APPENDIX A

ENGINEERING REPORT

APPENDIX A.5

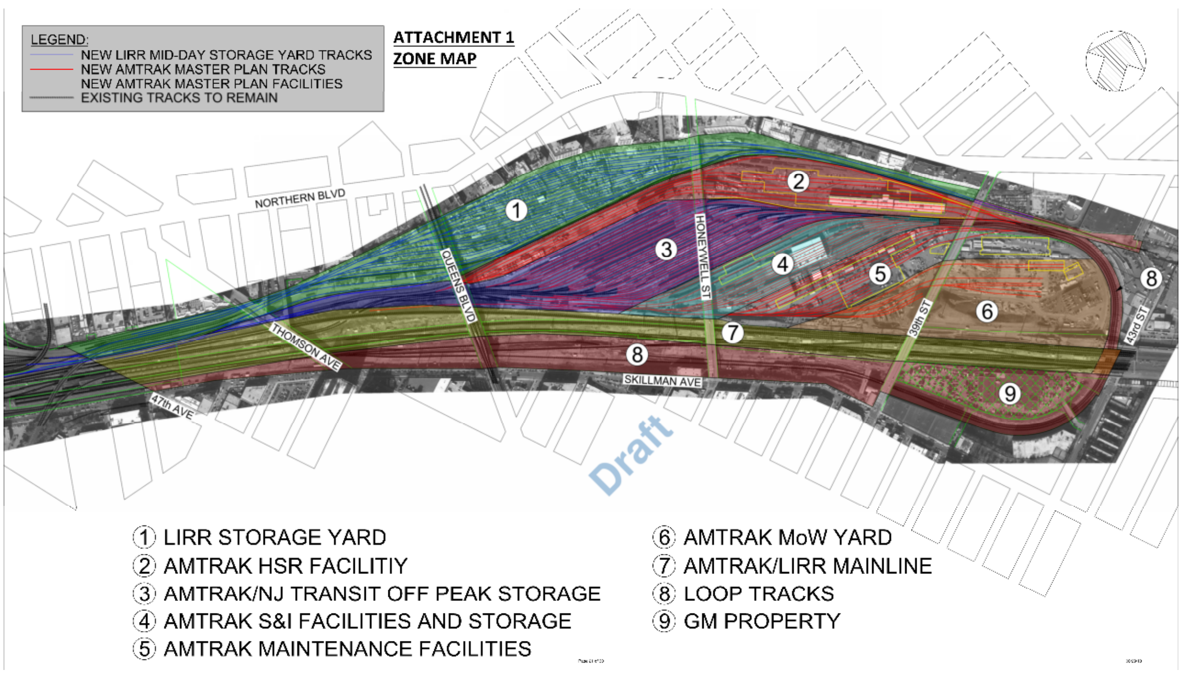
DECK COVERAGE EVALUATION

Sunnyside Yard Master Plan
February 27, 2020

I. Executive Summary

As part of the the deck coverage evaluation task undertaken by the Sunnyside Yard Master Plan engineering team, this memo presents an analysis of feasible locations for an overbuild at Sunnyside Yard. It summarizes our understanding to date based on documents reviewed, ongoing analysis and coordination with NYCEDC and stakeholders, including Amtrak. This analysis is in progress and continues into the conceptual deck design for the Sunnyside Yard Master Plan, as the team collects further information from other tasks on this project and from agencies such as MTA, NYPD and FDNY. Results shown on this document are not final.

Sunnyside Yard serves Amtrak's Empire, Keystone, and Northeast Corridor lines, intercity trains, and the Acela Express. It also serves as off peak storage for NJ Transit service. The Harold, R, Q and F Interlockings manage train control. Sunnyside Yard has been an important staging location for the MTA-LIRR "East Side Access" (ESA), a project that required significant rebuilding of the Harold Interlocking. MTA-LIRR tracks run through the Mainline and will also use the Loop Tracks to reach the Mid-Day Storage Yard. The NYCT No. 7 subway also spans over the yard along Queens Boulevard. For the Master Plan, the yard is divided into 9 zones as shown below.



Available historic data suggests that the subsurface conditions are represented by two generalized soil profiles covering the east and west parts of the site, divided approximately at Honeywell Street. The depth to bedrock is highly variable across the site, but generally increases to the east. There is a river that extends up from Dutch Kills Creek and cuts through the site. There are several MTA-LIRR ESA tunnels passing below the rail yard and a City Water Tunnel No. 2 runs below the rail yard along 39th Street. The Queens-Midtown Tunnel and the 7-Line subway begin running underground west of the overbuild area near the throat of rail yard and the E-, F-, M- and R-Lines run north of the site beneath Northern Boulevard.

The high loads and poor soil would typically result in excessive settlement if shallow footings and mat foundations are used. Further, if footings and mat can be justified, the construction of these large elements would require removal and replacement of large sections of tracks and utilities in the yards. High capacity, deep foundations are more appropriate here as they can be installed between tracks with necessary track outages and coordination with rail entities. New foundations will be required to transfer loads below the tunnels such that the tunnels do not experience any increased stress.

Interaction between structure and existing utilities is largely unavoidable. Water and gas mains, telecommunication conduits, electrical duct banks, transformers and vaults, oil lines, and sanitary and combined sewers are present throughout Sunnyside Yard. Some amount of relocation should be expected, particularly of minor distribution lines or services. Much of Sunnyside Yard falls within the NYSDEC State Superfund Site #241006. The site was divided into six Operable Units (OU-#), each of which received its own Record of Decision (ROD) from NYS DEC, detailing the results of remedial investigations and the remedial method selection process.

Minimum horizontal track clearances within Sunnyside Yard, as they pertain to column locations, are defined at two levels: (1) 16’ from centerline of track for any permanent obstruction (Amtrak standard), and (2) 8.5’ from centerline of track (New York State Law).

Vertical train clearance requirements differ between the Amtrak and LIRR portions of Sunnyside Yard. Most Amtrak tracks have an overhead traction power system, whereas LIRR tracks utilize third rail. Reduced Overhead Contact System (OCS) clearances have been proposed to Amtrak: with and without along- and cross-track feeder heights. Coordination with AMTRAK on variance and clearance studies along the NYCDOT bridges is in progress. This analysis is addressed in the Deck Coverage Evaluation.

There are different types of OCS structures and ancillary wires at the yard. Every existing OCS structure is different and the elevation of the OCS and ancillary wires at each structure varies across the yard due to the variable spans and the multiple overhead obstructions such as bridges, transmission power lines, cross-track feeders, along-track feeders, cable drops, etc. The relocation of OCS wires from existing to temporary to new structures will be challenging. Zones 2, 3, 7 and 8 show very little available real estate and very limited potential for track outages necessary to install new structures and to replace, reprofile, and transfer existing wires. Coordination with Amtrak will be critical in identifying construction staging for OCS wire relocation.

Two location-dependent approaches will be applied to address crash protection for the structural elements supporting a future overbuild deck. For the Low-Speed Area, columns will be designed to handle 1,766,600 lbs. (NJ Transit 12 car multi-level trainset). |For the High-Speed Area (all Mainline tracks with speeds of 60 MPH, crash walls will be utilized as described in AREMA Section 2.1.5 PIER PROTECTION. As stated in AREMA, it is not the intent of crash walls to “resist the full impact of a direct collision by a loaded train at high speed. Rather, the intent is to reduce the damage caused by shifted loads or derailed equipment.”

Based on the horizontal clearance requirements, and dynamic envelope analysis, a footprint was developed to define the zones within the project site where structural elements can be located. These zones were separated into two categories: (1) areas where the absolute minimum (8’-6”) clearance between centerline of track to face of column was achieved, and (2) areas where the desired minimum (16-0”) clearance between centerline of track to face of column was achieved. See Figure 1 on Page 5.

