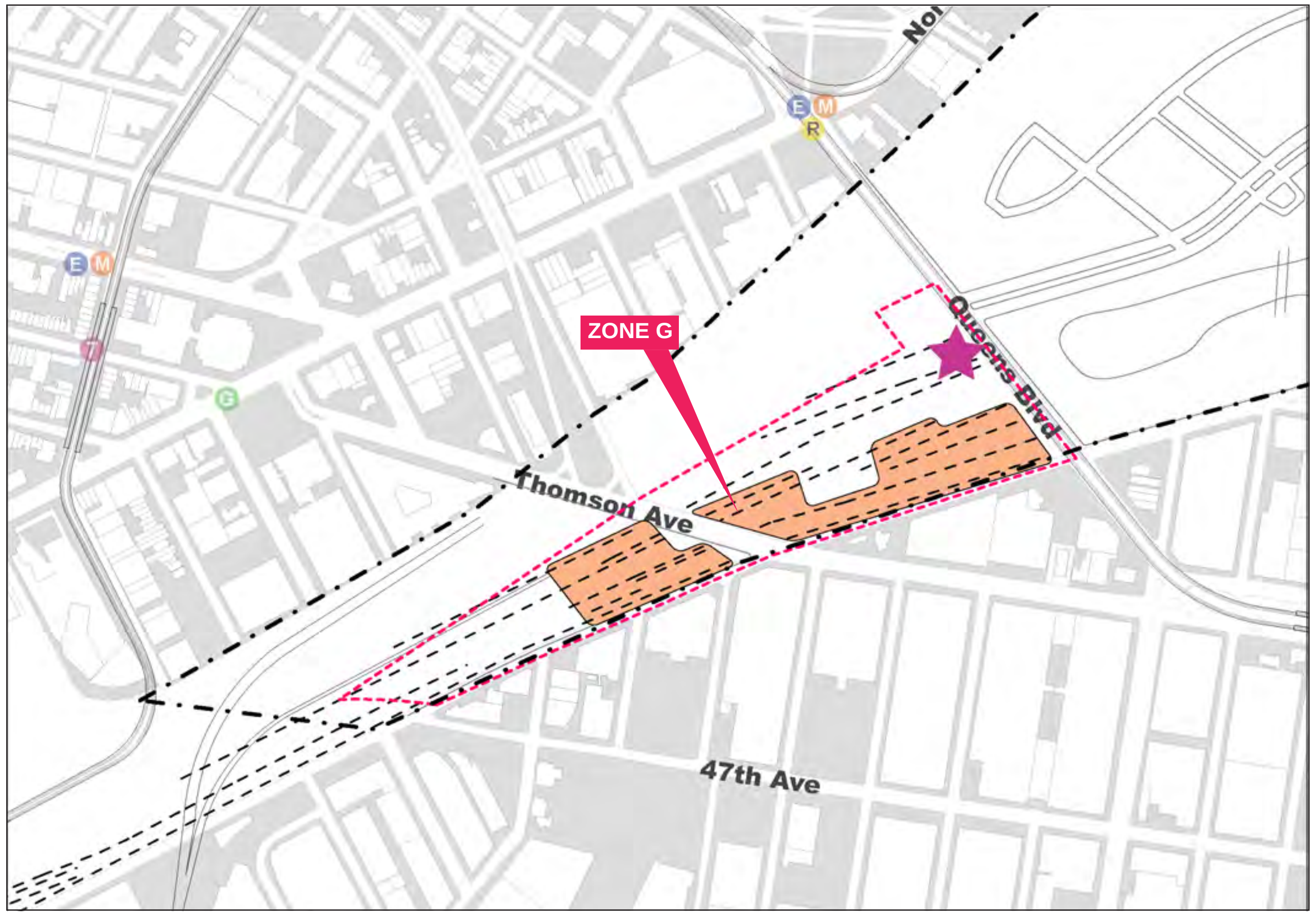


ZONE G: CONNECTIVITY + STREET GRID

- Possible Primary Connection
- Secondary Connection
- Pedestrian Connection
- Sunnyside Station

The development would front on, and be accessible from, Skillman Avenue and Queens Boulevard. Sunnyside Station will be accessible from Queens Boulevard and the station plaza. It is envisioned that either an at-grade crossing or above-grade sky bridge connection could link across Queens Boulevard to provide direct pedestrian movement between the LIRR and elevated No. 7 Subway portions of Sunnyside Station.

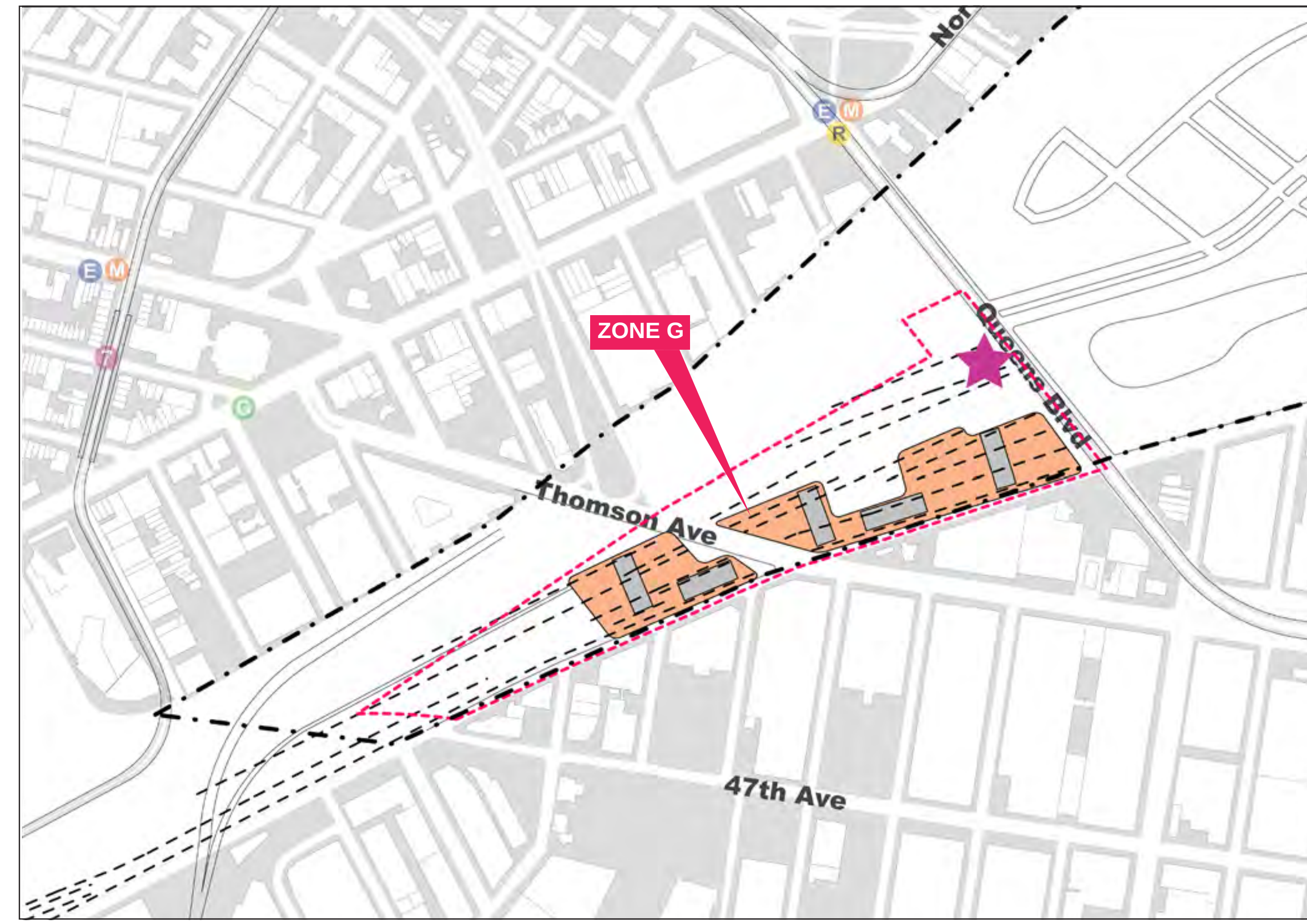
The Skillman Avenue edge has the opportunity to incorporate vertical access to the deck level within the building podiums. In the Residential Test Case an additional road would run along the north side of the deck, connecting Sunnyside Boulevard to Thomson Avenue and 47th Avenue. This connection would maximize the connectivity value of Sunnyside Boulevard but is structurally challenging.



ZONE G: COLUMN LOCATIONS + TOWER ZONES

Tower Zones
Sunnyside Station
Column Lines

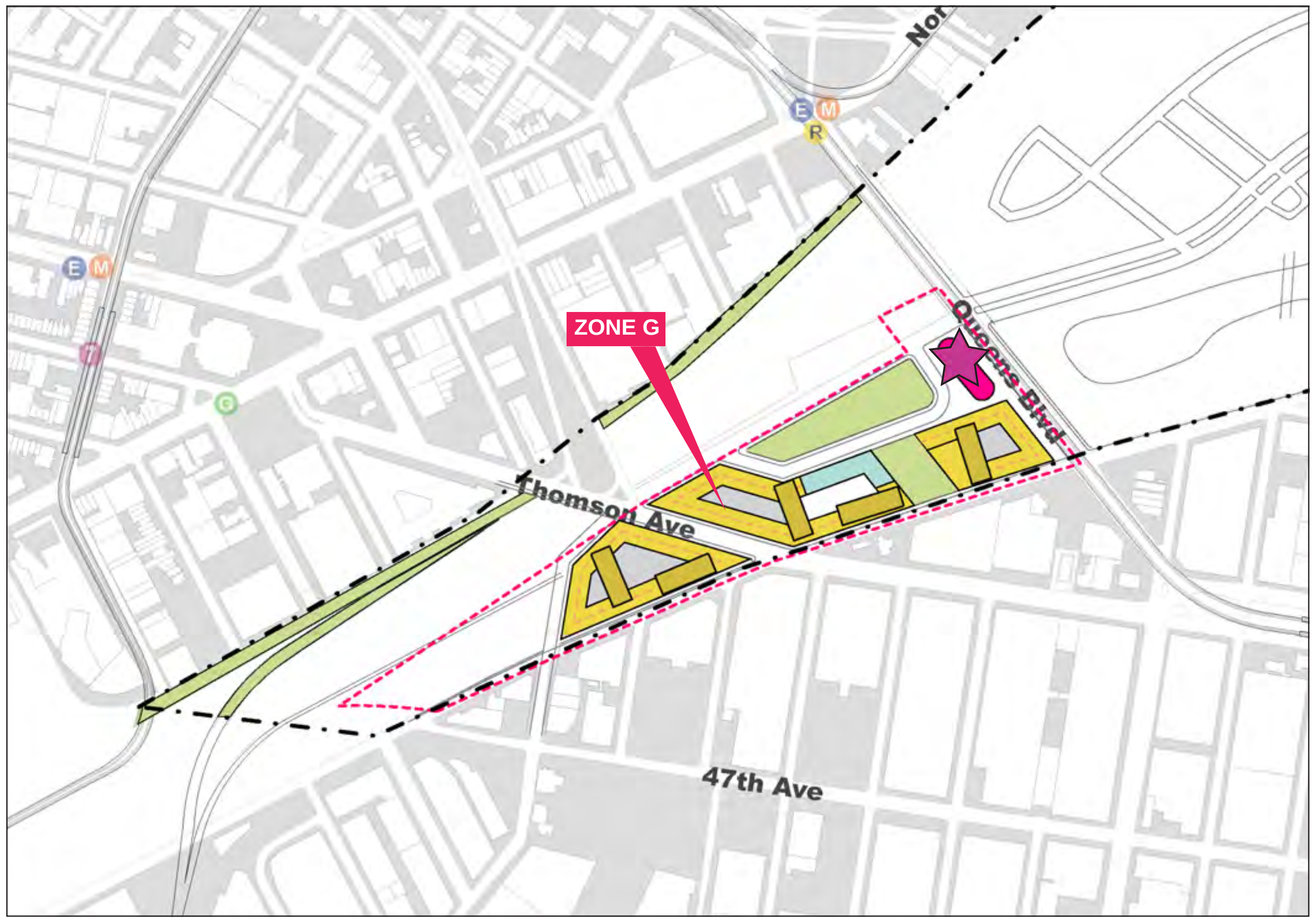
The tower zone is along Skillman Avenue. Tracks in Zone G are irregularly spaced, which results in irregular touchdown points for support walls. Platforms for the future LIRR Sunnyside Station will also be partially within this zone, which further limits column locations. Deck spans will generally be between 40' and 100'.



ZONE G: ILLUSTRATIVE TOWER LOCATIONS

Tower Zones
Sunnyside Station
Illustrative Tower Locations
Column Lines

In a few locations, the narrow depth of this zone makes it impossible to orient towers perpendicular to the track and column lines, limiting their potential height. Based on these limitations optimal tower heights range from 30 to 69 residential floors in approximately five towers.

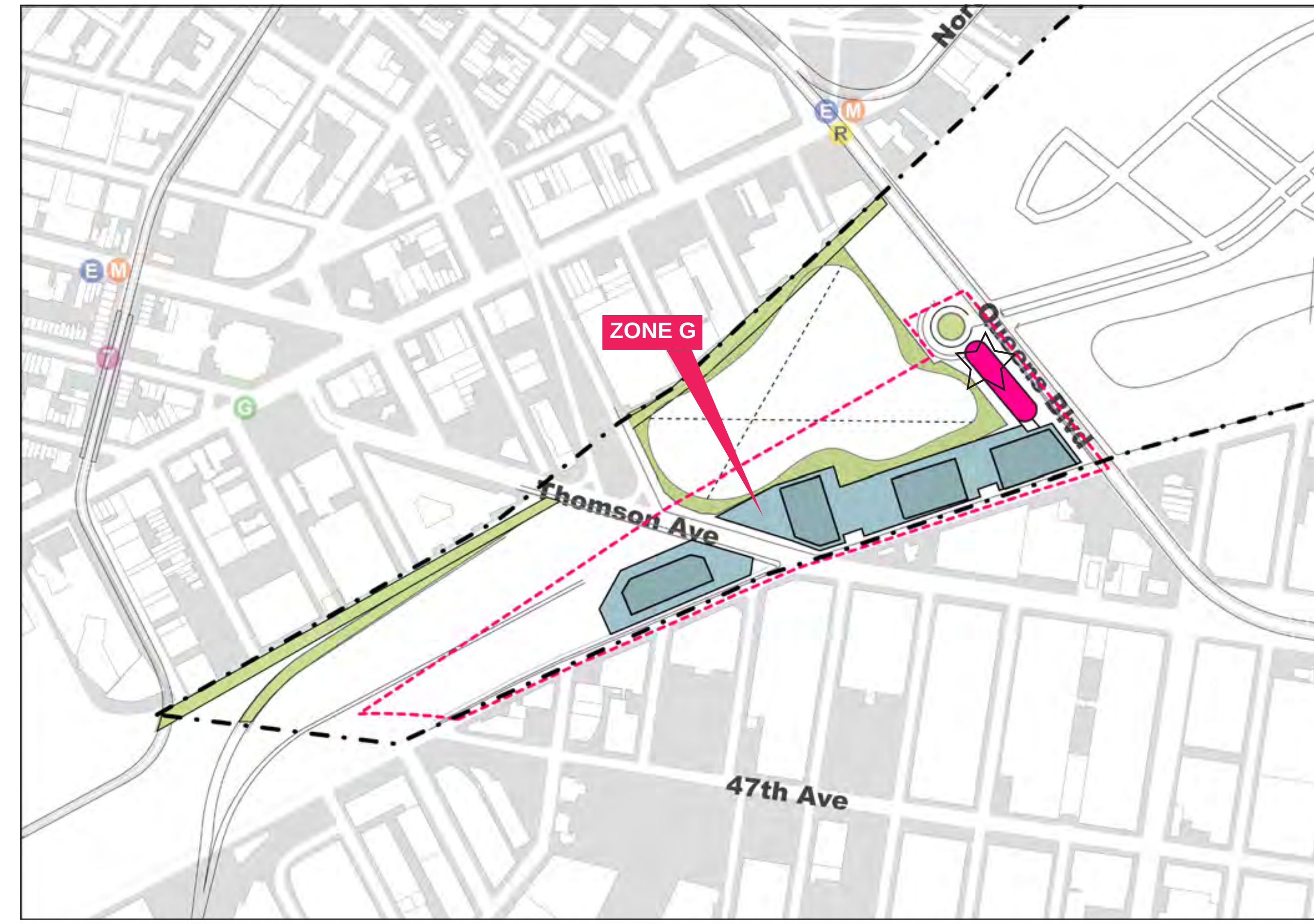


ZONE G: TEST CASE 1- RESIDENTIAL

- Residential Podium
- Residential Tower
- Creative office
- Office Podium
- Office Tower
- Mixed-Use
- School/Community
- Public Green Space
- Public Hardscape
- Landscape Buffer
- Parking
- Railroad Facilities
- Sunnyside Station

The area would consist of a mix of uses, with residential as the primary use. Other uses would include Sunnyside Station, a school, and open space. The buildings can be accessed from Skillman Avenue, Thomson Avenue, and Queens Boulevard. Several buildings may also front on the open space and secondary road that extends the boulevard. The school would be housed in the podium of the residential towers. A linear park connects the open space to Skillman Avenue between buildings, providing additional open space opportunities for the school.