Zones 1 to 6	approximately 98% of the site area can be decked over using structural spans under 200 feet, with approximately 90% of the spans under 140 feet.
Zone 7	approximately 50% of the zones requiring spans greater than 140’-0” with 20% of the spans greater than 200 feet.
Zone 8	approximately 90% of the spans are achieved by spans under 120 feet.

The top of rail is set close to the elevation at the sidewalk along Northern Boulevard. This will create challenges for access to the edge of the overbuild deck. Creative solutions will have to be developed in order to find ways to deal with these challenging transitions. At Skillman Avenue the gradual slope combined with a 40’-0” to 60’-0” strip of terra firma adjacent to Skillman allows for a transitional zone to negotiate the elevation difference between the sidewalk and the higher elevations required at the deck due to the along track feeders. The platform can either slope up or be transitioned using landscape architecture. In order to address the difference in elevations along the NYCDOT Bridges, we anticipate that a vertical clearance variance will need to be applied to Amtrak and LIRR in order to provide a transitional zone in which the structure can be lower than the typical minimum clearance.

Steel and precast concrete options were investigated for the structure of the overbuild deck over Sunnyside Yard. In both scenarios, for spans greater than 90 feet, the depth of the structure would allow for space to run mechanical services or to create occupied space for storage where the depth is sufficient. The advantage of a precast concrete deck is that precast elements can be set quickly. The advantage of a steel superstructure solution is that the steel is lighter than long span precast concrete elements.

Heat maps were developed for the different scenarios in order to form a holistic picture of the constraints. When the first regions of deck coverage are selected, additional analyses will be performed to understand the existing conditions of the OCS and cross track feeders as well as any future work. This analysis will ultimately be finalized into one heat map.

Wind loads were analyzed using the New York City Building Code 2014 using a 98 mph three second wind gust. Ultimately a wind tunnel study will be required for the site taking into account the master plan zoning. Depending on the platforms structural lateral system wind may not be the controlling load case, so the reduction in loading may not influence the design.

Seismic Loading in general decreases as building height increases, but increases with mass. It was found that the “Base Build” condition, where the platform is constructed with either plaza loading or five story buildings created the highest seismic loading of 108.2 psf of base shear, approximately five times higher than the highest wind loading base shear.

Structural isolation joints will be designed to allow the construction movement, while the finished expansion joints will be designed to allow movement of the completed structure. Expansion joints must also account for both seismic and wind movements, it is estimated joints will need to allow for approximately 6 to 8” of movement at the platform level.

Base isolation is very common in bridge construction, providing a significant reduction in the transfer of lateral loading and allowing for increased thermal expansion and contraction. There are two main types of base isolation, lead core rubber bearing and Friction Pendulum Dampers. Both options could significantly reduce the seismic loading, which in turn would allow for significant reduction in column and foundation sizes to resist lateral loading. A major hurdle in the implementation of base isolation would be the life span and replacement of the base isolators. Base isolators would need a regular maintenance and inspection program and would need to be replaced after their design life of 50 years.

Protective design criteria are defined in terms of the intensity of the explosive threat and the performance of the structure in response to the explosive threat. The Sunnyside Yards consist of nine different zones, based on the different entities and purpose throughout the site. Of the nine different zones, only the AMTRAK/LIRR Mainline, which is the main artery for the northeast corridor rail traffic, is highly critical. As such, it requires a greater extent of risk management compared to the other eight zones. The proposed criteria therefore distinguishes between the greatest criticality, moderate criticality and low criticality by specifying high, medium and low levels of protection.

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. Ventilation systems will be configured as a zoned ceiling exhaust system that utilizes stratification of hot smoke at the ceiling. Ventilation plants will be constructed in buildings at key locations on the overbuild. In order to realistically evaluate fire characteristics and fire movement below the deck area, Computational Fluid Dynamics (CFD) simulations will be performed using Fire Dynamics Simulator (FDS) software created by National Institute of Standards and Technology (NIST).

Overbuild construction will require the addition of code compliant egress facilities from existing structures within the overbuild to a public way space on top of the overbuild. Access and egress provisions must address normal use, emergency services access, and evacuation of Sunnyside Yard or trains.

Construction within the Yard will require close coordination with the different stakeholders/agencies with proper consideration for clearances and train operations to determine possible outages to perform work. An in-depth understanding of existing and future conditions, such as geologic profiles and proposed building typologies, will help identify the types of structures to build and appropriate types of equipment, access and construction staging. Innovative ways to construct an overbuild deck can be drawn upon recent projects such as Manhattan West and Hudson Yards.

II. Column Clearance & Structural Span Evaluation

a. LIRR & Amtrak clearances

Horizontal Track Clearances

Minimum horizontal track clearances within Amtrak's Sunnyside Yard, as it pertains to column locations, are defined at two levels: (1) 16' from centerline of track for any permanent obstruction (Amtrak), and (2) 8.5' from centerline of track (NYS). Any violation of the 16' requirement can be approved by Amtrak while any variance of the 8.5' requirement must be approved by the New York State Department of Transportation. As a general approach to the deck design every effort will be made to maximize clearance between the tracks and columns, and wherever possible to meet or exceed the 16' requirement. An absolute minimum clearance of 8.5' will be maintained for locations where the 16' is not achievable. Note that the same clearances apply for NJ Transit.

Additionally, these clearances must be increased through track curvature to account for excesses the vehicle generates as it navigates curved track. This is due to the nature of rigid straight vehicles being located on a curve resulting in what is called center and end vehicle overhang. This is illustrated in the Figure 1 below.

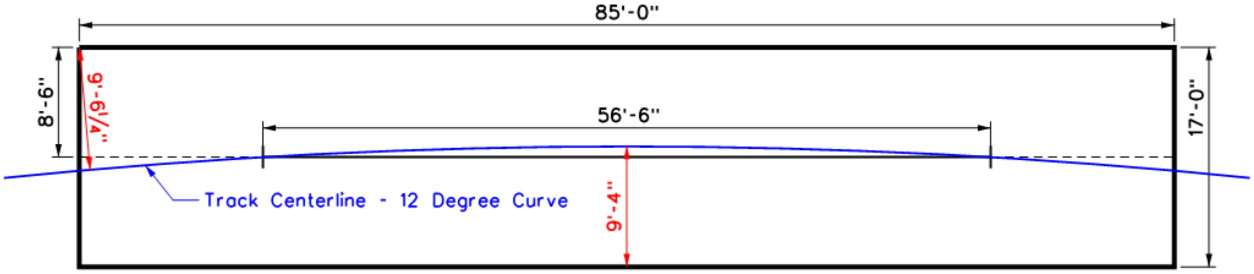


Figure 1 – Vehicle Excess from Track Curvature

In the figure above, an 85' long vehicle with trucks (wheels) spaced at 56.5' and drawn at 17' wide represent the 8.5' clearance to either side. The actual physical offset from centerline of track, at the center of the vehicle, increases from 8'-6" to 9'-4", representing the additional center overhang. A similar overhang can be seen at the ends of the vehicle known as end overhang.

To accurately model the excesses generated by track curvature, and to account for the transition between tangent and curved clearances, the vehicle clearance envelopes were pushed, through CAD software package Bentley Rail-Track, along all alignments and through switches generating a footprint called the Vehicle Swept Path. This creates a footprint representing an 8.5' clearance from centerline of track that accounts for not only tangent and curve clearance requirements, but also the transitions. Columns can be located outside this swept path footprint to meet the minimum clearance requirements. A layout of this footprint is shown in Figure 2 below.

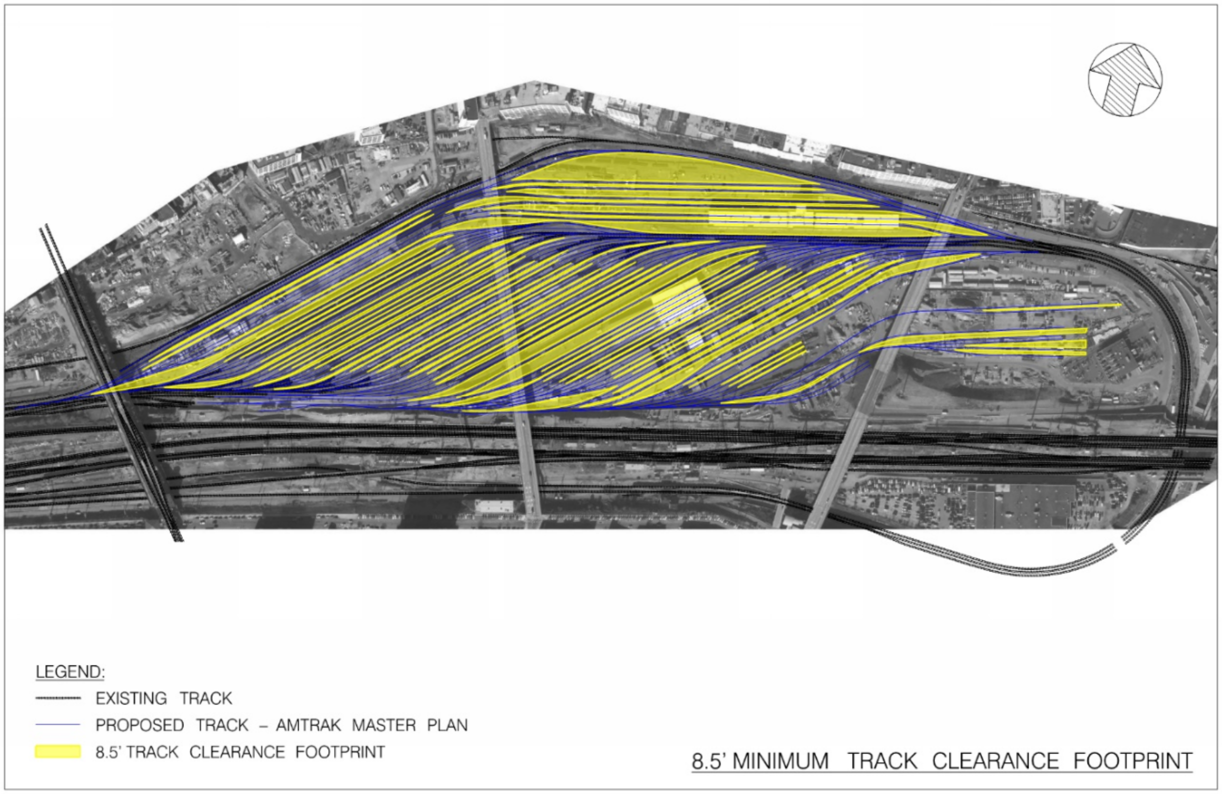


Figure 2 – 8.5' Minimum Track Clearance Footprint

Vertical Track Clearances

Most storage, loop, siding, and main tracks have overhead contact power (OCS). There are several types of OCS steel structures supporting the catenary wires: cross-catenary, portal, cantilever, and pull-off structures (See Appendix A.5.B for sample OCS structures):

- Cross-catenary structures: structures with two or more wires that straddle the tracks and supports several catenaries, or several single contact wires in multi-track area.
- Portal structures: A frame support structure, typically of galvanized steel, consisting of vertical columns supporting each end of a horizontal beam spanning multiple tracks. Several catenaries are usually supported from the beam. These portals may be k-frames, trusses or beam structures depending on the structural arrangement of the horizontal beam.
- Cantilever structure: OCS support frame typically for mounting a messenger support or suspension fitting and a contact wire registration assembly that is mounted on a pole or portal beam drop bracket using hinge fittings. There are single and twin cantilevers installed in the Yard.
- Pull-off structures: single pole structure without any horizontal structural member which support the radial load of one or multiple catenary wires on curves.

The OCS systems used in the Yard are compound and simple catenary wires: compound catenaries comprise a contact wire supported by an auxiliary wire, which, in turn, is supported from a messenger wire by hangers; simple catenaries do not use auxiliary wires. Existing Amtrak OCS in the Yard is fixed-terminated, without auto-tensioning equipment (counterweights) so the mechanical tension of the wires varies with temperature, being higher at low temperatures and lower at high temperatures.

In addition to catenary wires, existing overhead wires in the Yard are comprised of ancillary wires such as ground wires, along-track (parallel) feeders (OCS reinforcement and along track signal power), and cross-track feeder:

- Ground wires: The conductor installed to provide lightning protection and electrical continuity between the supporting structure of the overhead contact system and the common return or grounding system.

- Along-track (parallel) feeder: aerial bare or insulated cable mounted on the OCS poles which provides electrical power reinforcement to the OCS by means of T-connected feeder jumpers at regular intervals. There are also along track signal power feeders.

- Across-track feeder: aerial bare cables normally mounted on short cross brackets high up on OCS poles of the same portal structure. These are necessary for the division of the OCS into electrical sections, while allowing trolley poles and pantographs to operate from section to section.

The elevations of the OCS structures and ancillary wires vary throughout the site due to variable spans and overhead obstructions such as bridges, transmission power lines, cross-track feeders, along-track feeders, and cable drops.

Vertical train clearance requirements differ between the Amtrak and LIRR portions of Sunnyside Yard. The majority of Amtrak tracks have an overhead traction power system; the LIRR tracks utilize third rail. Two Reduced Overhead Catenary System (OCS) clearances have been proposed to Amtrak: with and without along- and cross-track feeder heights (See Appendix A.5.C for clearance diagrams; note that Amtrak clearances also apply to NJ Transit).

Vertical clearances from top of rail to underside of structural deck or fixtures are as follows:

- Amtrak: minimum 26'-9" from top of rail to any overhead bridge and other structures in electrified territory for 24'-6" trolley wire height (refer to Amtrak drawing ET200 – Minimum Roadway Clearances).

  However, these values are only valid for OCS systems where along- and cross-track feeders are not present. Many structures in Sunnyside Yard support these feeders which can increase the minimum to 40'-0" to account for the minimum electric clearances for 12kV systems and design requirements.

- LIRR/NYSDOT: minimum 22'-0" from top of rail.

The following reduced clearances have been proposed to Amtrak (See Appendix A.5.D for proposed OCS clearances):

- Reduced OCS clearances in areas with OCS structures supporting along- and cross-track feeder heights: A **35'-6**" minimum vertical clearance between the bottom of deck and top of rail when along and cross track feeders are present is less than the 40' required by current Amtrak standards; this clearance is strictly related to OCS and may increase based on ventilation/utility clearance requirements.

- Reduced OCS clearances in areas with OCS structures without along- and cross-track feeder heights: A **22'-8"** minimum vertical clearance between bottom of deck and top of rail when along and cross track feeders are not present is less than the 27'-9" required by current Amtrak standards; this clearance is strictly related to OCS and may increase based on ventilation/utility clearance requirements.

- Reduced OCS clearances along the NYCDOT bridge structures: The current OCS clearances underneath the bridge structures will be maintained. The bottom of the deck structure will be no lower than the existing bottom of the adjacent bridge structure.

These reduced minimum clearances will allow a minimum contact wire height of 18' and a maximum messenger wire height of 21'. This will require temporary intermediate supports and extensive design and construction efforts. OCS wires will need to be reprofiled to within the minimum system height so the temporary support structures can be installed above, which will enable the catenaries to be transferred and the existing tall cross catenary structures to be removed.