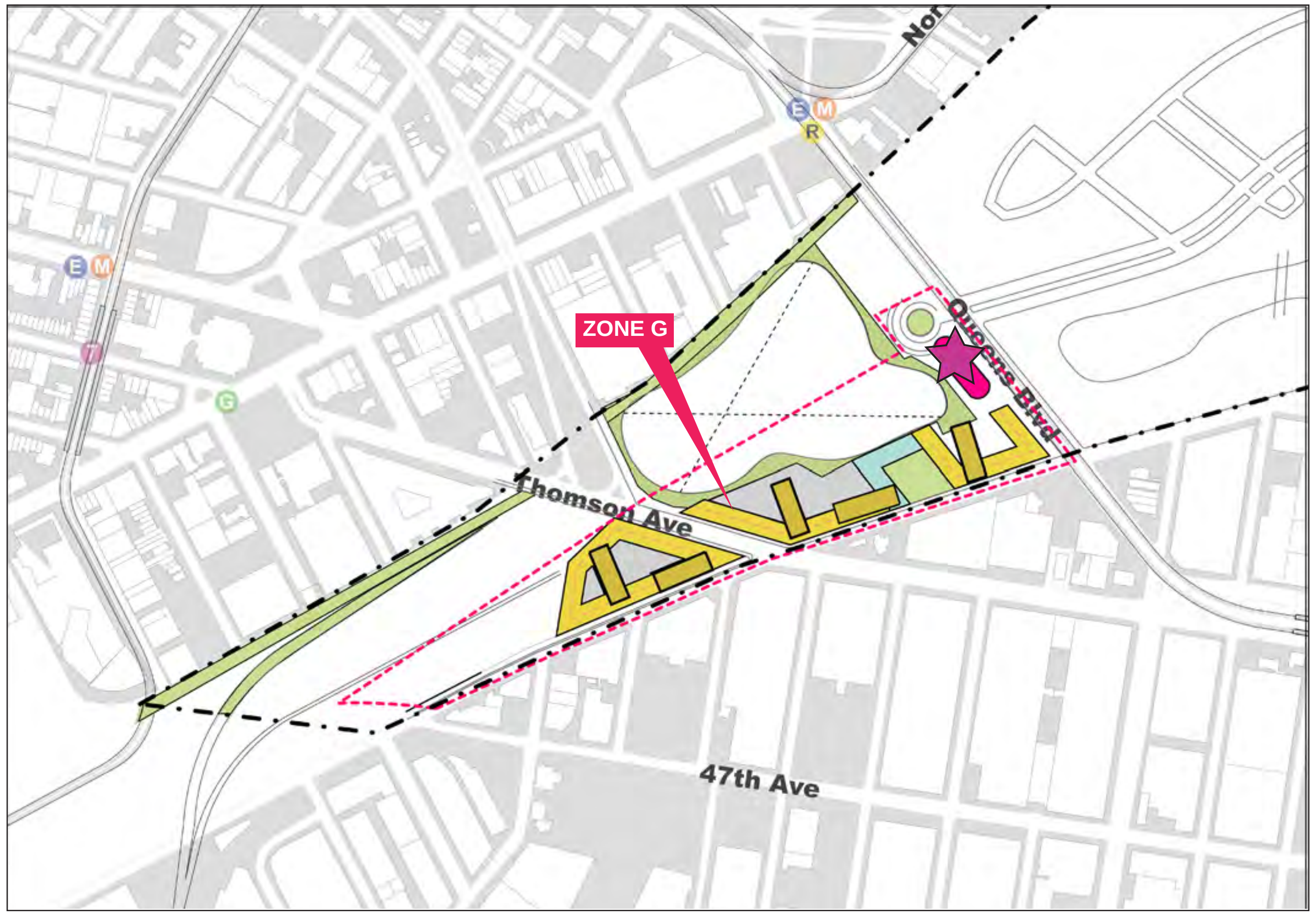
A boulevard extension connects it to Thomson Avenue and 47th Avenue. This connection is structurally challenging but would maximize the connectivity of Sunnyside Boulevard and better integrate both Zone G and the LICIBZ areas around Newtown Creek Basin into the Sunnyside Yard development.



ZONE G: TEST CASE 2- LIVE/WORK/PLAY

- Residential Podium
- Residential Tower
- Creative office
- Office Podium
- Office Tower
- Mixed-Use
- School/Community
- Public Green Space
- Public Hardscape
- Landscape Buffer
- Parking
- Railroad Facilities
- Sunnyside Station

The program in this test case would be primarily office use in towers over a podium. This program would take advantage of the transportation opportunities and gateway character created by Sunnyside Station and Queens Boulevard, and extends the commercial activity of Queens Plaza further south. The office towers northeast of Thomson Avenue could have direct pedestrian access to the station. Southwest of Thomson Avenue is a single office tower over a podium with frontage on Thomson and Skillman Avenues.



ZONE G: TEST CASE 3- DESTINATION

Residential Podium
Residential Tower
Creative office
Office Podium
Office Tower
Mixed-Use
School/Community
Public Green Space
Public Hardscape
Landscape Buffer
Parking
Railroad Facilities
Sunnyside Station

This test case is similar to the Residential Test Case, but without the extension of Sunnyside Boulevard and the larger deck-level open space. The area between Queens Boulevard and Honeywell Street would consist of a mix of uses, with residential as the primary use. Other uses include Sunnyside Station and a school. These buildings would front on Skillman Avenue and Queens Boulevard. A small park would be adjacent to the school. The area south of Thomson Avenue would be identical to the Residential Test Case.

D. Public Open Space Network

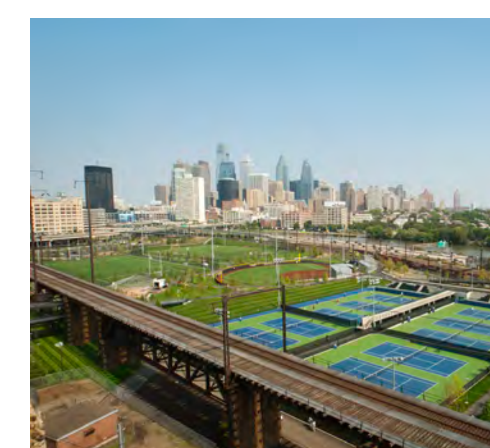
Open space will be an important part of a complete community. The project provides opportunities for the creation of a diverse range of open spaces that can be integrated into the overall development. Because the location and configuration of the major open spaces are driven primarily by the location of areas on the deck with limited structural capacity, where the development of towers is not feasible, the overall organization and hierarchy of open space across the test case programs is similar. The resulting open spaces afford significant opportunities for new community amenities: neighborhood parks, pocket parks, plazas, sports fields, and recreational facilities, forming an interconnected network of green space onsite of nearly 31.5 acres in size. This represents approximately 17.5% of the 180-acre project site and over 20% of the 154-acre portion of the site to be decked. (Approximately 25.7 acres will remain open to the railyard below) There could be an additional 4.5 acres of green space offsite, including 2.4 acre existing Lou Lodati Park. (Figure 5.6)

Open space designs were developed as part of the test cases, and test-fit with programmatic elements that would serve the communities around them. These were intended to test feasibility of certain program elements, and are not intended as prescriptive designs. From these designs a series of shared principles were established as a result of the test fits to guide future designers. The following pages describe the key common elements of the open space network.

FIGURE 5.6: COMPOSITE OPEN SPACE FRAMEWORK

SCALE PRECEDENT: SMALL

SCALE PRECEDENT: MEDIUM

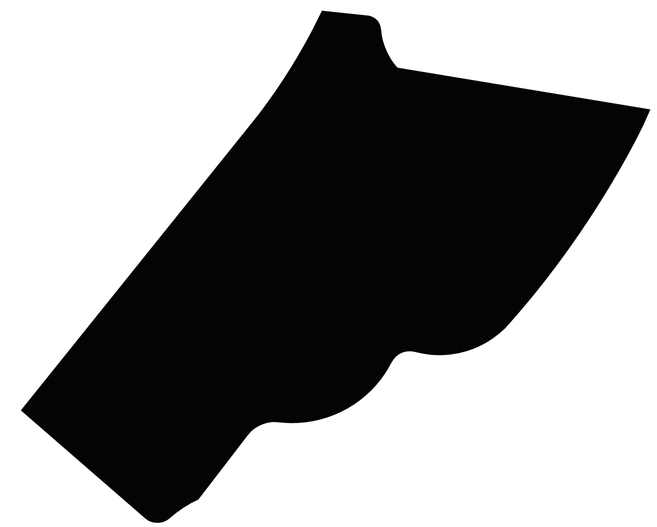


SCALE PRECEDENT: LARGE

Landscape Component: Anchor Parks

The study tested two anchor parks to serve the projected population of Sunnyside Yard, and provide additional open space for the adjacent community. Each anchor park should express different characteristics and complementary programs to offer a variety of spatial experiences for residents and neighbors. (Figure 5.7, Figure 5.8)

Penn Park
Philadelphia, PA
15.0 acres



“The Yard”
11.7 acres

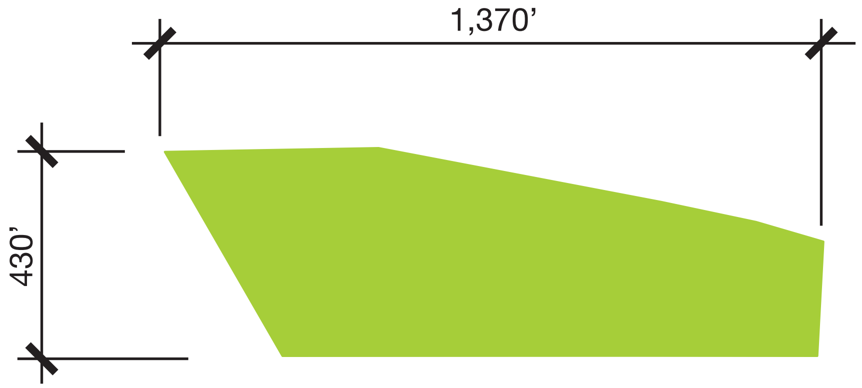
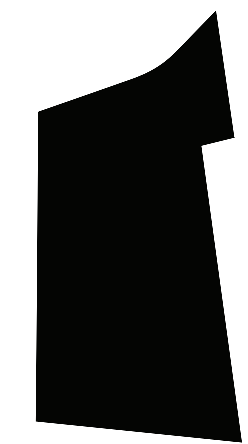


FIGURE 5.7: THE YARD ANCHOR PARK

Elmhurst Park
Queens, NY
6.6 acres



“Sunnyside Common”
7.0 acres total
(4.5 acres are offsite including existing 2.4 acre Lou Lodati Park

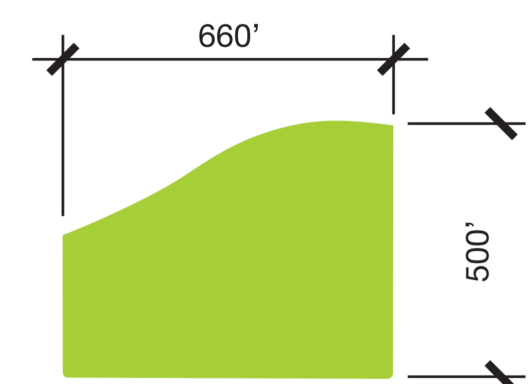
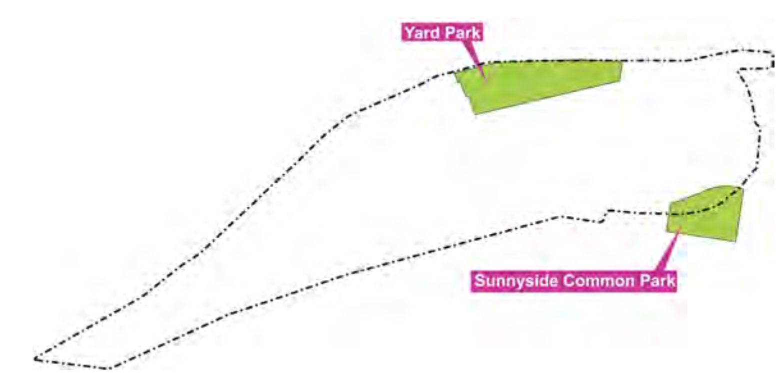


FIGURE 5.8: SUNNYSIDE COMMON ANCHOR PARK

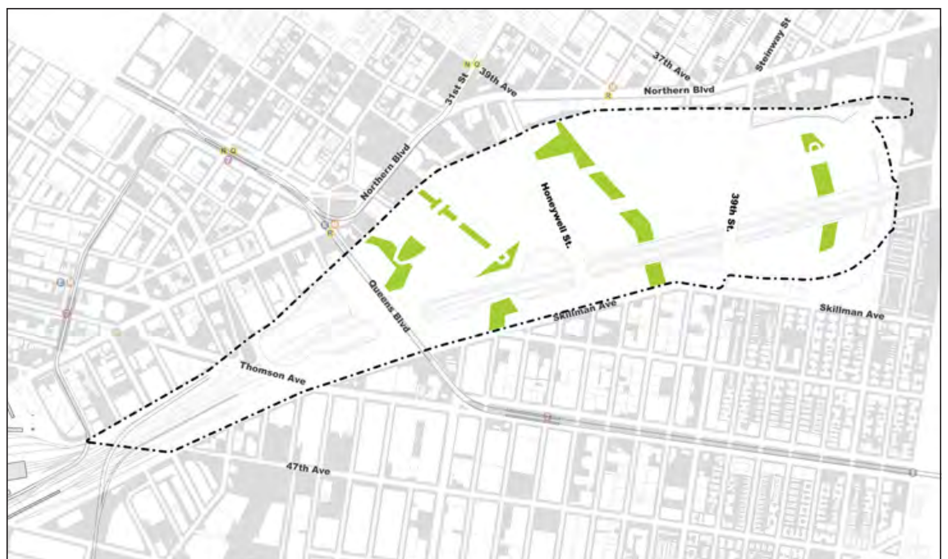


KEY PLAN

Other Landscape Components

Plazas and Pocket Parks

A range of urban plazas and pocket parks were studied. They would be located throughout the Sunnyside Yard development. These plazas would range in use from open public gateways into the development to secluded and shaded social gathering spots. Gateways have the ability to create a distinct arrival experience for users while also integrating the site with the adjacent urban fabric. Interior plazas and pocket parks are at a scale and diversity to provide a range of user experiences. These spaces are more intimate in nature and can accommodate other complimentary uses such as cafes and dining terraces, informal seating groves, formal building entry plazas and places for pop-up vendors and temporary seasonal markets. (Figure 5.9)