Most of these structures support multiple OCS wires, and span on multiple columns across the yard from the North Runner track to the north and south of the Mainline. Removal of one section of the cross catenary structure will introduce high unbalanced forces to the next column, thereby necessitating reinforcement and new cable stays.

Based on this information, the following vertical clearances are proposed (See Appendix A.5.E for typical yard photos):

Zone 1 – LIRR Storage Yard

LIRR storage tracks do not use overhead catenary power. However, 60 new lighting structures will be installed under the LIRR Mid Day Storage Yard Project as part of the East Side Access: 54 cross catenary structures and six rigid structures in the launch shaft area with a maximum height of 36' from the rails. It is assumed that the lights will be relocated to the deck or the walls and that the cross catenary and rigid structures will be removed.

Minimum vertical clearance requirement in Zone 1 is 22'-0"; however, LIRR and NYSDOT may grant a waiver to allow for lower vertical clearance in the decked portion.

Zone 2 – Amtrak High-Speed Rail (HSR) Facility

There are currently 3 electrified tracks (North Runner, Hump, and Lead 6) with wires supported on cross catenary structures; 2 more electrified tracks (RT 4 and RT5) are expected in the future as part of Amtrak's High-Speed Rail (HSR) Facility project.

OCS wires are supported on shared multi-pole cross catenary structures spanning the Amtrak HSR facility tracks and the ladder tracks (bowls). The existing columns of these structures are up to 60' in height, some of which support not only OCS wires but also cross-track feeders and switch disconnectors at the top of the poles.

A 22'-8" minimum reduced vertical clearance for Zone 2 is proposed; however, the area adjacent to the NYCDOT bridges and area with existing cross track feeders and switching arrangements will need to be analyzed individually.

Zone 3 – Amtrak/NJ Transit Off Peak Storage

Ladder tracks are electrified with OCS wires supported on multi-pole cross catenary structures with some of these spans supporting as many as 20 or more catenaries. Most of the storage tracks cannot be de-energized separately due to the lack of sectionalizing switches and section insulators. Therefore, the existing catenaries will need to be reprofiled to keep within the minimum system height; new cross tracks feeders and additional sectionalizing will be necessary to facilitate construction.

A 22’-8” minimum reduced vertical clearance for Zone 3 is proposed. However, the area where the proposed cross track feeders and switching arrangements are to be installed will require individual analysis and may require a minimum 35’-6” clearance.

Zone 4 – Amtrak Service & Inspection Facilities and Storage

Tracks accessing the Service & Inspection (S&I) facilities are electrified with wires supported on cross catenary, cantilevers, and portal structures.

A 22’-8” minimum reduced vertical clearance for Zone 4 is proposed. However, the area where the proposed cross track feeders and switching arrangements are to be installed will require individual analysis and may require a minimum 35’-6” clearance.

Zone 5 – Amtrak Maintenance Facilities

Zone 5 contains the Amtrak main 60 Hz supply substation. Relocation of the Con Ed feeders may be required; clearances around 26.4 kV equipment may also be required.

There are no existing OCS wires over this zone; however, according to the Amtrak masterplan, future tracks will be electrified. New design should incorporate OCS wires and switching arrangements installed on the deck.

A 22’-8” minimum reduced vertical clearance for Zone 5 is proposed.

Zone 6 – Amtrak Maintenance of Way Yard

Zone 6 contains the Amtrak Sunnyside Yard Frequency Converter. Clearances for 138 kV terminations on transformers and utility switches will be required.

There are no existing OCS wires over this zone; however, according to the Amtrak masterplan, future tracks will be electrified. New design should incorporate OCS wires and switching arrangements installed on the deck.

A 22’-8” minimum reduced vertical clearance for Zone 6 is proposed.

Zone 7 – Amtrak/LIRR Mainline

Mainline tracks and most of the crossovers and turnout tracks are electrified with OCS wires and/or third rail. OCS wires are supported on portal, cross catenary, cantilever, or pull-off structures which also support multiple along- and cross-track feeders for catenary feeding and electrical sectionalizing purposes.

In addition to the OCS structures, the following structures carry overhead wires in this zone:

- Utility bridges (40’)
- LIRR insulated power cable crossings (60’)
- Signal power monopoles for signal power separation between Amtrak and LIRR (70’-88’)
- Signal bridges (35’)

Along-track feeders, signal power cables, LIRR aerial insulated cables, and aerial utility cables will need to be dropped and relocated underground in cable troughs, duct banks, and micro tunnels. Signal bridge elevations may be reduced by implementing Reduced Aspect Signals (RAS) while keeping maximum line of sight distances to the signals.

Catenaries are supported at different elevations on several types of OCS structures (portals, cross catenary, cantilever, pull-offs) which extend up to 45’ from top of rail. Messenger wire elevations range between 16'-6" in the proximity of the bridges where the overhead clearance is very low, to 28'-

0" where the structures can be spaced further apart. Reducing the height of the catenary and ancillary wires will require intermediate supports (OCS structures) in an area with very little available real estate and very limited potential for temporary track outages necessary to install new structures and to replace, reprofile, and transfer existing Mainline wires.

35'-6" minimum reduced vertical clearance for Zone 7 is proposed; however, this will require extensive and challenging reprofiling of the existing OCS cables, installation of temporary intermediate structures, and final transfers.

Zone 8 – Loop Tracks

Similar to the Mainline, loop tracks and most of the crossovers and turnout tracks in Zone 8 are electrified with OCS wires. OCS wires are supported on portal, cross catenary, cantilever, or pull-off structures. Some of these structures also support along- and cross-track feeders.

In addition to the OCS structures, the following structures carry overhead wires in this zone:

- Signal bridges (35')
- 26.4kV Con Ed insulated aerial cable crossing

Along-track feeders and 26.4kV Con Ed aerial power cables will have to be dropped and relocated underground in cable troughs, duct banks and micro tunnels. Signal bridge elevations may be reduced by implementing Reduced Aspect Signals (RAS) while keeping maximum line-of-sight distances to the signals.

Catenaries are supported at different elevations on several types of OCS structures (portals, cross catenary, cantilever, pull-offs) which extend up to 55' from top of rail. Messenger wire elevations range between 17'-6" at the proximity of the bridges where the overhead clearance is low, to 27'-6" where the structures can be spaced further apart. Reducing the height of the catenary and ancillary wires will require intermediate supports (OCS structures) in an area with very little available real estate and very limited potential for track outages necessary to install new structures and to replace, reprofile, and transfer existing Loop Track and Mainline wires.

35'-6" minimum reduced vertical clearance for Zone 8 is proposed; however, this will require extensive and challenging reprofiling of the existing OCS cables, installation of temporary intermediate structures, and final transfers.

Zone 9 – GM Property

There are no tracks within Zone 9.

Coordination with AMTRAK on variance and clearance studies along the NYCDOT bridges is in progress. This analysis will be discussed with the Conceptual Deck Design.

b. MTA, Amtrak, NJ Transit operational needs / facilities

Sunnyside Yard was conceived to support Penn Station through minimal use of land in Manhattan. Lines #1 and #2 (eastbound trains departing Penn Station for Sunnyside Yard, and trains bound for New England) are located under 32nd Street. Lines #3 and #4 (trains from Sunnyside Yard to Penn Station) are located under 33rd Street. These lines pass under Manhattan subway lines that run under 7th and 6th Avenues, Broadway, and Lexington Avenue, and through the East River Tunnels into Queens.

Trains heading to Sunnyside Yard from Penn Station normally operate on Line #1 and enter Loop Tracks near the East River Tunnel portal. A car washer is located on one of the loop tracks. All trains operating to Sunnyside Yard from Penn Station are looped. This precludes moving locomotives to the other end of trains and changing the direction of the coach seats.