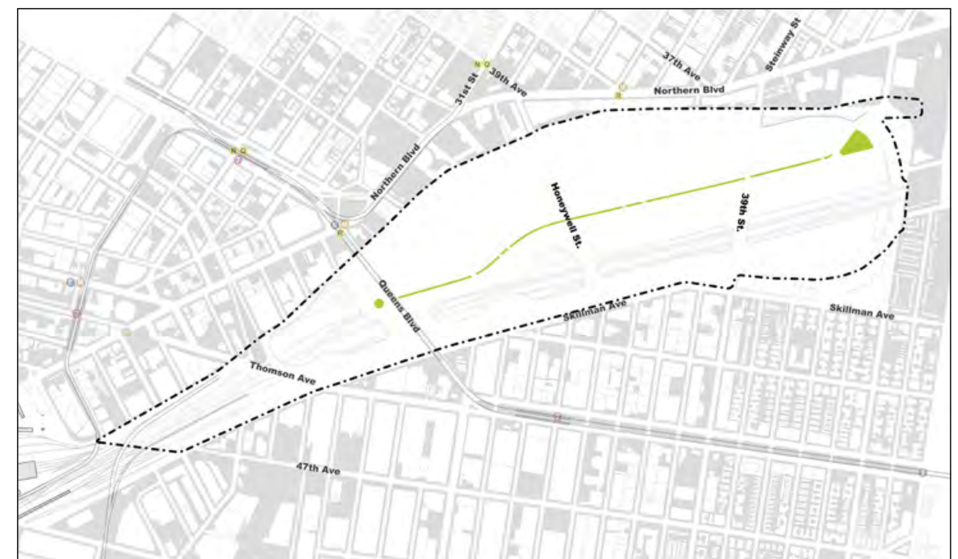
Principles:

- Flexibility: Plazas and pocket parks should accommodate a range of uses including outdoor dining, pop-up vendors, art exhibits, movable seating, and temporary kiosks;
- Adjacent Uses: These spaces should encourage connections between public open spaces and active ground floor uses and provided visual connections to cultural and retail uses.

FIGURE 5.9: PLAZAS AND POCKET PARKS

Sunnyside Boulevard

A grand civic boulevard was studied as the main east–west roadway. The boulevard would serve as a central artery and major organizing element for the project site. Sunnyside Boulevard, in addition to serving important multi-modal transportation purposes, would be a broad civic street with a planted median and stately canopy trees that offer shade, contribute to placemaking, and help to establish a sense of identity for Sunnyside Yard. The boulevard would connect from a new rail station at Queens Boulevard in the west to Northern Boulevard at the northeast corner of the site. (Figure 5.10)



Principles:

- Public Rights-of-way: Right-of-ways should be open to the sky and adhere to the R.O.W. dimensions specified in Chapter 4;
- Pedestrian and Bicycle Priority: The proposed boulevard should encourage bicycling and walking and prioritize safety for cyclists and pedestrians;
- Furnishings: Pedestrian amenities such as seating, bicycle parking, as well as litter and recycling bins should be incorporated.

FIGURE 5.10: SUNNYSIDE BOULEVARD

The Sideline

Running along the northern edge of the project site, this new, elevated public space would leverage the dead end streets prevalent along this stretch of Northern Boulevard, transforming them into programmed public open spaces with direct connections to the adjacent overbuild, and strengthen connections to adjacent neighborhoods. (Figure 5.11)

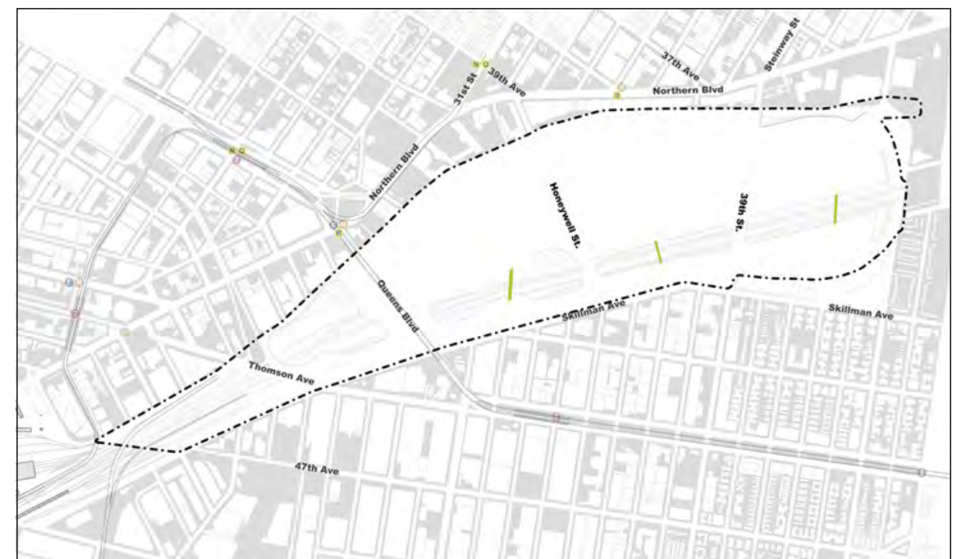
Principles:

- Programming: A diverse mix of programming for each street-end plaza should be established; opportunities range from landscaped plazas to active recreation;
- Visibility: Plazas shall maintain a high level of visibility from Northern Boulevard and The Sideline;
- Connection: Each street-end plaza shall maintain the ability to be connected vertically to The Sideline via elevator and/or stairs where necessary.

FIGURE 5.11: THE SIDELINE

Pedestrian Bridges

Three potential pedestrian bridges would be located on site in order to facilitate the movement of pedestrians across the Main Line open-cut where the railyard is not decked, and improve connections to Skillman Avenue. (Figure 5.12)



Principles:

- Visibility: Connections across the open-cut should remain open and visible with adequate pedestrian lighting in order to maintain safety and comfort both night and day;
- Durability: The material and construction of pedestrian bridges should be durable and able to withstand exposure to natural elements;
- Design: The pedestrian bridges present a unique opportunity for design expression and sculptural presence in the public realm.

FIGURE 5.12: PEDESTRIAN BRIDGES

The Yard Park

Yard Park would be located along the northern site boundary and accessible from Northern Boulevard via a civic stair. This 11.7-acre open space would accommodate various active recreational facilities. The site would be partially located above Amtrak's future high-speed rail facility, where development of towers is not feasible. (Figure 5.13) This Amtrak facility necessitates various elevation challenges that can be mediated through terraced platforms. In total, the grade change from Northern Boulevard to the upper-level recreational fields is approximately 53'. From the upper-level fields, the park would step down 7' to the tennis terrace and another 7' to the adjacent street level. Athletic courts and a terraced garden help mediate the elevation change. Each level has the ability to support recreational programming as well as horticultural plantings. Large sports fields would be located at the highest level above the Amtrak facility; with courts, a running track, and other athletic facilities at street level. (Figure 5.14) The following are general principles to guide the park design:

- **Recreation** The park should offer space for active recreation in the form of athletic courts, ball fields, as well as specialty features such as a climbing wall and running track.
- **Public Access** Site access should be inviting and visible from street level and provide ADA access.
- **Gateways** The site should have multiple points of access that create inviting and iconic gateways. Access from Northern Boulevard should engage the adjacent community as well as proposed development.
- **Views** The highest terrace level should be located above the Amtrak high-speed rail facility and should keep visual obstructions to a minimum to allow for views across the park.
- **Plantings** Plantings should be strategically placed where athletic programming cannot be located due to significant grade changes to provide shade for participants and spectators and create informal seating groves.

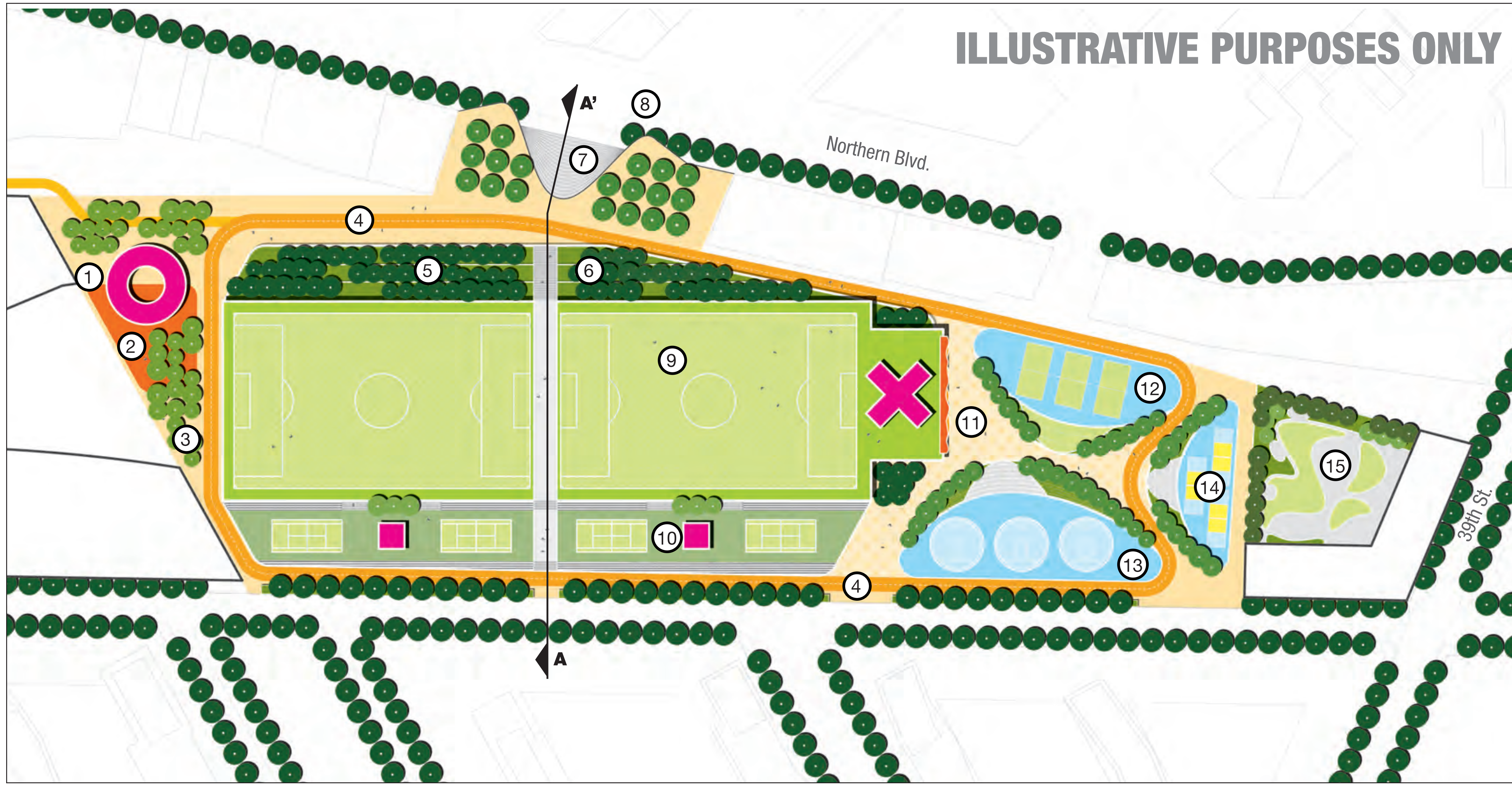
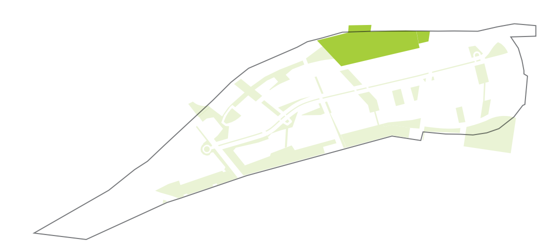


FIGURE 5.13: ILLUSTRATIVE YARD PARK PLAN

1. Plaza Pavilion
2. West End Plaza
3. Hammock Grove
4. Running Track
5. Terrace Gardens
6. Garden Steps
7. Grand Staircase
8. Northern Blvd. Overlook
9. Sports Fields
10. Tennis Terrace
11. Climbing Center
12. Volleyball Arena
13. Basketball Arena
14. Handball Arena
15. School Playground



KEY PLAN

'All renderings, illustrations, and plans in this study are intended for illustrative purposes only. There are a variety of potential design solutions and these renderings, illustrations, and plans shall not be construed to be a representation of an intended design solution'

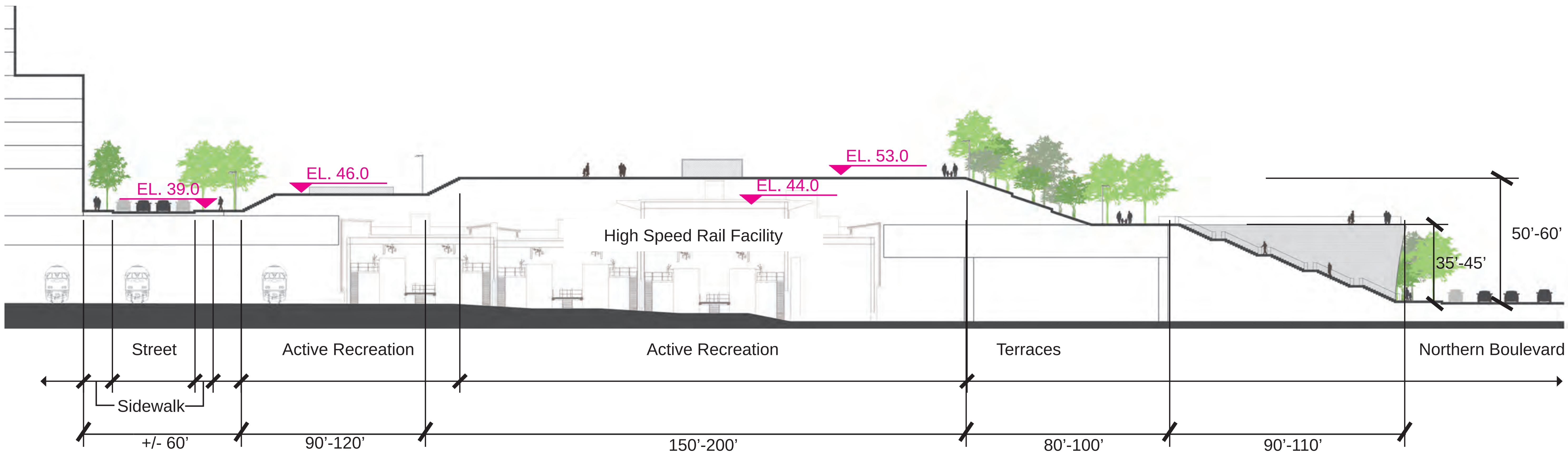


FIGURE 5.14: YARD PARK SECTION A-A

'All renderings, illustrations, and plans in this study are intended for illustrative purposes only. There are a variety of potential design solutions and these renderings, illustrations, and plans shall not be construed to be a representation of an intended design solution'

Sunnyside Common Park

Sunnyside Common Park is the second of the two anchor parks studied for Sunnyside Yard. At the southeast corner of the site, bordering Skillman Avenue and 43rd Street, Sunnyside Common Park would be a green traditional pastoral park and would provide an interface between the existing Sunnyside Gardens neighborhood and an overbuild development. Sunnyside Common Park would significantly expand the existing Lou Lodati Park. The resulting Sunnyside Common Park would be large enough to be a significant community amenity, providing a broad and flexible lawn, canopy trees, community gardens, athletic courts, and a fountain plaza. (Figure 5.15)

The studied park site rests primarily on terra firma and possesses few topographical challenges to construction. This also affords the opportunity for multiple seamless connections between the existing park/neighborhood and the expanded park/new development. The following are principles to guide landscape development of the park:

- **Community Amenity** The park should provide a significant open-space amenity for both the proposed development and the existing adjacent community.
- **Access** Public access should be provided from multiple locations along the perimeter of the park.
- **Programming** In addition to Lou Lodati Park, “Sunnyside Common” should include some recreation courts, but focus predominantly on community gardens, water features, horticultural display gardens, as well as a variety of comfortable seating options.
- **Social Lawn** A large and flexible social lawn should be provided to allow for both formal and informal gatherings such as picnicking, sun bathing and community organized events.
- **Plantings:** A rich palette should be introduced to provide shade and seasonal interest; areas for community gardens should also be considered.

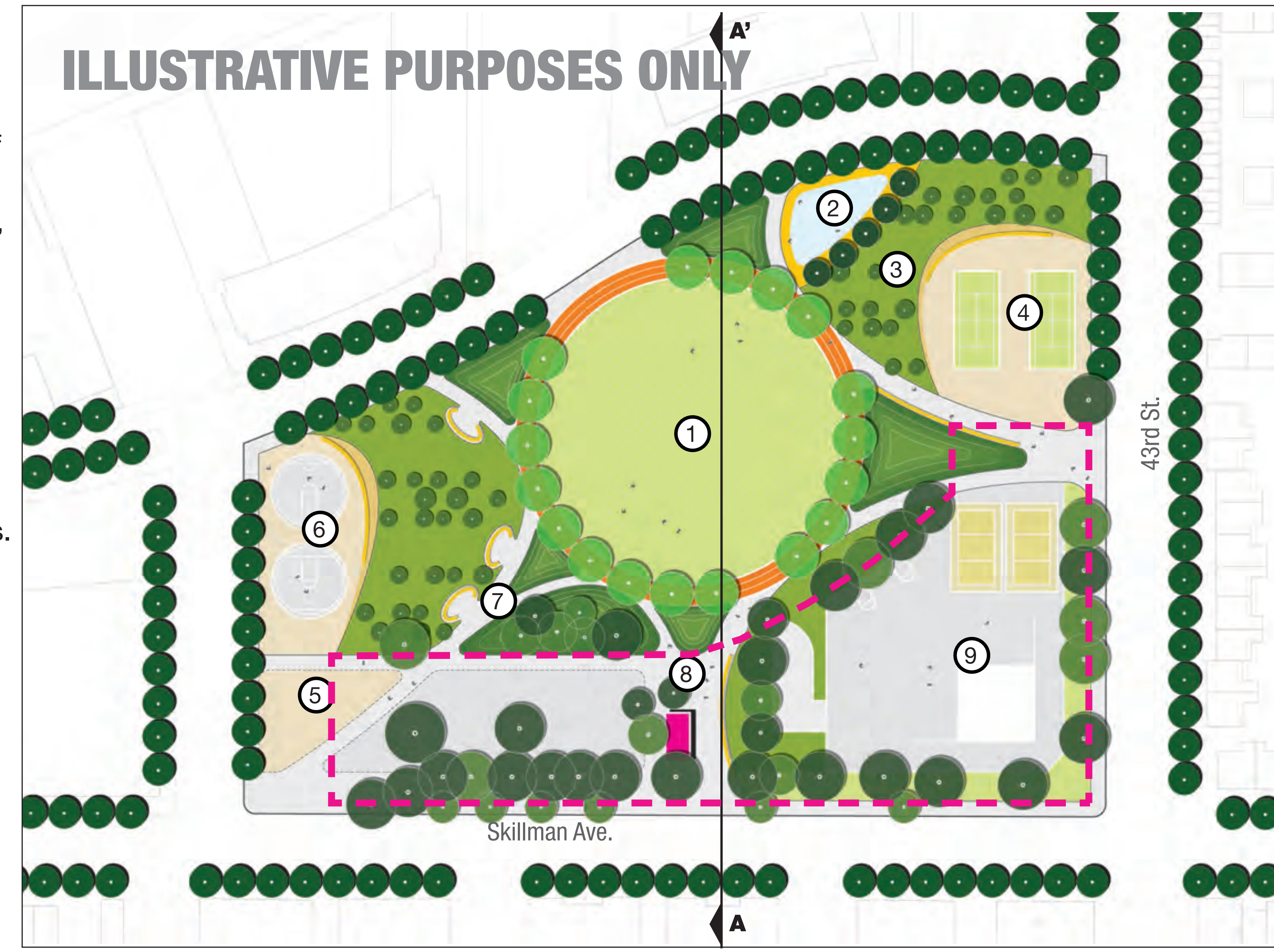


FIGURE 5.15: ILLUSTRATIVE SUNNYSIDE COMMON PLAN

1. Community Lawn
2. Water Plaza
3. Horticultural Gardens
4. Tennis Courts
5. Lou Lodati Playground Expansion
6. Basketball Courts
7. Garden Walk
8. Park Pavilion
9. Existing

Boundary of existing 2.4 acre Torsney/Lou Lodati Playground

KEY PLAN

‘All renderings, illustrations, and plans in this study are intended for illustrative purposes only. There are a variety of potential design solutions and these renderings, illustrations, and plans shall not be construed to be a representation of an intended design solution’

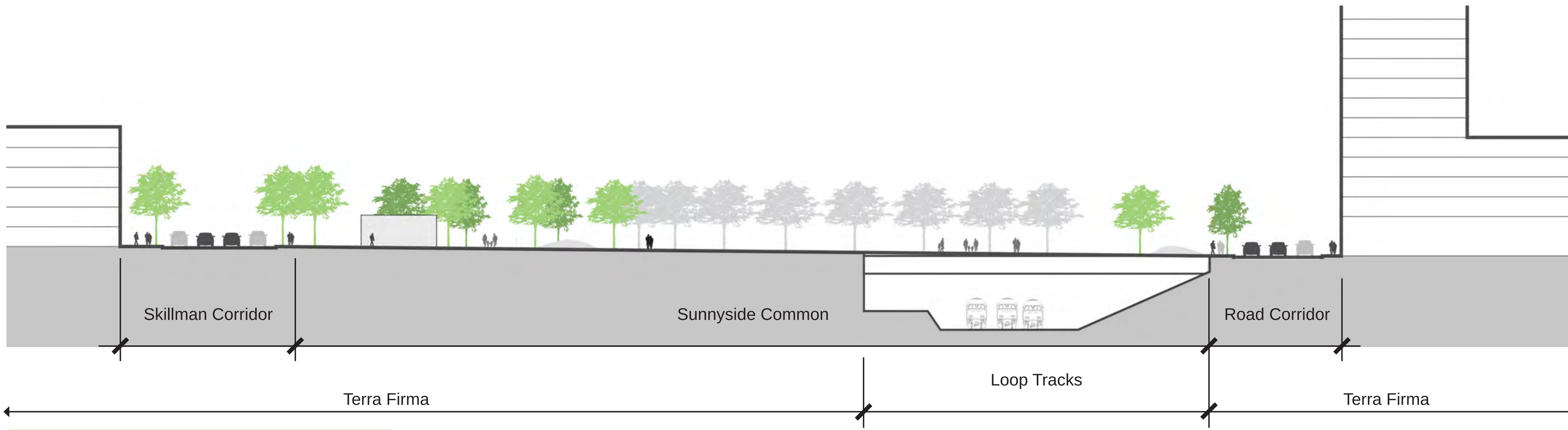


FIGURE 5.16: SUNNYSIDE COMMON SECTION A-A

'All renderings, illustrations, and plans in this study are intended for illustrative purposes only. There are a variety of potential design solutions and these renderings, illustrations, and plans shall not be construed to be a representation of an intended design solution'

E. Economic Feasibility

A comprehensive and credible financial analysis is central to establishing the feasibility of an overbuild development at Sunnyside Yard. The three test cases described previously were used as a basis for testing and reviewing project economics through a process that iteratively modified physical and programmatic configurations of each scheme in response to financial analysis. This section summarizes the methodology for minimizing public investment, examines the cost implications of an overbuild development, reviews key revenue assumptions, and presents high-level findings for each of the three test cases.

A railyard overbuild development project at the scale contemplated for Sunnyside Yard will incur a range of extraordinary costs associated with materials, labor, and equipment. Where possible, the study has sought to incorporate lower-cost solutions through its assumptions, with regard to foundation type and material selection. Other onsite costs that are factored into this analysis include railroad labor ("force account"). Offsite costs assumed in the analysis include improvements to address increases in utility demand caused by an overbuild.

The program and placement of each use also has a strong influence on costs which are offset by revenue generated by selling and leasing residential and commercial space. Phasing, financing strategies, and regulatory approvals are other key factors that will minimize public investment. The engineering, urban design, and financing considerations are inter-dependent and therefore an iterative process has been followed to identify optimized solutions.

1. Overbuild Costs

Overbuild costs include both "horizontal" and "vertical" costs. Horizontal costs are defined as those costs associated with an overbuild deck and directly associated elements on, within, and below the deck. The cost of the mega-transfer trusses that support building towers (primarily for residential or office) is described as "overbuild premium", while the rest of the building costs are treated as vertical costs. This allows for more direct comparison to typical building costs, and an understanding of the premiums associated with building on a deck. Overbuild premium costs are primarily driven by two factors - the mega transfer truss structure for buildings over five stories and the spacing between tracks underneath the buildings. As the spacing increases, the cost for constructing any overbuild increases.

The feasibility-level cost estimates are based on conceptual designs and material quantities and are informed by considerations of constructability. For each zone and the range of spans between support points and as dictated by track layout, a menu of costs was developed for seven different building typologies. Different layouts were tested, using the menu of construction costs, to determine which had the optimal revenue-to-cost ratio. Other considerations, such as public policy and urban design, were also incorporated.

Substructure and Decking Costs

For each of the test cases, a feasibility-level engineering design for the substructure and deck was developed. As described earlier, a family of similar designs was used throughout Sunnyside Yard, but quantities and costs varied by location depending on

FIGURE 5.17: BASE COST CATEGORIES

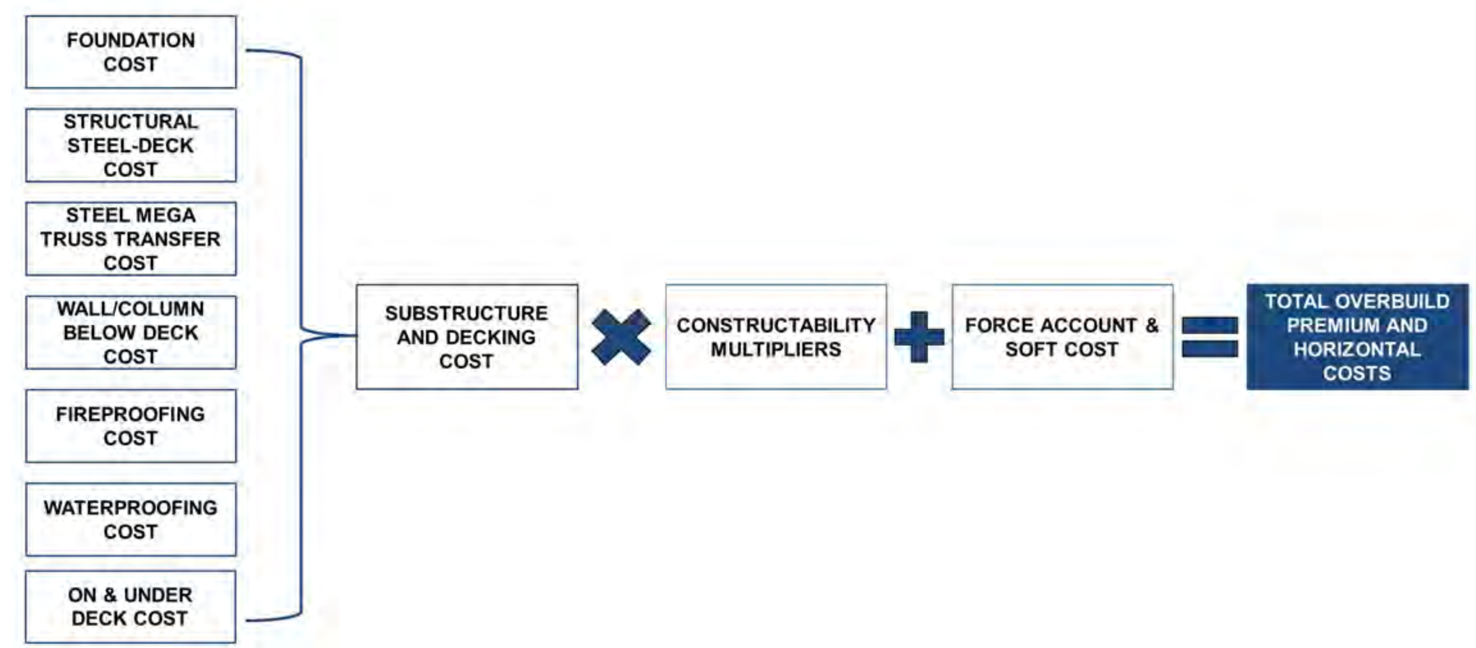


FIGURE 5.18: SUMMARY OF SUBSTRUCTURE COSTS

Residential Typologies – Premium Costs for 55 Ft Span before Multipliers and Force Accounts		
	175' Footprint	195' Footprint
R1 15 Stories	$14.6 M ($76 BSF)	
R2 43 Stories	$31.9 M ($67 BSF)	$34.1 M ($61 BSF)
R2.5 56 Stories	$40.5 M ($66 BSF)	$43.7 M ($64 BSF)
R3 69 Stories	$55.0 M ($73 BSF)	$58.9 M ($70 BSF)
Office Typologies – Premium Costs for 55 Ft Span Before Multipliers and Force Accounts		
O1 15 Stories, Wide	$57.8 M ($83 BSF)	
O2 43 Stories	$75.0 M ($88 BSF)	
O3 69 Stories	$108 M ($95 BSF)	

*BSF = Buildable square foot

FIGURE 5.19: ROAD HARD COSTS

Typology	$/SF	Example Roads
Primary	$14/SF	Broadway (Upper West Side), Manhattan, NY Park Avenue, Manhattan, NY
Secondary	$10/SF	Warren Street (Battery Park City), Manhattan, NY Murray Street (Battery Park City), Manhattan, NY
Minor	$9/SF	20th Street, Manhattan, NY 83rd Street, Manhattan, NY

factors such as the height and size of buildings to be supported, and the spans between support walls. Some key costs and variables that affect cost include:

- Foundation cost is influenced by the depth to rock and the weight of structure to be supported;
- Support wall cost is influenced by the amount of embedded steel and number of openings, which are a function of the weight and height of the structure to be supported;
- Deck cost is mainly influenced by the span between support points (deck cost includes steel and concrete elements);
- Mega transfer truss cost is influenced by the weight of buildings to be supported and the span between support points (mega transfer trusses have large quantities of steel, many connections, and drive a significant percentage of total cost); and
- Waterproofing and fireproofing are relatively minor structural costs.
- The cost of elements on, within, and under the deck were added, including parks, roads, utilities, streetlights, ventilation, emergency egress, and fire suppression.