Proceeding east the Loop Tracks pass under the NEC at HAROLD Interlocking and approach R Interlocking, where trains are routed to the Loop By-pass Tracks that continue around the Yard towards Q Interlocking, the High-Speed Train Maintenance Facility, or to the main yard. Once in the Yard, there are multiple storage tracks used by either Amtrak or NJ Transit trains, some of which provide dual capacity (NJ Transit for mid-day storage and Amtrak for overnight storage).

The Yard provides the following train operational support for Amtrak:

- Empire Corridor:
  - Trains are looped for return trip to Albany-Rensselaer
  - Layover of trains between runs
  - Overnight storage of Montreal and Toronto trains
  - Cleaning and inspection of trains for return trips
  - Stocking of café cars for Rutland and Niagara Falls
- Keystone Corridor
  - Trains are looped for return trip to Harrisburg
  - Layover of trains between runs
  - Cleaning and inspection of trains for return trips
  - Overnight storage of first departure in morning
- Northeast Corridor
  - Trains are looped for return trip to Washington DC
  - Café cars are stocked
  - Cleaning and inspection of trains for outbound trips
  - Trains for New England / Boston depart west to Penn Station and then operate east again for assigned runs
- Intercity Trains
  - Trains are looped for next assignment
  - Stocking of café, dining and sleeping cars
  - Servicing and inspection of trains
  - Crew base for on-board service personnel
- ACELA (High Speed Trains)
  - Trains are looped for next assignment
  - Stocking of café cars
  - Inspection and cleaning of trains
  - Maintenance of the high-speed trainsets

Amtrak trains operating between Penn Station and Sunnyside Yards in both directions tend to operate with relay or “pin-up” crews, that the Amtrak road crews to Albany-Rensselaer, Boston, Harrisburg, New Haven, and Washington leave or accept their trains at Penn Station.

NJ Transit is an important tenant for Amtrak at Sunnyside Yard, using the Yard facility to support train movements from the following lines:

- Northeast Corridor
- North Jersey Coast Line
- Raritan Line
- Morristown Line
- Montclair – Boonton Line

In addition to off-peak storage, NJ Transit utilizes Sunnyside Yard for the servicing, inspection and cleaning. They also loop trains for return trips to New Jersey.

In the future the LIRR will begin to use parts of the Loop Tracks to reach their Mid-Day Storage Yard with trains from Penn Station. Access to the Mid-Day Storage Yard will allow LIRR to shift the layover of some trains from West Side Yard, and create assignments for crews and equipment between their two Manhattan terminals.

The control of trains at Sunnyside Yard is managed by a network of interlocking towers, including:

- HAROLD (PSCC) – junction of LIRR connections from Long Island City and Hunters Point Avenue with the NEC and Hellgate Lines to CP 216 at New Rochelle.
- R – east end of yard connections to High Speed Rail Facility
- Q (remote from R) – west end of yard through the Sub tracks on approaches to Line #2
- F – (remote from Penn Station Central Control) controls Loop Tracks from Mainline (Loops A, 1, & 2 Running Tracks), and Sub Tracks (1, 2, & 3 Running Tracks)

Trains departing from Sunnyside Yard for Penn Station use the Sub tracks that bring the westbound trains under the eastbound traffic, which allows for trains heading to Line #4 to proceed without conflicting movements.

On an average day, mostly on weekdays, Sunnyside Yard will accommodate several hundred train movements for both NJ Transit and Amtrak. All Amtrak trains originating and terminating at Penn Station operate to or from Sunnyside Yard.

Facilities

Amtrak is the primary operator of the facilities at Sunnyside Yard with a focus on supporting the following operations (See Appendix A.5.O – Existing & Proposed Structures):

- Storage of trains
- Turning of trains for return trips to the west and south
- Cleaning, service and inspection of trains
- Locomotive shop
- Car shop
- Commissary for stocking of café and dining cars
- Electric Traction Power Supply
- Maintenance of Motor Vehicles
- Maintenance-of-way department; staging and storage of material

Amtrak also maintains an inventory of spare locomotives and cars in Sunnyside Yard to replace equipment pulled from service for repair. The wheel shop equipment at Sunnyside Yard (maintained by Amtrak) minimizes the time that cars requiring wheel repairs are out of service.

NJ Transit uses Sunnyside Yard primarily for the storage and looping of equipment. Most activities are limited to service and inspection.

Sunnyside Yard has been an important staging location for the LIRR ESA project, which has required significant rebuilding of HAROLD Interlocking. LIRR will use only the Loop Tracks to reach the Mid-Day Storage Yard and does not require any other interaction with Sunnyside Yard. Arch Street Shop was designed to support LIRR equipment maintenance needs, and the Yard can provide a connection for moving rolling stock from Penn Station/West Side Yard to Grand Central Terminal.

Systems

To support the maintenance and storage of trains, Amtrak has a variety of support systems for the movement and storage of trains:

Electric Traction Power – most of the Yard is electrified with an overhead catenary system and supplied from Substation # 44 for the electric trains used on the Northeast Corridor. The approach tracks on the Loop's at F Interlocking are also equipped with Overriding Third Rail for the Empire Corridor trains, that use a DM-32 dual powered electric – diesel. This type of locomotive uses the third rail to operate in the East River tunnels and then transition back to diesel power, as they enter the Loop Tracks. At Q Interlocking the sub-tracks are equipped with third rail to allow the DM-32's to transition back from diesel operation used for movement in Sunnyside Yard to electric operation to enter the East River Tunnels to operate back to Penn Station.

All other Amtrak and NJ Transit trains operating between Penn Station and Sunnyside Yard use the overhead electric contact system.

Water – water systems are available on some tracks for servicing of restrooms and other systems on the passenger cars.

Toilet Servicing – a waste recovery system is available on some tracks for the emptying and servicing of restrooms on the passenger cars.

Compressed Air – is available in the Yard for placing the trains on air system for charging brake systems, operating the water systems, and inspection of trains.

Wayside Power – is available on some tracks to allow trains to have heating and air conditioning when no locomotives are attached to the trains.

Diesel Operations – Amtrak uses diesel powered switch engines where tracks are not equipped for electric operations. These engines are sent at times to either Albany-Rensselaer or Wilmington for repair. The DM-32's on the Empire Corridor trains are receive daily inspection or light repairs at Sunnyside Yard, while maintenance and heavy repairs are handled at Albany-Rensselaer.

c. Crash walls

Protection of the structural elements supporting a future overbuild over the Sunnyside Yard and adjacent Mainline will be handled with two distinct approaches depending on the location:

- Low-Speed Areas (e.g., Amtrak's Sunnyside Yard, LIRR's Mid-Day Storage Yard, Loop Tracks)
- High-Speed Area (e.g., LIRR Main Line)

For **Low-Speed Areas**, which are comprised of Amtrak's Sunnyside Yard, LIRR's Mid-Day Storage Yard, and the Loop Tracks, the approach will be to design all columns to have the ability to withstand a direct impact of a derailed train without failing. Additionally, tracks adjacent to columns would be constructed with guard rails installed between the running rails to further limit how far a derailed train could deviate from the track.

To calculate the forces a column would have to absorb without failing, a NJ Transit twelve car Multi-Level trainset was used for modeling given that this is the heaviest train set in the Yard. The weights of the trainset components are as follows:

- 1 PL-42 AC Locomotive = 288,000 lbs. Each
- 5 NJ Transit Multi-Level Trailer Car (w/out toilet) = 132,990 lbs. Each
- 5 NJ Transit Multi-Level Trailer Car (w toilet) = 134,880 lbs. Each
- 1 NJ Transit Cab Car = 139,250 lbs. Each

These weights are based on empty equipment (no passengers) and result in a total weight of 1,766,600 lbs. for the full trainset.

The speeds used to calculate the kinetic energy to be absorbed by the columns are the restricted speeds as given in the operating agencies' timetables: for most tracks the restricted speed is 5 MPH, but there are some tracks with a restricted speed of 15 MPH. Columns will be designed based on the restricted speed of the adjacent track.

For the **High-Speed Area**, which is comprised of all Mainline tracks with speeds of 60 MPH, crash walls will be utilized as described in AREMA Section 2.1.5 PIER PROTECTION. It should be noted, as stated in AREMA, that it is not the intent of crash walls to "resist the full impact of a direct collision by a loaded train at high speed. Rather, the intent is to reduce the damage caused by shifted loads or derailed equipment. This is accomplished by: deflecting or redirecting the force from the pier; providing a smooth face; providing a resisting mass; and distributing the collision forces over several columns."

d. Geotechnical

Historic and Geologic Maps

Historic maps show the original course of the Dutch Kill and a tidal marsh covering central area the rail yard west (between Van Dam and Queens Streets); this general area was largely undeveloped prior to the rail yard construction in the early 1900s, but a street grid was in-place prior to rail yard construction. Bedrock geology maps indicate the site is underlain by the Hartland formation, consisting primarily of schist, gneiss, and amphibolite at depths typically varying from about 40 to greater than 100 feet. (See Appendix A.5.F for Geologic Maps).

General Subsurface Profile

Available historic data suggests that the subsurface conditions are represented by two generalized soil profiles covering the east and west parts of the site, divided approximately at Honeywell Street. The depth to bedrock (NYCBC Class 1c or better) is highly variable across the site, but generally increases to the east. The areal extent of these soil profiles has not been defined by test boring or other data, rather it was inferred from historic maps; therefore, the extents and properties should be considered very conceptual. Additional data and investigation will be required to better define soil types, properties, and extents.

West – This area is generally defined by the former Dutch Kill and tidal marsh. It roughly extends from the western throat of the rail yard to about Honeywell Avenue. Soils in this area are generally characterized as fill underlain by loose to medium sand and silt, soft to stiff clay (including some varved silt and clay), a discontinuous layer of peat and organic silt. Layers of glacial till and/or decomposed rock generally sit atop bedrock, the top of which varies from about el -10 to deeper than el -80. Boulders or cobbles were reported in several boring locations. Groundwater was reported between el +7 and el 0 in this part of the rail yard.

East – This area represents the rail yard east of the Dutch Kill and tidal marsh. It generally extends from Honeywell Avenue to the east end of the yard. Note test boring data was not provided for the majority of this area. Soils in this area can generally be characterized as fill underlain by loose to medium sands followed by dense glacial till. Boulders or cobbles, and pockets of dense silt or hard clay were reported in several borings. Decomposed rock sits above bedrock, the top of which varies from about elevation 45 to deeper than elevation -80. Groundwater was encountered between el 14 and el 16 in this part of the rail yard.

Preliminary Foundation Discussion

The overbuild will have column service loads on the order of about 700 to 6,000 kips for plaza or low-rise structures, about 4,000 to 31,000 kips for residential or office towers, and up to about 37,000 kips at long-span trusses. The relatively high loads, the generally poor subsurface conditions, and the very crowded rail yard make foundation design and construction challenging. The high loads and poor soil would typically result in excessive settlement if shallow footings and mat foundations are used. Further, if footings and mat can be justified, the construction of these large elements would require removal and replacement of large sections of tracks and utilities in the yards. High capacity, deep foundations that can be installed between tracks or with limited track and utility disturbance are more appropriate.

Drilled shafts are considered a viable option for support the proposed overbuild. Drilled shafts can be designed in numerous diameters (18- to 96-inch diameter or more) to fit a variety of locations and can provide significant individual capacity. Given the highly variable depths to competent bedrock, drilled shafts may be supported by rock (i.e. caissons) in some areas and by soil in other areas; caissons will provide much higher capacity than drilled shafts in soil.

As an alternate to drilled shafts, barrettes – large rectangular-shaped deep foundations – could be useful in some areas. Barrettes are typically on the order of 3 feet wide by 8 to 12 feet long and can provide very high axial and lateral capacities. The barrettes would likely be end-bear on rock or be socketed a modest depth into rock.

While shallow foundations are likely not feasible for the majority of the overbuild, in areas with lightly loaded columns, or where new buildings and structures will be built under and independent of the platform, shallow foundations may be appropriate.

Seismic design considerations will impact the overbuild design. The variable soil conditions and depth to rock will result in different seismic demands and design criteria. For preliminary planning we recommend assuming the west soil profile area be considered Site Class E and the east soil profile area be considered Site Class D. A detailed site specific seismic study will be required for final design. The study must be performed to adequately define design parameters for different soil conditions and for different platform areas defined by expansion joints.

Preliminary Foundation Options

Rock socketed caissons are feasible where bedrock is within about 150 feet of the surface; caissons are possible where rock is deeper however equipment becomes more specialized and the number of contractor able to perform the work becomes more limited. Designers can plan for 13,000 to 30,000 axial kips per pile for diameters of 48 to 96 inches, respectively assuming Class 1b rock or better with a 30-foot long rock socket. Caissons are typically designed using a presumptive side shear of 200 psi in compress and 100 psi in tension. However, given the significant number of caissons required for the overbuild we recommend performing design-phase load tests to evaluate the potential for achieving a higher side shear value; and side shear value of 300 to 350 psi may be possible for high quality bedrock and could significantly reduce the length of rock sockets.

If rock is very deep, soil-socket drilled shafts can be considered. Capacities will be impacted by the soil types present at these locations. We considered soil consisting of denser glacial till (east), weaker sands, silts and clays (west), and a mixed soil profile for shaft diameters ranging from 48 to 96 inches. The range of axial capacities for 100-foot and 150-long drilled shafts is summarized in Table 1 below.

Table 1 – Axial Capacities for Drilled Shafts						
Drilled Shaft	48-inch (kips/pile)		72-inch (kips/pile)		96-inch (kips/pile)	
Length	100 ft	150 ft	100 ft	150 ft	100 ft	150 ft
Denser Glacial Till	1,800	2,500	3,000	4,300	4,500	6,000
Mixed Soil Profile	1,600	2,400	2,800	3,800	4,000	5,400
Weaker Soils	1,200	1,800	1,900	2,800	2,700	3,900
Caissons (for 30-ft Rock Socket)	13,000		21,000		30,000	

Barrettes, although currently unavailable in the region, can provide greater lateral load resistance than drilled shafts of similar cross-sectional area. They can also provide a significant bearing area and corresponding high axial load resistance. They are constructed similar to a slurry wall, using clamshell or hydromill excavation equipment and bentonite slurry. Barrettes would extend to bedrock and can be arranged in linear rows or in I, T or X configurations to obtain required axial and lateral capacities. Axial capacity of about 2,800 to 4,300 kips are likely feasible for 8' to 12' long barettes bearing on Class 1a rock.

Shallow foundations may also be feasible for lightly loaded columns, or for low rise ancillary buildings and utilities in the yard areas within soil profiles dominated by denser glacial till with an axial capacity of about 3 tons per square foot.

Foundation Construction Considerations

The original feasibility study noted that track removal and replacement may be required for foundation construction (drilled shafts and pile caps), and that new foundations may extend beneath the tracks. Clear space between the existing tracks varies from about 4 to 21 feet with ballast and asphalt surface covers. Four feet clearance will limit the size shaft that can be constructed to about three foot diameter (about 7,000 to 8,000 kip maximum caisson load). In these areas track removal will likely be required, or numerous smaller diameter shafts will be needed (with lower axial and lateral capacity). In tight spacing areas where higher loads are required, barrettes may be more viable.

We expect that the railroads will require the new foundations be isolated from the track bed. This is to prevent the transfer of load or the movement of rails as a result of overbuild lateral loads. On similar projects a track isolation casing was used. The isolation casing is slightly larger than the drilled shaft casing and provides an annulus for the caisson to move without imparting load to the track bed. For barrettes, a means of isolating the barrette from the track bed, or demonstrating only a nominal movement under load will be required.