These elements are shown in the left column of Figure 5.17 and form the basis of the engineering cost estimate.

The cost of materials, labor, and equipment were estimated using data from other large engineering projects in New York and comparable cities. In general, these projects were on terra firma sites, whereas Sunnyside Yard will be constructed above active rail lines, which significantly increases labor and equipment costs. This additional cost was estimated using comparable projects, such as Hudson Yards and Pacific Park overbuilds, and the additional cost was incorporated using "constructability multipliers," which are discussed below.

The costs of structures required to support different types of buildings varies depending on the span between tracks and the level support walls that can be feasibly used in the area. To assist with financial analysis, these costs have been recast based on a square footage of coverage, which is estimated based on the assumed footprint of each proposed building typology. See Figure 5.18 for a summary of substructure premium costs, which are added to the typical terra firma costs to determine the full construction costs of the building.

FIGURE 5.20: OPEN SPACE HARD COSTS

Typology	Unit Cost	Comparable Open Space
Neighborhood Park	$19/SF	Navy Yard Central Green, Philadelphia, PA Sara D. Roosevelt Park, Manhattan, NY Brooklyn Bridge Park – Pier 1, Brooklyn, NY
Plaza	$34/SF	Dilworth Plaza, Philadelphia, PA David H. Koch Plaza @ the MET, Manhattan, NY
Linear Park	$81/SF	The 606, Chicago, IL Continental Bridge, Dallas, TX The High Line Section 3, Manhattan, NY
Pocket Park	$23/SF	Rector Park, Manhattan, NY Seward Park, Manhattan, NY

Utilities, Mechanical, and Safety

Utilities, mechanical, and safety costs for the project were developed and categorized as follows:

- Under Deck includes fire protection, HVAC/ ventilation, and Life Safety Emergency Access;
- Above Deck includes sanitary & storm, water supply, private utilities, and street lights.

Under-deck and above-deck hard costs were developed based on the recommended design approaches. These costs represent aggregated per square foot costs for all under-deck and all above-deck elements after applying constructability multipliers for labor, equipment, and material. A 30% soft cost assumption has been applied to both under- and above-deck costs.

Roads, Open Space, and Vertical Circulation

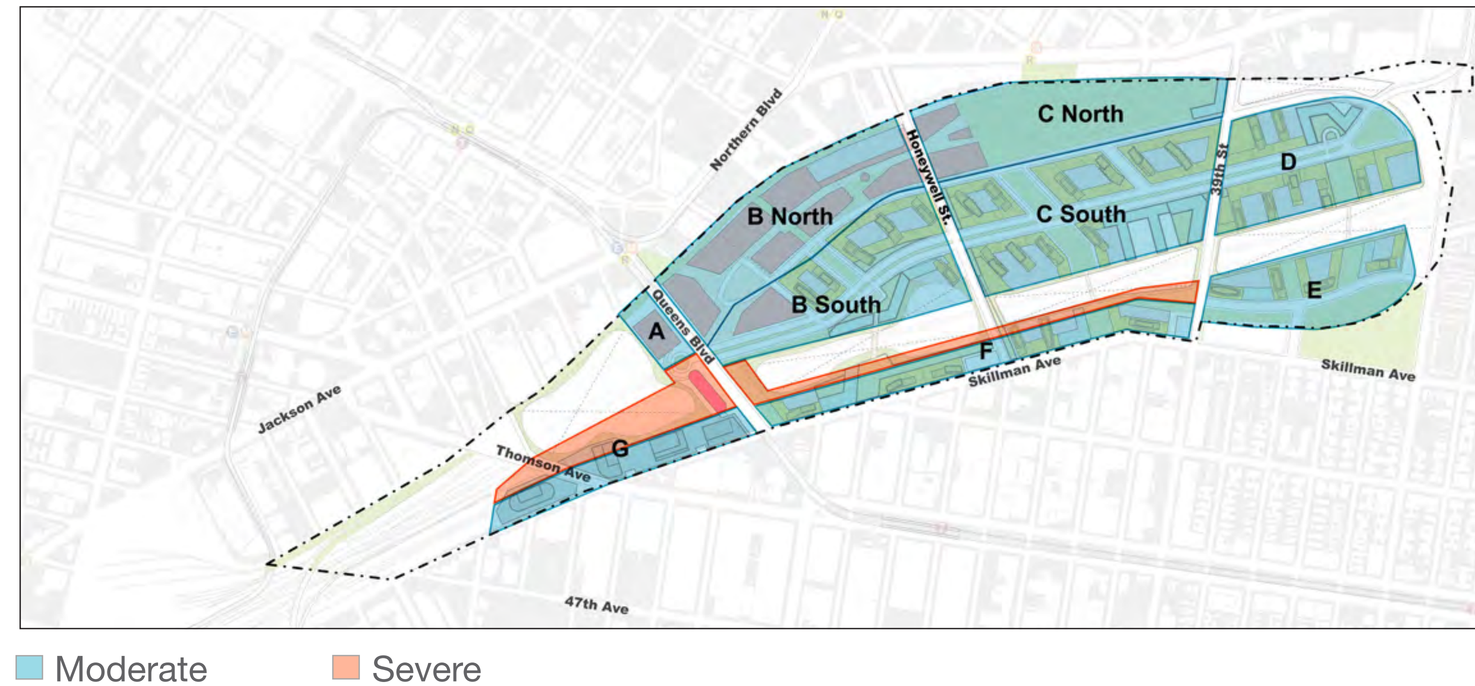
The project will incur significant costs associated with roads, open space, and vertical circulation. Cost assumptions for each element are as follows:

- **Roads:** Costs were estimated based on three typologies of roads envisioned for Sunnyside Yard. Road typologies are defined and costed by traffic density and envisioned vehicular use and are based on typical New York City roads. (Figure 5.19)
- **Open space:** Cost estimates were derived from construction costs for existing open spaces of similar size, design, and amenities as those envisioned for Sunnyside Yard. Estimated costs cover typical landscaping, including allocations for soil, grading, drainage, waterproofing, lighting, furnishings, plantings, play equipment, water features,

FIGURE 5.21: VERTICAL CIRCULATION HARD COSTS

Typology	Unit Cost	Example Vertical Circulation
Elevators	$275K/unit	Highline access at 30th Street, Manhattan, NY Elevated Acre @ 55 Water Street, Manhattan, NY
Pedestrian Bridge	$332/SF	Gibbs Street Pedestrian Bridge (East Terminus), Portland, OR
Stair/Terraced Connection	$2,300/riser	Harbor Steps, Seattle, WA 215th Street Stairs, Manhattan, NY
"Lids" Over Rails	$640/SF	Brooklyn-Queens Expressway Enhancement Project, NY

FIGURE 5.22: MAP OF CONSTRUCTABILITY RESTRICTIONS



fences/gates, sports fields, and other specialty surfaces such as tennis or basketball courts, playgrounds, and running tracks. (Figure 5.20)

- **Vertical circulation:** Costs focus on pedestrian connections to the site and edge treatments/visual screening of active rail uses. Four main types of vertical circulation elements are included in the horizontal costs of Sunnyside Yard. (Figure 5.21)

Soft costs for roads, open space, and vertical circulation are assumed to equal 30% of hard costs.

Constructability Multipliers

To account for the variance in construction complexity among the zones, constructability multipliers were developed and applied to the substructure costs, as illustrated in Figure 5.22 and Figure 5.23. The constructability multipliers considered labor conditions across a variety of trades to scale construction complexity and the additional costs for working around railroad activity. Base unit costs (with a multiplier of 1.0) consider labor, equipment, and materials on conventional terra firma projects. The multipliers are added to the initial multiplier of 1.0 to account for additional constraints resulting from building around an active railroad. Each zone was considered independently and evaluated as either a moderate restriction zone or a severe restriction zone.

Constructability cost multipliers are comprised of multiple elements:

- **General Conditions Labor Multiplier:** This multiplier accommodates the empirical labor premium experienced on other similar projects in New York City (including, but not limited to Pacific Park, an overbuild of the Vanderbilt Yard in Brooklyn) and New York projects using large amounts and sizes of major equipment.
- **Labor Constructability Multiplier:** This is a combination of two considerations:

  -Night and weekend shift consideration for significantly active zone where work is required to occur outside the standard work day and labor will receive time and a half.

  -Severe restriction zones consideration where there is a loss in productivity efficiency resulting from the severity of the work window restrictions.
- **Equipment Constructability Multiplier:** In the severe restriction zones, the work schedule and associated restrictions may require special equipment and that equipment will need to be mobilized and demobilized at a greater frequency than in a moderate restriction zone.
- **Steel Mega Transfer Truss Multiplier:** This multiplier determines the value of the labor premium for the portion of construction that includes installing steel mega trusses. The multiplier has been set equal to the typical General Conditions Labor Multiplier for similar large scale projects, as it is intended that steel mega transfer truss installation will occur following the installation of the rail overbuild structure and deck, and work is therefore relatively unconstrained by railroad work window restrictions.

Of the 12 zones only two are defined as severe, as they abut the mainline, and the remaining 10 are moderate zones. (Figure 5.22, Figure 5.23). For all zones the applicable multipliers were added to a base of 1.0 and then applied to the horizontal costs to account for the cost increase resulting from the construction complexity.

FIGURE 5.23: CONSTRUCTABILITY MULTIPLIERS BY ZONE[1]

Zone	Type of Restriction	General Conditions Labor	Labor Constructability	Equipment Constructability	Mega Transfer Truss
(A) The Neck	Moderate	0.45	0.29	0	0.35
(B North) Mid-Day Storage	Moderate	0.45	0	0	0.35
(B South) Amtrak Core Yards	Moderate	0.45	0.15	0	0.35
(C North) Amtrak Core Yards	Moderate	0.45	0.29	0	0.35
(C South) Amtrak Core Yards	Moderate	0.45	0.29	0	0.35
(D East) North Loop Tracks	Moderate	0.45	0.31	0	0.35
(D West) North Loop Tracks	Moderate	0.45	0.15	0	0.35
(E) South Loop Tracks	Moderate	0.45	0.31	0	0.35
(F North) East Skillman	Severe	0.45	0.83	0.5	0.35
(F South) East Skillman	Moderate	0.45	0.29	0	0.35
(G North) Queens Blvd + West Skillman	Severe	0.45	0.83	0.5	0.35
(G South) Queens Blvd + West Skillman	Moderate	0.45	0.29	0	0.35

FIGURE 5.24: SUMMARY OF FORCE ACCOUNT ESTIMATES

Zone	Force Account Estimate	RR Overlap Cost	Total Force Account Estimate w/ Overlap
(A) The Neck	$9 M	$3 M	$12 M
(B North) Mid-Day Storage	$11 M	$3 M	$14 M
(B South) Amtrak Core Yards	$10 M	$3 M	$13 M
(C North) Amtrak Core Yards	$6 M	$2 M	$7, M
(C South) Amtrak Core Yards	$12 M	$3 M	$15 M
(D East) North Loop Tracks	$5 M	$1 M	$6 M
(D West) North Loop Tracks	$7 M	$2 M	$9 M
(E) South Loop Tracks	$9 M	$0 M	$9 M
(F North) East Skillman	$9 M	$3 M	$11 M
(F South) East Skillman	$5 M	$0 M	$5 M
(G North) Queens Blvd + West Skillman	$10 M	$3 M	$12 M
(G South) Queens Blvd + West Skillman	$6 M	$2 M	$7 M
Total	**$97 M**	**$25 M**	**$122 M**

Soft Costs

Soft costs were applied to horizontal costs, based on the horizontal program specific to each test case. Soft costs are estimated to be approximately 30% of hard costs and include the costs for engineering, construction management, owner controlled insurance program, special inspections, FRA or other Federal, State, or City funding compliance monitoring and reporting, and program contingency.

Force Accounts

Force account costs, a commonly carried cost for the additional railroad personnel needed to support construction activity occurring above an active railroad, were estimated drawing on prior project experience with a variety of major railyard efforts, including the ongoing reconstruction and future overbuild of the Vanderbilt Yards in Brooklyn. The force account estimate included considerations for the following:

- Power/catenary
- Utilities
- Signals
- Tracks
- Communications
- Flag protection
- Engineering

The total number of days needed by the appropriate crew size to complete force account related work for each zone was estimated based on the overall anticipated duration of the construction in the zone for foundation, structure, deck and site work, and typical service outages.

Like constructability multipliers, force account conditions were assumed for both moderate restriction zones and severe restriction zones, where levels of overtime work on the foundation, structure, deck, and site work vary.

The force account estimates include only the railroad labor specifically required to support an overbuild program, and avoids "double counting" force account related efforts in each zone associated with Amtrak's Master Plan reconstruction of Sunnyside Yard. Some allowance has been made for force account overlap efforts occurring in certain zones where multiple rail operators exist, and where coordination between force account efforts will likely be necessary. These allowances are the estimated "RR Overlap Costs" detailed in Figure 5.24.

Figure 5.24 details force account estimates and delineates the force account costs and the additional railroad coordination costs for each zone. Material costs associated with relocated or modified railroad facilities are not included.

[1] Restrictions in each zone vary depending on the development year, and the progress of other projects, notably the East Side Access Moderate Restriction Zones allow some level of "track outages" offering opportunities to stage and progress work in a logical manner. Severe Restriction Zones allow very little or no level of "track outages" offering few or no opportunities to stage and progress work in a typical manner.

Total Onsite and Offsite Horizontal Costs

Total onsite and offsite horizontal costs in each test case range from $2.93 billion to $3.43 billion, depending on the test case. With the most number of towers, Test Case 1 (Residential) has the highest horizontal costs, while Test Case 3 (Destination) has the lowest horizontal costs. (Figure 5.25).

Total Development Costs

Total development cost for Sunnyside Yard would include all of the horizontal costs (both in and outside of building footprints) and all vertical costs associated with the development of the overbuild. Total development cost in each test case range from approximately $16 billion to $19 billion in 2017 dollars, depending on the test case. Test Case 3 has the highest total development costs, while Test Case 1 has the lowest total development costs (Figure 5.26).

2. Project Economics

Applying rent and operating assumptions for each of the uses, total project costs were assessed against total project revenues to evaluate economic feasibility. The mid-point of each vertical program range was assumed for purposes of these analyses. The financial measurements used to evaluate project economics include:

- **Gross Land Proceeds:** Value a developer would pay for the land and development rights, considering normal development costs if this were a typical development on terra firma.
- **Overbuild Premium:** Cost premium for the deck and mega transfer truss within the building footprint(s).
- **Onsite and Offsite Horizontal Costs:** Costs for horizontal development outside of a building footprint including railroad force accounts and other site wide systems such as streets, open space, municipal buildings, and utilities, and costs related to offsite utilities to support density and capacity on Sunnyside Yard.
- **Residual Land Value:** Gross land proceeds, less overbuild premium and onsite and offsite horizontal costs.