There are several MTA-LIRR tunnels passing below the rail yard and a City Water Tunnel No. 2 runs below the rail yard along 39th Street. The Queens-Midtown Tunnel and the 7-Line subway begin running underground west of the overbuild area near the throat of rail yard and the E-, F-, M- and R-Lines run north of the site beneath Northern Boulevard. New foundations will be required to transfer loads below the tunnels such that the tunnels do not experience any increased stress. This is typically accomplished using a secondary casing as a bond breaker above a theoretical influence line (typically 1H:1V or 1.5H:1V) extending upwards from the tunnel to eliminate and load transfer above the line. The specific requirements for bond breakers will be dictated by the railroad and must be evaluated based on actual foundation layout and loading. Advanced modeling will likely be required to justify the bond breaker and to justify any requested variation from the railroads requested influence line.

Constructing foundations for a large overbuild requires significant equipment occupying a rather large footprint. The actual equipment performing the work, material handling equipment, spoils management, slurry tanks, and general operations require adequate room to safely perform the work. A specific minimum track outage plan must be agreed to by the various agencies as part of any RFP to developers. Without agreed to minimum track outages the responders will not be able to develop construction schedules or budgets.

Numerous buried utilities and the overhead catenary power system will complicate construction and will require close coordination to relocate utilities during construction.

All intrusive work (such as excavation and drilling) will need to comply with environmental requirements as defined by site-specific consent orders and general New York State Department of Environmental Conservation regulations. This will mostly focus on proper worker health and safety and on soil and groundwater handling and disposal.

e. Civil / Utilities

Interaction between structure and existing utilities is largely unavoidable. Water and gas mains, telecommunication conduits, electrical duct banks, transformers and vaults, oil lines, and sanitary and combined sewers are present throughout Sunnyside Yard. Some amount of relocation should be expected, particularly of minor distribution lines or services. An evaluation of conflicts by zone is presented in Table 2 below and in Appendix A.5.G. This evaluation should not be considered comprehensive, and is intended to highlight utilities that are or may be of high importance or difficult to relocate. Figures 1 to 4 in Appendix A.5.G illustrate areas with high utility concentration in Zone 1, Zone 2, and Zone 6.

References for the existing utility evaluation include Amtrak Master Plan existing utility plan files and SSY Feasibility Study existing utility base maps. AT&T telecommunication plates and Con Edison electric and gas plates for the project area have been retrieved, and are being used as a reference for base map development. Water and sewer records have been requested from the NYC DEP, and will be released pending resolution of protocols and permissions related to preparation of work product derived from sensitive records.

Table 2 – Existing Utilities

Zone	Utility Considerations
Zone 1(LIRR Mid day storage yard/MTA owned)	A network of 8-inch storm drain lines run parallel to tracks, and ultimately drain to larger storm sewers (18-inch to 48-inch) that outfall to the Dutch Kill. According to available records, there is a 4-ft x 8-ft combined sewer that drains to the north, out of SSY. This sewer is over 100-years old and its condition is not known. Refer to Appendix A.5.G, Figure 1.
Zone 2 (Amtrak HSR Facility)	An 18-inch combined sewer, a 24-inch combined sewer, and a 21-inch storm sewer drain to the north, out of SSY. There is a utility trench parallel to the southern limit of the HSR Facility building. There is a utility trench running perpendicular to the HSR Facility building which houses large telecom and electrical conduit banks and which extends into Zone 4 and Zone 5. Refer to Appendix A.5.G, Figure 2.

Table 2 – Existing Utilities (continued)	
Zone 3 (Amtrak/NJ Transit Off Peak Storage	A utility tunnel traverses part of Zones 3, 4, and 5. Records detailing the size and type of utilities housed in the utility tunnel are not available. Two 42-inch combined sewers cross Zone 3 perpendicular to the tracks, draining to the north. Several smaller storm sewers cross Zone 3, but drainage structures within the bowl tracks are not shown in available records.
Zone 4 (Amtrak S&I Facilities and Storage)	An 8-inch combined sewer connection from the Running Repair building drains to an 18-inch combined sewer via force main. The 18-inch combined sewer drains through Zone 2 to the north. A vacuum sewer network runs parallel to the tracks, with a vacuum station for the system located near the southern limit of Zone 4, to the east of Honeywell Street. A utility tunnel traverses part of Zones 3, 4, and 5. Records detailing the size and type of utilities housed in the utility tunnel are not available. A separate tunnel housing electrical duct banks and compressed air service crosses into Zone 3 from the southwestern extent of Zone 4.
Zone 5 (Amtrak Maintenance Facilities)	An 8-inch gas main crosses through Zone 5 before servicing the Running Repair and Commissary buildings in Zone 4. A 21-inch storm sewer passes through Zone 5 and drains to the north.
Zone 6 (Amtrak MOW Yard)	An electrical substation is located in the southwestern part of Zone 6, west of 39th Street. Duct banks within Zone 6 connect the substation to the area surrounding the Frequency Convertor building and adjacent transformer field, located in the eastern part of Zone 6. Several drainage structures and a sanitary sewer neat the Frequency Convertor building connect to a 21-inch combined sewer which crosses into Zone 5 and Zone 2 to the north. A 12-inch water main within the 39th Street bridge is the DEP water service point for Amtrak. A 12-inch gas main within the 39th Street bridge is the Con Ed gas service point for Amtrak. Water and gas metering are both located in Zone 6, to the east of the electrical substation and to the west of 39th Street. Refer to Appendix A.5.G, Figure 3 and Figure 4.
Zone 7 (Amtrak/LIRR Mainline)	The mainline tracks cross over several sewers, ranging from 12-inch to 42-inch diameter. A 12KV electrical duct bank runs along the northern limit of Zone 7, at one point crossing under several of the mainline tracks. Four transformers are located to the north of the mainline tracks near Honeywell Street.
Zone 8 (Loop Tracks)	Site storm and sanitary sewers drain east to west, traversing from Zone 8 to Zone 7 and under the mainline tracks via 42-inch combined sewer. Overhead telecommunications lines skirt the southern limit of Zone 8. A utility corridor servicing Zone 9 crosses Zone 8 near the eastern limit of SSY
Zone 9 (GM Facility)	There is a known pump station for the sewer system, and several drainage structures have been surveyed around the existing building. A utility corridor servicing Zone 9 crosses Zone 8 near the eastern limit of SSY

The existing utility and drainage infrastructure within SSY is assumed to be sufficient for current yard operations. Electrical demand for operations below deck will increase in the overbuild condition when considering lighting and ventilation requirements. Loading on sewers from below deck activities will decrease with increased shelter from rainfall.

Restoration and relocation of track-level roadways, walkways, fencing, gates, and similar structures that are disturbed or obstructed by platform construction will be constructed to provide track, vehicle, and pedestrian access required to serve operations in and around the new-building facilities. Pavements and walkways will be designed to support heavy industrial loading and track vehicle equipment. Geometric alignment of the access roads will be designed to accommodate turning movements for the appropriate design vehicles.