FIGURE 5.25: TOTAL HORIZONTAL COST ELEMENTS BY TEST CASE

Zone	Test Case 1: Residential	Test Case 2: Live/Work/Play	Test Case 3: Destination
(A) The Neck	$90 M	$46 M	$50 M
(B North) Mid-Day Storage	$445 M	$491 M	$378 M
(B South) Amtrak Core Yards	$370 M	$493 M	$442 M
(C North) Amtrak Core Yards	$650 M	$614 M	$595 M
(C South) Amtrak Core Yards	$462 M	$437 M	$449 M
(D East) North Loop Tracks	$308 M	$218 M	$225 M
(D West) North Loop Tracks	$231 M	$164 M	$169 M
(E) South Loop Tracks	$320 M	$320 M	$330 M
(F North) East Skillman	$116 M	$289 M	$87 M
(F South) East Skillman	$100 M	$269 M	$75 M
(G North) Queens Blvd + West Skillman	$130 M	$49 M	$71 M
(G South) Queens Blvd + West Skillman	$108 M	$37 M	$60 M
Total	$3,332 M	$3,427 M	$2,932 M

FIGURE 5.26: TOTAL HORIZONTAL AND VERTICAL DEVELOPMENT COSTS BY TEST CASE (2017 DOLLARS)

Zone	Test Case 1: Residential	Test Case 2: Live/Work/Play	Test Case 3: Destination
(A) The Neck	$280 M	$721 M	$183 M
(B North) Mid-Day Storage	$1,630 M	$1,677 M	$1,600 M
(B South) Amtrak Core Yards	$2,666M	$2,687 M	$2,657 M
(C North) Amtrak Core Yards	$853 M	$853 M	$911 M
(C South) Amtrak Core Yards	$4,197 M	$4,197 M	$4,197 M
(D East) North Loop Tracks	$675 M	$675 M	$675 M
(D West) North Loop Tracks	$1,866 M	$1,882 M	$1,882 M
(E) South Loop Tracks	$1,034 M	$1,034 M	$1,034 M
(F North) East Skillman	$857 M	$1,332 M	$791 M
(F South) East Skillman	$646 M	$719 M	$589 M
(G North) Queens Blvd + West Skillman	$1,291 M	$2,292 M	$1,024 M
(G South) Queens Blvd + West Skillman	$901 M	$819 M	$659 M
Total	$16,896 M	$18,890 M	$16,203 M

Test Case Findings

Project economics are strongly influenced by the mix of uses, placement of uses and the amount and type of residential development included in each test case. Horizontal project costs are generally the same between different test cases and vary modestly due to differences in phasing and the number of roads, size of open space, and other horizontal program elements. (Figure 5.27)

Test Case 1 (Residential)

Test Case 1 generates $3.98 billion in gross land proceeds. Overbuild premium costs are approximately $2.38 billion and onsite and offsite horizontal costs are approximately $3.33 billion. Test Case 1 results in -$1.73 billion in residual land value.

FIGURE 5.27: FINANCIAL FEASIBILITY FINDINGS

	Gross Land Proceeds	*Overbuild Premium*	*On & Offsite Horizontal Costs*	*Residual Land Value*
Test Case 1 (Residential)	$3,978 M	-$2,377 M	-$3,332 M	-$1,730 M
Test Case 2 (Live/Work/Play)	$3,333 M	-$3,381 M	-$3,427 M	-$3,475 M
Test Case 3 (Destination)	$3,934 M	-$2,849 M	-$2,932 M	-$1,848 M

FIGURE 5.28 FINANCIAL FEASIBILITY FINDINGS, TEST CASE 1

	Gross Land Proceeds	Overbuild Premium	On & Offsite Horizontal Costs	Residual Land Value
(A) The Neck	$30 M	-$34 M	-$90 M	-$94 M
(B North) Mid-Day Storage	$299 M	-$183 M	-$445 M	-$329 M
(B South) Amtrak Core Yard	$617 M	-$371 M	-$370 M	-$123 M
(C North) Amtrak Core Yard	$0 M	-$26 M	-$650 M	-$676 M
(C South) Amtrak Core Yard	$1,281 M	-$917 M	-$462 M	-$98 M
(D) North Loop Tracks	$810 M	-$416 M	-$539 M	-$146 M
(E) South Loop Tracks	$162 M	-$11 M	-$320 M	-$170 M
(F) East Skillman	$318 M	-$138 M	-$216 M	-$36 M
(G) Queens Blvd + West Skillman	$462 M	-$281 M	-$239 M	-$58 M
Total	**$3,978 M**	**-$2,377 M**	**-$3,332 M**	**-$1,730 M**

Test Case 2 (Live/Work/Play)

Test Case 2 generates $3.33 billion in gross land proceeds, the lowest among the three test cases due to the inclusion of over 3 million SF of office in Zone G and over 1 million SF of academic space in Zone F. Overbuild premium costs are approximately $3.38 billion. Onsite and offsite horizontal costs are approximately $3.43 billion, resulting in -$3.48 billion in residual land value. (Figure 5.29)

FIGURE 5.29: FINANCIAL FEASIBILITY FINDINGS, TEST CASE 2

	Gross Land Proceeds	Overbuild Premium	On & Offsite Horizontal Costs	Residual Land Value
(A) The Neck	$23 M	-$251 M	-$46 M	-$274 M
(B North) Mid-Day Storage	$321 M	-$251 M	-$491 M	-$422 M
(B South) Amtrak Core Yard	$821 M	-$511 M	-$493 M	-$182 M
(C North) Amtrak Core Yard	$0 M	-$25 M	-$614 M	-$639 M
(C South) Amtrak Core Yard	$1,210 M	-$866 M	-$437 M	-$93 M
(D) North Loop Tracks	$574 M	-$305 M	-$382 M	-$113 M
(E) South Loop Tracks	$162 M	-$11 M	-$320 M	-$170 M
(F) East Skillman	$166 M	-$339 M	-$557 M	-$731 M
(G) Queens Blvd + West Skillman	$57 M	-$822 M	-$86 M	-$851 M
Total	**$3,333 M**	**-$3,381 M**	**-$3,427 M**	**-$3,475 M**

Test Case 3 (Destination)

Test Case 3 generates $3.93 billion in gross land proceeds and $2.85 billion in overbuild cost premium. Onsite and offsite horizontal costs are approximately $2.93 billion, resulting in -$1.85 billion in residual land value. (Figure 5.30)

FIGURE 5.30: FINANCIAL FEASIBILITY FINDINGS, TEST CASE 3

	Gross Land Proceeds	Overbuild Premium	On & Offsite Horizontal Costs	Residual Land Value
(A) The Neck	$44 M	-$50 M	-$50 M	-$56 M
(B North) Mid-Day Storage	$190 M	-$617 M	-$378 M	-$805 M
(B South) Amtrak Core Yard	$901 M	-$520 M	-$442 M	-$61 M
(C North) Amtrak Core Yard	$79 M	-$72 M	-$595 M	-$588 M
(C South) Amtrak Core Yard	$1,245 M	-$891 M	-$449 M	-$95 M
(D) North Loop Tracks	$590 M	-$313 M	-$393 M	-$117 M
(E) South Loop Tracks	$167 M	-$12 M	-$330 M	-$175 M
(F) East Skillman	$329 M	-$133 M	-$163 M	$33 M
(G) Queens Blvd + West Skillman	$388 M	-$240 M	-$132 M	$16 M
Total	**$3,934 M**	**-$2,849 M**	**-$2,932 M**	**-$1,848 M**

Real Estate Taxes

The development of Sunnyside Yard would unlock potential future tax revenues that could potentially offset project costs. Based on the analysis, the test cases could generate between $1.31 billion and $1.53 billion in real estate taxes. Further analysis and development of the deal structure is needed to assess the feasibility of potential funding sources. (Figure 5.31)

FIGURE 5.31: FULL YARD ONSITE REAL ESTATE TAX REVENUE

Zone	Test Case 1	Test Case 2	Test Case 3
(A) The Neck	$26 M	$98 M	$38 M
(B North) Mid-Day Storage	$117 M	$165 M	$254 M
(B South) Amtrak Core Yards	$191 M	$255 M	$302 M
(C North) Amtrak Core Yards	$0 M	$0 M	$62 M
(C South) Amtrak Core Yards	$384 M	$362 M	$373 M
(D) North Loop Tracks	$264 M	$187 M	$192 M
(E) South Loop Tracks	$57 M	$57 M	$58 M
(F) East Skillman	$113 M	$58 M	$115 M
(G) Queens Blvd + West Skillman	$156 M	$219 M	$132 M
Total	**$1,307 M**	**$1,401 M**	**$1,528 M**

Phasing Strategies

Similar to other major development projects such as Hudson Yards, Pacific Park, and Battery Park City, an overbuild development at Sunnyside Yard would require a thoughtful approach to project phasing. The financial analysis assumed a unique phasing strategy for each test case. The strategy is based on five guiding principles:

- **Develop complete districts:** Phasing should create complete, cohesive districts that are integrated with existing offsite and onsite neighborhoods.
- **Facilitate critical and supportive neighborhood amenities**: Each phase should include amenities such as open space, schools, and other community facilities, in addition to proposed residential, retail, and/or office programs.
- **Start with an easy entry point:** The initial phase should connect to existing neighborhoods and infrastructure.
- **Coordinate phasing with railroad construction:** Minimize construction cost by undertaking overbuild concurrently with phased reconstruction of Sunnyside Yard railroad facilities.
- **Start development with the most financially feasible parcel:** Build revenue stream and development momentum over time such that value creation accrue to other parcels as Sunnyside Yard matures over time.
- **Leverage a mix of uses to speed up absorption:** Buildout can be accelerated by developing non-competing uses (e.g., office and residential) in the same phase.

Phasing affects the financial feasibility of each zone due to the time value of money. For example, zones where onsite and offsite horizontal costs are significantly greater than net land proceeds will become more negative in present value terms if they are developed earlier. Conversely, zones where net land proceeds exceed onsite and offsite horizontal costs will become more positive in present value terms if they are developed earlier. The goal of the phasing strategy is to identify a sequence that leverages the time value of money by maximizing land value while minimizing potential public investment and reducing development timeline.

Grouping of zones into phases allows for more financially feasible zones such as C South to cross-subsidize less feasible zones such as C North. Cross-subsidization can also occur between different phases. For example, excess revenues from Phase 1 can be used to subsidize Phase 2 or any other subsequent phase. All test cases are developed in five phases; however, the sequence of each phase varies by test case to improve feasibility. (Figure 5.32)

FIGURE 5.32: PHASING STRATEGIES

	Test Case 1			
	Zones	Construction Start	Absorption Start	Stabilization
Phase 1	D	2022	2025	2028
Phase 2	C North, C South	2025	2028	2035
Phase 3	A, B North, B South	2032	2035	2040
Phase 4	E	2037	2040	2040
Phase 5	F, G	2037	2040	2042
	Test Case 2			
	Zones	**Construction Start**	**Absorption Start**	**Stabilization**
Phase 1	A, B North, B South	2022	2025	2026
Phase 2	C North, C South	2027	2030	2037
Phase 3	D	2034	2037	2040
Phase 4	E	2037	2040	2040
Phase 5	F, G	2037	2040	2048
	Test Case 3			
	Zones	**Construction Start**	**Absorption Start**	**Stabilization**
Phase 1	A, B North, B South	2022	2025	2027
Phase 2	C North, C South	2024	2027	2036
Phase 3	D	2033	2036	2039
Phase 4	E	2036	2039	2039
Phase 5	F, G	2036	2039	2041

Test Case 1 (Residential)

Phase 1 of the project begins near Steinway Street and Northern Boulevard and extends the residential character of existing neighborhoods. Development will then progress westward towards Queens Boulevard. Zones near Sunnyside Gardens and Sunnyside would be developed last, completing the project in approximately 2042.

Test Case 2 (Live/Work/Play)

Phase 1 of the project begins near Queens Boulevard, leveraging the area's proximity to transit and attractiveness for retail. Development will then progress east towards Steinway Street and Northern Boulevard. Zones near Sunnyside Gardens and Sunnyside will be developed last, completing the project in approximately 2048.

Test Case 3 (Destination)

Phase 1 of the project begins near Queens Boulevard, leveraging the area's proximity to transit and attractiveness for retail. Development will then progress east towards Steinway Street and Northern Boulevard. Zones near Sunnyside Gardens and Sunnyside will be developed last, completing the project in approximately 2041.

Core Yard

Based on an understanding of the technical constraints and the lessons learned by optimizing feasibility for the three test case scenarios, the Core Yard, defined as Zones D, C, and B-South covering approximately 70 acres, has been identified as an area most viable for development, and would be a likely early phase of the total overbuild project.

Based on railroad operations and the future track layout, the Core Yard could support a high density of residential uses. The majority of the area is under single ownership and overlaps with elements of the Amtrak Master Plan requiring immediate coordination. Development in the Core Yard would encourage consistent block and street grid formation and the creation of a central east-west boulevard to facilitate future phases of development. The area is connected to the existing road and bridge network and is large enough to accommodate a complete and economically feasible neighborhood. (Figure 5.33)

The development of the Core Yard could bring substantial benefit to the City, including approximately 11,000 to 15,000 total new housing units, 15 to 20 acres of open space, and new schools, community facilities, and retail amenities to serve surrounding communities and new residents. The Core Yard could create at least 3,300 to 4,500 new permanently affordable housing units, helping to meet City policy goals. Across the test cases, the Core Yard produces similar levels of financial feasibility. By evaluating the impacts of the range of uses, number of roads and open space, the Core Yard program was refined to improve financial feasibility. Total development cost is approximately $10 billion in 2017 dollars. Using the mid-point of a refined Core Yard program, the project could generate approximately $2.84 billion in gross land proceeds. After accounting for approximately $1.81 billion in overbuild premium and approximately $1.84 billion in onsite and offsite horizontal costs, the Core Yard can have an estimated residual land value of -$798 million.

A negative residual land value indicates that public investment will be required in the project. The financial feasibility of the project was evaluated by analyzing the public goods and tax proceeds that would be generated by this potential investment.

FIGURE 5.33: CORE YARD AND FULL YARD LAND PROGRAM

	Sunnyside Yard (Full Yard)	Core Yard
Residential	14.2 M – 24.4 M	11.3 M – 15.3 M
Total # of Residential Units	14,000 – 24,000 units	11,000 – 15,000 units
30% Affordable Units	4,200 – 7,200 units	3,300 – 4,500 units
Class A Office	0 – 4.8 M	0
Creative Office	0 – 800 k	0
Neighborhood Retail	500 k – 900 k	400 k – 600 k
Mixed-Use	110 k – 1.5 M	300 k – 500 k
Community Facilities	1.0 M – 2.0 M	700 k – 800 k
# of Schools	10 – 19 schools	6 – 11 schools
Higher Education	0 – 1.4 M	0
Parking	700 k – 1.6 M	400 k – 600 k
# of Parking Spaces	2,400 – 5,300 spaces	1,500 – 2,000 spaces
Total Floor Area	**20.3 M – 29.8 M**	**13.2 M – 17.8 M**
Open Space	31 – 52 acres	15 – 20 acres

The Core Yard could deliver substantial public benefits in the form of affordable housing, open space, and public facilities at a cost that is comparable to other major infrastructure investments and large scale developments led by the City. Moreover, the Core Yard could generate significant tax proceeds. The real property taxes alone (approximately $934 million over 40 years) could exceed the total cost of investment. Finally this investment would leverage substantial private investment to catalyze economic impacts at a regional scale. Considering this combination of factors, the Core Yard is financially feasible.

E. Conclusion

Three program-based test cases were created to evaluate alternate development scenarios for Sunnyside Yard. The three test cases include: Test Case 1 (Residential); Test Case 2 (Live/Work/Play); and Test Case 3 (Destination). All test cases assume that 30% of residential units will be permanently affordable per Mandatory Inclusionary Housing guidelines.

Each of the test cases address project challenges with a slightly different approach to programming, providing alternate scenarios for evaluation. The three test cases were used as a basis for testing and reviewing economic feasibility through an iterative process. To account for the variance in construction complexity among the zones, constructability multipliers were developed and applied to the substructure costs by zone.

The test cases were broken down into a series of geographic zones. Guidelines for each of the zones within each of the test cases establish the basic organization of the zone, its general street pattern and circulation systems, locations for support columns at the track level, and the resulting potential tower locations above the deck.

Extensive financial analyses were performed to identify the residual land value and potential real property tax by each zone and Test Case scenario. Changes in revenue and cost assumptions, phasing, financing strategies, and regulatory approvals would alter these financial findings. Based on the technical constraints and lessons learned, the Core Yard has been identified as the area most suitable for development in early phases of an overbuild.

The iterations of the test cases and the zone-by-zone evaluation help create a clear picture of what combinations of uses and locations within Sunnyside Yard are more feasible than others. Based on these findings it is possible to generate a development program and scenario that maximizes feasibility while also addressing policy objectives.

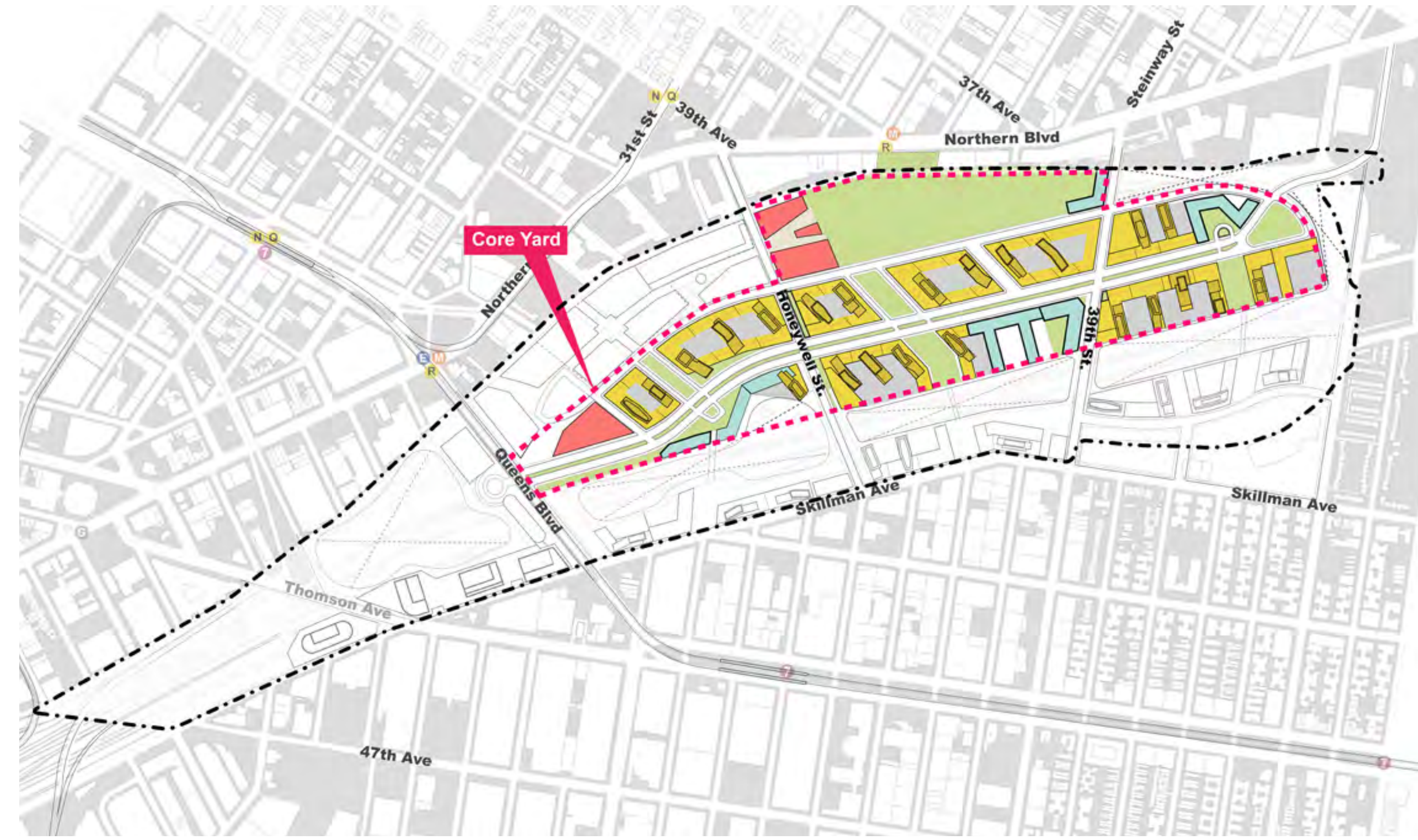


FIGURE 5.34: CORE YARD LAND USE

Residential Podium	Office Podium	School/Community	Landscape Buffer
Residential Tower	Office Tower	Public Open Space	Parking
Creative office	Mixed-Use	Public Open Space	Railroad Facilities

Chapter 6: Conclusions

Table of Contents

A. CHAPTER OVERVIEW

This report is the first step in the integration of engineering, economic, urban design, and public policy guidelines for an overbuild development at Sunnyside Yard. In this study, three test case programs were developed, each with a programmatic theme. They were refined through an iterative process with the goal of creating the most value while maintaining programmatic focus. This chapter summarizes key findings learned from the test case programs based on engineering constraints, urban design principles, and enhancements to optimize feasibility. Finally, this chapter describes potential next steps to advance plans for a partial overbuild at Sunnyside Yard and to guide the City, Amtrak, other stakeholders, and future planners.

B. FINAL RECOMMENDATIONS

1. Engineering Constraints

The operational demands of a busy railyard create engineering constraints, which in turn limit overbuild. (Figure 6.1) Some key findings include:

- Track alignment, orientation, and spacing between tracks varies across Sunnyside Yard, affecting column location and the structural spans of a deck. Access roads and vehicular circulation at track level also affect column locations and spans.
- Required train clearance heights above the tracks and the varied site topography impact deck height.
- Catenary and overhead power systems may also impact deck height. Most catenary and overhead lines will need to be modified.
- The difference in height between the deck and surrounding streets limits accessibility, and complicates the ability to connect new streets on the deck to the existing street system.
- The height of some new Amtrak facilities proposed under their Master Plan exceeds the proposed deck height, and will require coordinated design and construction.
- As railroad operations in Sunnyside Yard expand, deck construction will get more complicated and potential construction schedules will lengthen, increasing costs.
- It is anticipated that by 2030, the MTA's East Side Access tunnel will be operational, and Amtrak's Master Plan is anticipated to be underway, with existing tracks realigned, new tracks added, new facilities constructed, access expanded, and rail traffic increased. Close coordination between future improvements and overbuild design can avert conflicts and mitigate any additional incremental costs.

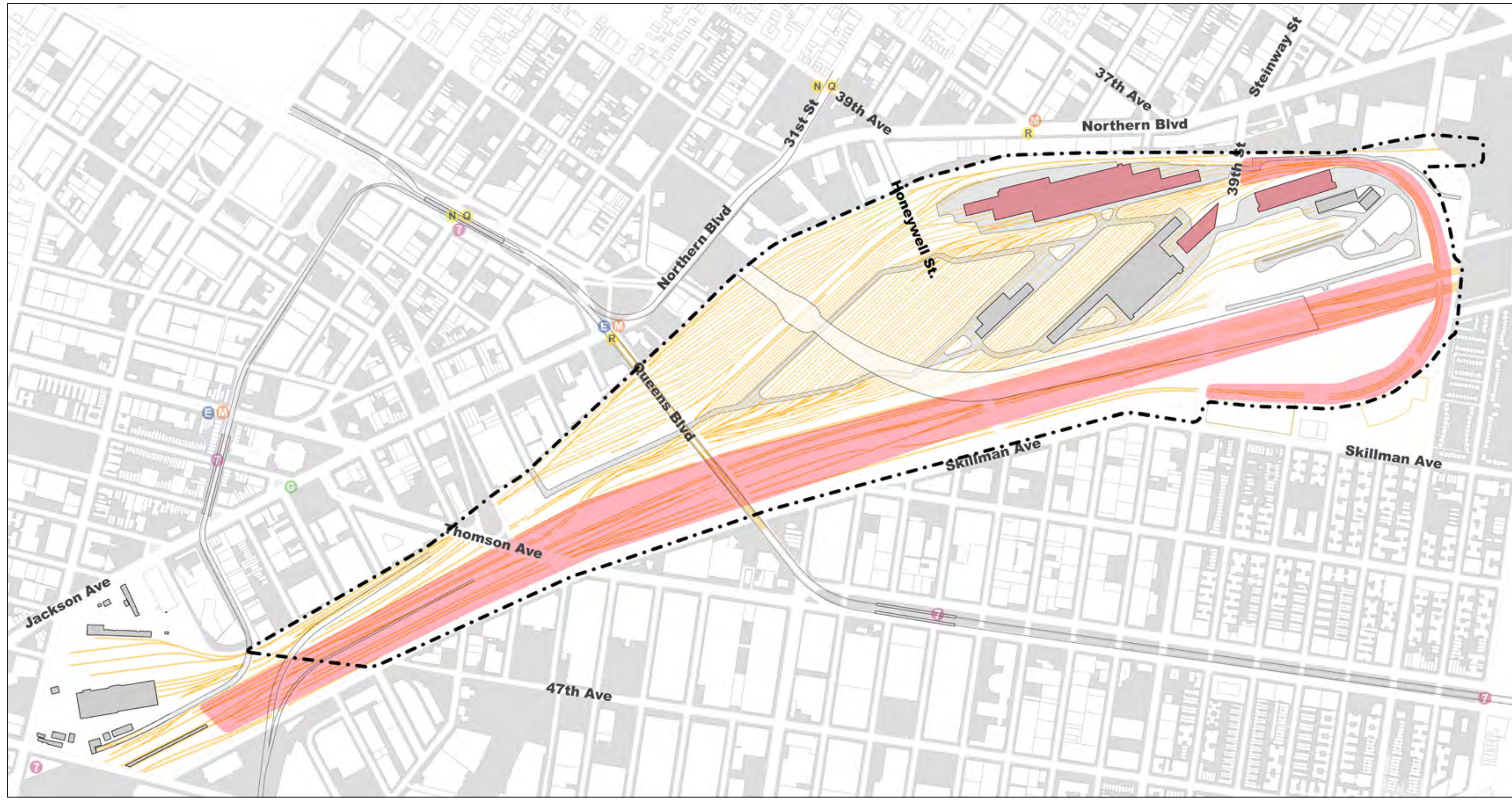


FIGURE 6.1: RAILROAD OPERATIONS

Future Amtrak Master Plan Buildings
Future Amtrak Master plan Driveways
Structures and infrastructure which interact with proposed deck
East Side Access Tunnel
Future Track Alignment
Areas of high rail traffic (especially complicated for decking)

Certain engineering guidelines will help to optimize the engineering feasibility of overbuild development (Figure 6.2):

- Structural steel construction is preferred for the platform as it is lighter than precast concrete and is therefore easier to maneuver and install in congested areas.
- Structural support walls and columns must be located outside of required railroad track clearances.
- Deck spans vary across Sunnyside Yard. Shorter spans between support walls or columns allow taller overbuild structures (above 60').
- Deck depth increases with span length and can be somewhat adjusted to accommodate deck elevation for urban design considerations.
- Buildings under 60' tall, roads, and open space can be supported by the inherent strength of a spanning deck without significant reinforcement to the deck or building structure.
- Buildings or towers over 60' tall generally:

  -Need to be oriented with their long axis perpendicular to the direction of the tracks in order to provide adequate resistance to wind loads.

  -Require columns/support walls at track level (with support walls running between tracks).

  -Must span three to four lines of columns (depending on tower length/height).

  -Require a mega transfer truss in the building podium (the lower 60') to transfer the loads to support walls. The size of the mega transfer truss varies depending on span and tower height.
- New rail-related structures will require coordination in design and construction with deck/overbuild. Some future facilities or structures may extend up through the proposed deck, with upper levels incorporated into overbuild structures. Railroads have the opportunity to incorporate these measures, where possible, to avoid precluding a future overbuild.

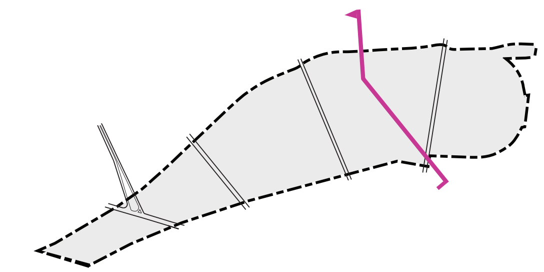
FIGURE 6.2: RAILROAD OPERATIONS AND TOWER LOCATIONS

Structures and infrastructure that interact with proposed deck
Tower Footprints
Future Track Alignment
Optimized Tower Locations
Studied Boulevard Alignment

2. Urban Design Principles

A consistent urban design approach will also help to optimize feasibility. Core urban design principles for Sunnyside Yard include:

- The existing bridges at 39th Street, Honeywell Street, and Queens Boulevard should be utilized as the primary north-south vehicular connectors. Vehicular connections to the deck, wherever possible, should be from the existing bridges where the elevation of the deck is close to the elevation of the bridge.
- A central, roughly east-west boulevard, should be established along the length of Sunnyside Yard to link the different phases of development.
- Pedestrian connections should be established to provide links over un-decked open areas, and to connect surrounding dead-end streets and Skillman Avenue to the deck.
- Transit use should be encouraged by providing easy access to existing transit and incorporating new transit, such as the proposed LIRR Sunnyside Station.
- New neighborhood districts should have a clear identity and organization.
- Each development phase should create a complete neighborhood with a balance of uses to meet a broad range of needs
- New development should respond to the surrounding neighborhood context, with transitions and buffers negotiating differences in scale, elevation, and use.
- A system of connected parks and open spaces, supporting a variety of programming, should be integrated with new development and incorporate the pedestrian network.
- A strong but flexible vision for development is necessary for a successful phased and long-term buildout.



KEY PLAN

Section Cut

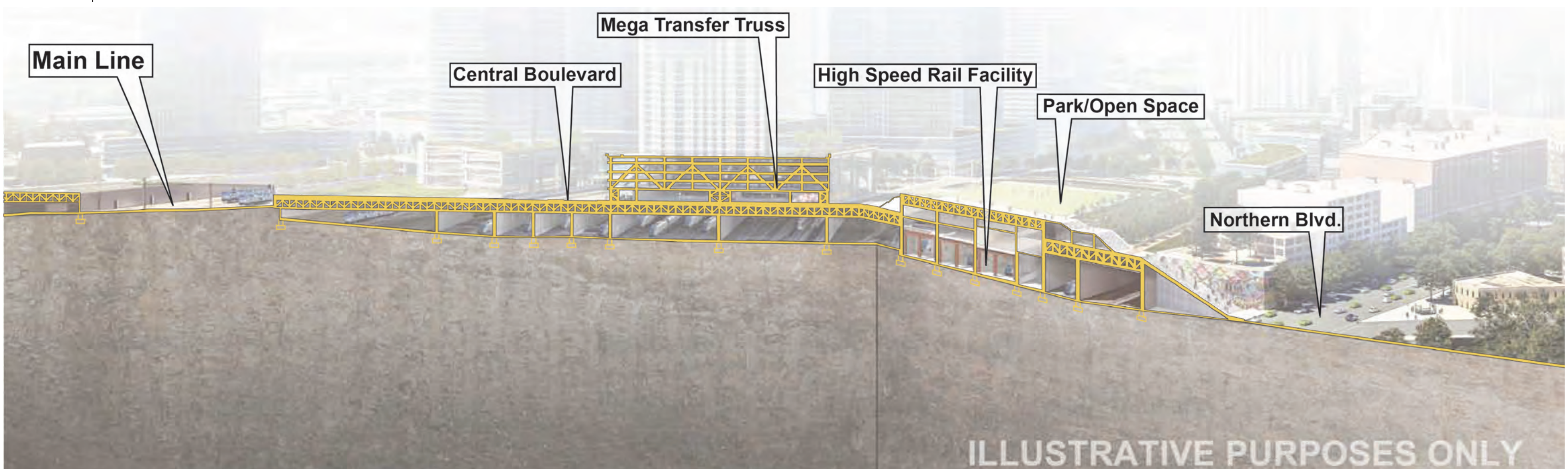


FIGURE 6.3: SECTION RENDERING AT AMTRAK HIGH SPEED RAIL SHOP AND YARD PARK

'All renderings, illustrations, and plans in this study are intended for illustrative purposes only. There are a variety of potential design solutions and these renderings, illustrations, and plans shall not be construed to be a representation of an intended design solution'

3. Economic Considerations

The economic feasibility of an overbuild depends on optimizing the strategic placement and phasing of various building typologies and programs. The following guidelines can optimize the feasibility of a project (Figure 6.4):

- Buildings should be located where they are most structurally feasible, with heights, footprint size, and overall site density maximized.
- Parks, roads, and open space should be located where overbuild is structurally more difficult.
- Areas that are most difficult to build over should be left open with no deck. Targeting 80-85% overall deck coverage can achieve urban design, and public policy objectives based on the program and phasing.
- Low-density/high value uses should be strategically located where railroad operations limit height and density, such as the Mid-Day Storage Yard.
- Construction should be phased to:

  -Coordinate as closely as possible with Amtrak's Master Plan to synchronize track outages, minimize railroad disruption, and reduce potential duplication of rail reconstruction work.

  -Leverage time value of money by delaying low-value uses, such as office, to later phases.

  -Capitalize on the mix of uses to allow non-competitive uses to be absorbed simultaneously by the market.

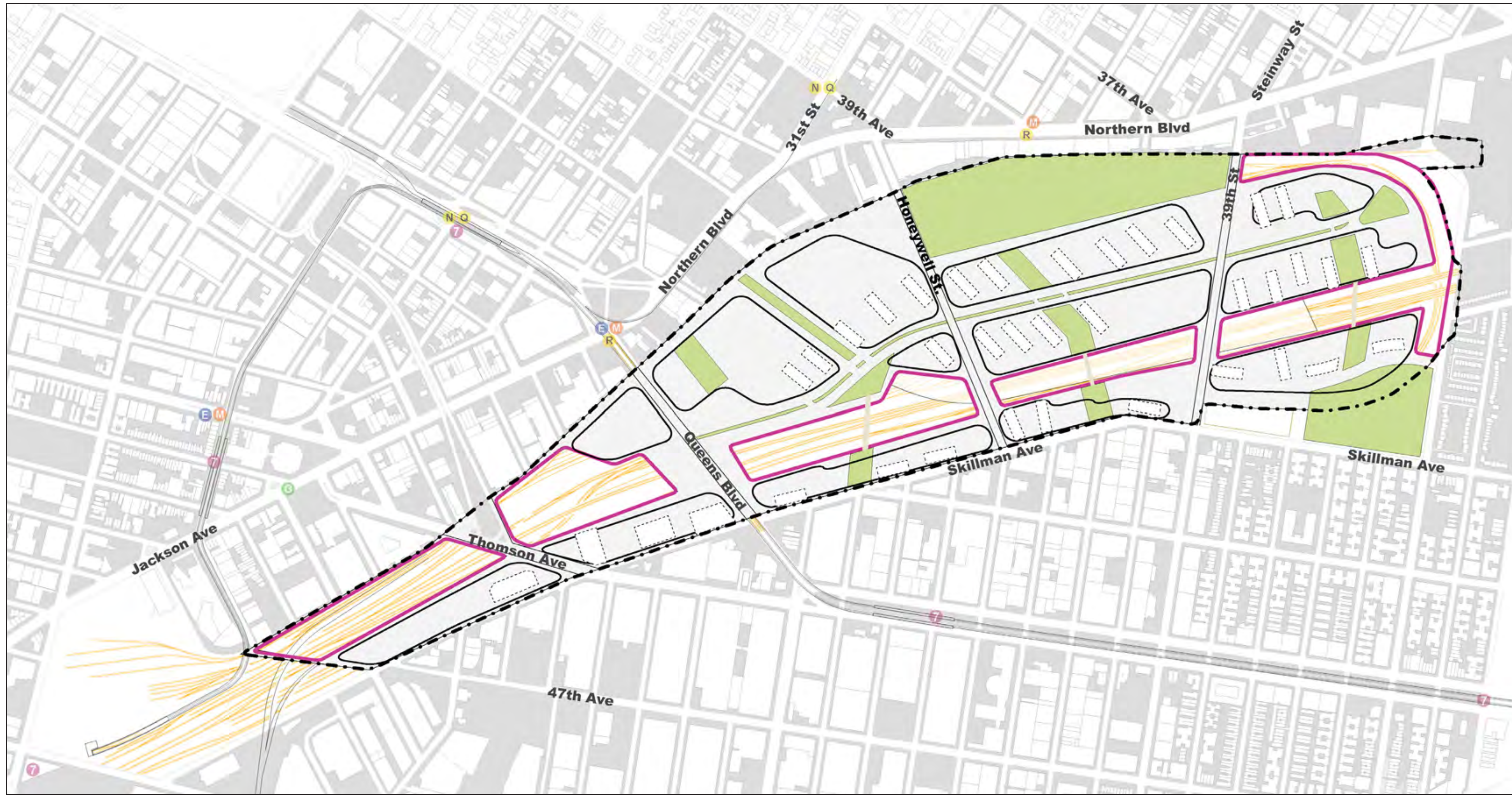


FIGURE 6.4: OPTIMIZED DECK COVERAGE, OPEN SPACE AND TOWER FOOTPRINTS

Outline of Non-Decked Areas
Public Open Space
Tower Footprints

C. NEXT STEPS

This study is the initial undertaking in what could be a long-term project; to advance further, the City and partner entities will need to develop and execute a detailed course of action, requiring a high level of commitment on the part of the City, Amtrak, and other stakeholders. The next phases of the project should include a more extensive investigation of railroad operations, engineering considerations and urban design to further understand the feasibility of the project. Immediate actions and specific master plan elements would include:

Immediate Actions

The following are immediate action items required to lay the ground work for a Master Plan:

- Work with Amtrak and other agencies to coordinate plans for upcoming projects, so that they do not preclude or complicate overbuild. Projects to be considered include:

  -Amtrak – Final Design of High Speed Rail Facility

  -Amtrak – Final Design of Focus Building

  -Amtrak – Final Design of Commissary and Materials Management Building

  -MTACC – Design and construction of ESA Midday Storage Yard

  -MTACC – Design and construction of LIRR Sunnyside Station

  -MTACC – Future use of property adjacent to 42nd Place / 43rd Street

  -LIRR – East River Tunnel flood protection barriers

- Coordinate closely with Amtrak to explore various feasibility study recommendations, including:

  -Reduced railroad vertical clearances

  -Decking over MOW Yard, supported by columns/walls

  -Deck over frequency converter substation, supported by columns/walls

  -Relocation of signal power towers

Master Plan

This study has laid the ground work for the overbuild and identified key findings to be used as a starting point for further analysis, including the development of a Master Plan for the full Yard, which would study in greater detail:

- Engineering Constraints:

  -Incorporate the designs of Amtrak facilities and structures and overbuild

  -Study regional transportation to assess current utilization of roads and public transit and propose a set of local transportation solutions

  -Study western Queens utility supply and demand study to determine requirements

- Urban Design

  -Perform detailed analysis of deck access strategies

  -Formulate a more detailed development program

  -Refine initial parks and open space program based on revisions to development program

  -Formulate a set of design guidelines describing a vocabulary of architectural typologies

  -Identify green and sustainable goals, objectives, strategies, and appropriate certification

  -Formulate proposed rezoning and related actions to facilitate development program

- Agency/Stakeholder Input

  -Coordinate with agencies (DCP, DEP, DOT, NYSDEC, etc)

  -Additional community outreach and engagement

- Core Yards

  -Study early project phases in greater detail

- Project Governance

  -Evaluate potential governance structures to manage project planning and implementation

  -Evaluate public financing strategies

  -Establish preliminary working agreements between primary land owners

  -Develop a strategy to apportion horizontal infrastructure in a way that limits total costs and maximizes total project returns

Risks and Caveats

While employing these guidelines will help to improve feasibility, there are market, political, and implementation risks that could impact the project. Policy-driven changes to the program uses, such as additional affordable housing or additional non-revenue producing community uses; shifts in macro market dynamics; modifications to tax policy; or changes in construction costs would all influence the ultimate feasibility of the project. Dense development may raise concerns regarding offsite impacts, such as increased strains on transportation. Solutions to fully mitigate the offsite impacts to transportation and utility systems require further study. Finally, the planning and construction of an overbuild development above the operations of multiple railroads will require a high level of coordination and a focus on long-term goals from all parties.

D. CONCLUSION

While an overbuild development has been proposed before, the confluence of factors—Amtrak and MTA master plans for Sunnyside Yard, favorable market conditions, and a City policy agenda prioritizing affordable housing and equitable growth—creates an opportunity to move forward with an overbuild in the near future before such a project becomes more complex and costs increase due to the advancement of Sunnyside Yard planned projects and other market forces. (Figure 6.5)

FIGURE 6.5: POTENTIAL SITE PLAN BASED ON TECHNICAL FINDINGS

Glossary

RAILROAD TERMS

Amtrak: Amtrak is the operating name of the National Railroad Passenger Corporation, a federally regulated company that receives federal funding.

Amtrak Gateway Project: The Gateway Project is a proposed set of strategic rail infrastructure improvements designed to preserve current rail services into New York City and ultimately create new capacity that will allow the doubling of passenger trains running under the Hudson River.

Conventional Rail: Passenger trains or components that are not considered high speed rail. This includes train sets for Amtrak Long Distance, NEC Conventional, Empire and Keystone Services as well as NJ TRANSIT train sets. Conventional train sets operate at a maximum of 125mph or slower.

Core Yard: The area between Queens Boulevard Bridge and 39th Street Bridge that is occupied by Amtrak storage tracks, maintenance buildings and the existing Maintenance of Way yard.

East Side Access Project: The East Side Access project in Queens, NY, is a major ongoing construction project partially within Sunnyside Yards. This project will connect the LIRR main line, and points east, to Grand Central Terminal.

Harold Interlocking: The series of tracks, signals, and switches where the Long Island Railroad main line enters (or exits) the Northeast Corridor. It extends from an area between Queens Boulevard and Honeywell Street at the west end and to almost 48th street on the east end. It is being expanded and upgraded to accommodate LIRR service to Grand Central Terminal, in addition to enhanced Amtrak and MNR services.

High Speed Rail Trains (HSR Trains): ACELA and Next GEN HSR train sets that provide a premier passenger experience at speeds that are higher than traditional conventional trains. In the United States, trains that operate at speeds in excess of 125 mph are considered high speed trains.

Loop Tracks: Tracks on the south and east side of Sunnyside Yard that provide access to the Yard for trains departing from Penn Station and arriving at Sunnyside Yard. Loop tracks may also be used by LIRR trains en route to the Mid-Day storage.

Main Line: Train tracks shared by LIRR and Amtrak used for trains traveling through the Sunnyside Yard. The tracks are located on an embankment and are in constant service during the day.

Moderate Restriction Zones: Areas with active train tracks. Extended track outages for overbuild construction may be possible.

MOW: Maintenance of Way.

NEC: The Northeast Corridor.

REA Area: The location where the former Railway Express Agency (REA) facility was located in Sunnyside Yard. The REA was a national monopoly set up by the Federal Government in 1917 to provide small package and parcel transportation using the railroad network. REA ceased operations in 1975

Ready Track: Storage tracks extending from the High Speed Rail Service and Inspection Facility and serving as a yard/holding tracks for trains traveling to Penn Station.

River to River Rail Resiliency Project: Long Island Rail Road's "River to River Rail Resiliency" project proposes to build flood walls to reduce the risk of flood water entering the tunnels from either the Manhattan and/or Queens portals.

Severe Restriction Zones: Areas experiencing continuous train traffic. Track outages for construction activities are possible for short periods of time.

STRUCTURAL TERMS

Catenary: A system of overhead wires used to supply electricity to railroad equipment. Also known as an overhead contact system (OCS).

Column Line: A series of columns or a continuous wall that supports part of an overbuild structure.

Consist: A lineup of railroad carriages cars, with or without a locomotive, that form a unit.

Drilled Shaft: Large diameter, deep, reinforced concrete shaft cast placed in a cylindrical bored ("drilled") excavation.

HCM: Highway Capacity Manual Laydown area: An area used by a contractor for the temporary storage of equipment and supplies.

LOS: Level of service, qualitative measure used to relate the quality of traffic.

Mega Transfer Truss: A large truss structure used to transfer vertical and horizontal loads from a building to support walls. Mega transfer trusses have large quantities of steel, many connections, and drive a significant percentage of total cost.

Operable Unit: A portion of a complex cleanup area that has identified based on its geographical or site specific issues.

Secant Pile: Foundation type consisting of overlapping drilled shafts.

Terra Firma: "Solid earth". The phrase refers to the dry land mass on the earth's surface.

Truss: A structure consisting of straight elements connected at joints to from a shape of conjoined triangles.

FINANCIAL TERMS

Constructability Multipliers: Account for the variance in construction complexity among the zones. The multipliers considered labor conditions across a variety of trades to scale construction complexity and the additional cost for working around railroad activity. Base unit costs ("initial multiplier") consider labor, equipment and materials on conventional terra firma projects. The construction multipliers are added to the initial multiplier of 1.0 to account for the additional constraints resulting from building around an active rail road.

Force Accounts: A commonly carried cost for the additional railroad personnel needed to support construction activity occurring above an active railroad. It pertains to work performed within the right-of-way of the agency.

LODES: LEHD (Longitudinal Employer-Household Dynamics) Origin-Destination Employment Statistics.

Gross Land Proceeds: Value a developer would pay for the land and development rights, considering normal development costs if this were a typical development on terra firma.

Overbuild Premium: Cost premium for the deck and mega transfer truss within the building footprint(s).

Onsite and Offsite Horizontal Costs: Costs for horizontal development outside of a building footprint including railroad force accounts and other site wide systems such as streets, open space, municipal buildings, and utilities, and costs related to offsite utilities to support density and capacity on Sunnyside Yard.

Residual Land Value: Gross land proceeds, less overbuild premium and onsite and offsite horizontal costs.

PLANNING AND URBAN DESIGN TERMS

Podium: Is either a freestanding building or tower base that is assumed to be 60' maximum height and 5 stories or less.

OTHER ACRONYMS

CEQR: City Environmental Quality Review

EIS: Environmental Impact Statement

ERT: East River Tunnels

FDNY: New York City Fire Department

LICIBZ: Long Island City Industrial Business Zones

LIRR: The LIRR (Long Island Railroad) is a subsidiary of the Metropolitan Transportation Authority (MTA), which is New York State agency.

MNR: Metro North Railroad

MTA: Metropolitan Transportation Authority

MTACC: Metropolitan Transportation Authority Capital Construction

NJT: NJT (New Jersey Transit) is a railroad corporation owned by New Jersey State.

NYCDOT: The New York City Department of Transportation

NYCEDC: New York City Economic Development Corporation

NYCDCP: New York City Department of City Planning

NYCDDC: New York City Department of Design and Construction

NYCDEP: The New York City Department of Environmental Protection

NYCT: New York City Transit Authority

NYSDEC: The New York State Department of Environmental Conservation

ULURP: Uniform Land Use Review Procedure

LDC: Local development Corporations

OU: Operable Units

REA: Railroad Express Agency

RFP: Request for Proposal

ROD: Record of Decision

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