Water, gas, electric, and telecommunication utility services for development above the deck will likely be routed from surrounding infrastructure on terra firma. Sanitary and combined sewers will drain to NYC DEP sewers around SSY. Upgrades to existing NYC DEP sewers accepting increased loading from development is likely to be needed. Stormwater discharge to new or existing below deck sewers may prove an effective way of limiting demand on the Bowery Bay Wastewater Treatment Plant by draining part of deck and development runoff to outfalls in the Dutch Kill..

f. Environmental

Much of Sunnyside Yard falls within the NYS DEC State Superfund Site #241006. The site was divided into six Operable Units (OU-#), each of which received its own Record of Decision (ROD) from NYS DEC, detailing the results of remedial investigations and the remedial method selection process. The Operable Units can be summarized as:

- OU-1: Soil above groundwater in footprint of HSTF
- OU-2: Soil above groundwater in area adjacent to HSTF
- OU-3: Soil above groundwater in NE of site with separate-phase petroleum hydrocarbons (SPH)
- OU-4: Soil above groundwater in the remainder of the site
- OU-5: Sewer system beneath the site
- OU-6: Groundwater and soil vapor

OU-1, OU-2, and OU-6 have undergone remedial measures and there is no currently required further action, although there is an environmental easement associated with OU-6. OU-3, OU-4, and OU-5 have ongoing remedial action. Overbuild may impact the Site Management Plans associated with the Operable Units with ongoing remedial action, and may require modification of the environmental easement associated with OU-6.

Due to the site’s environmental history, should the development of SSY require public discretionary action through ULURP, the site will likely be given an E designation and will require New York City Mayor’s Office of Environmental Remediation (OER) oversight to satisfy regulatory requirements. If the site does not require a discretionary action, modifications to the exiting Site Management Plans or additional remedial activities will likely be required by the New York State Department of Environmental Conservation.

Overlap of Operable Units and Zones is presented in Table 3. Zone 1 is not included in the NYS DEC State Superfund Site. Zone 2 overlaps with all Operable Units. The remainder of the Yards overlaps with OU-4 and OU-6. OU-5, the sewer system beneath the Yards with known PCB contamination, overlaps with Zones 3, 4, 5, 7, and 9.

References include NYS DEC easement documents provided by NYC EDC and Amtrak in July, 2018.

Table 3 – Existing Environmental Conditions	
Zone	**Environmental Considerations**
Zone 1(LIRR Mid day storage yard/MTA owned)	Not included in NYSDEC State Superfund Site #241006. Availability of previous studies unknown. There are likely contaminants present given proximity to and similar use to Amtrak SSY
Zone 2 (Amtrak HSR Facility)	Overlaps with all 6 OUs. 2. OU-3, OU-4, and OU-5 have ongoing remedial action, and there is an environmental easement associated with OU-6
Zone 3 (Amtrak/NJ Transit Off Peak Storage	Overlaps with OU-4, OU-5, and OU-6. OU-4 and OU-5 have ongoing remedial action, and there is an environmental easement associated with OU-6
Zone 4 (Amtrak S&I Facilities and Storage)	
Zone 5 (Amtrak Maintenance Facilities)	
Zone 6 (Amtrak MOW Yard)	Overlaps with OU-4 and OU-6. OU-4 has ongoing remedial action, and there is an environmental easement associated with OU-6
Zone 7 (Amtrak/LIRR Mainline)	Overlaps with OU-4, OU-5, and OU-6. OU-4 and OU-5 have ongoing remedial action, and there is an environmental easement associated with OU-6
Zone 8 (Loop Tracks)	
Zone 9 (GM Facility)	Overlaps with OU-4 and OU-6. OU-4 has ongoing remedial action, and there is an environmental easement associated with OU-6

III. Structural Span Evaluation

Based on the horizontal clearance requirements and dynamic envelope analysis discussed in *Section II.a.* and the proposed underground structures and utilities discussed in *Section II.e.*, a diagram was developed to determine the zones on the site where structure can be placed. These zones were separated into two categories – areas where the minimum physical clearance between centerline of track to face of column was met (8'-6" or minimum dimension from a dynamic envelope analysis) and areas where the minimum constructability clearance between centerline of track to face of column was met (16-0"), see Figure 3 below. The minimum constructability clearance would allow work to occur with a partial height barrier in place between the work zone and tracks with minimal disruption to the adjacent track services. Refer to Appendix A.5.H showing column clearance zones across the site.

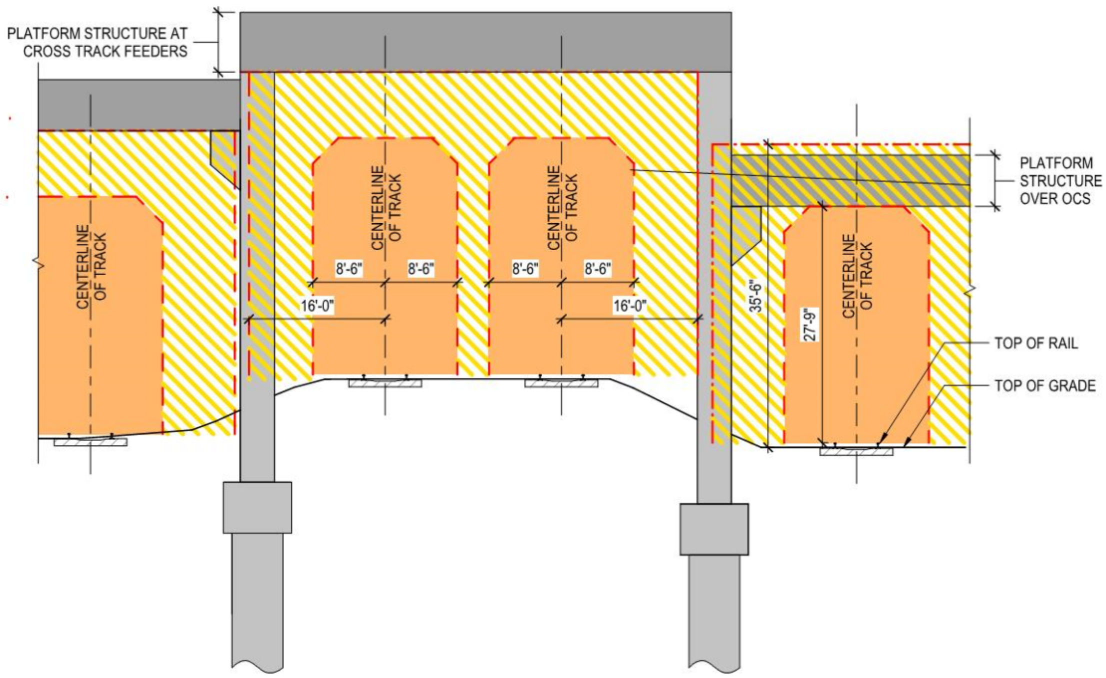


Figure 3 - Clearance Diagram

Zone 1 though 6 – LIRR Mid-day Storage & Amtrak Maintenance and Storage

The strategy in Zone 1 through 6 is to place columns where possible such that the face of column is greater than 16'-0" from the centerline of track. Where that is not possible, the columns should be placed as far from the tracks as possible but no closer than 8'-6" from the centerline of track. Based on this strategy, east-west structural zones were identified as the primary lines of structures. North-South grids were located at approximately 30'-0" o.c. in the direction that would minimize the structural spans. Across these zones, approximately 98% of the site area can be decked over using structural spans under 200 feet, with approximately 90% of the spans under 140 feet. Refer to Table 4 below.

Zone 7 – Amtrak / LIRR Mainline

At Zone 7, in order to minimize disruption to services in the adjacent tracks, the main strategy is to maximize placing columns in the zones where 16'-0" clearance from centerline of track to face of column could be achieved. However, there are certain areas within Zone 7 where columns may be required such that the column clearance to track is less than 16'-0". This occurs in areas that are significantly constrained and would result in spans much greater than 200 ft. These columns will need to be investigated with Amtrak and LIRR to understand the impact to operations. Based on this criteria, this results in approximately 50% of the zones requiring spans greater than 140’-0” with 20% of the spans greater than 200 feet.

Zone 8 - Loop Tracks

At Zone 8, the columns adjacent to the loop tracks can typically be placed in zones where 16’-0” clearance can be achieved. This includes a 40 to 60 foot strip of terra firma adjacent to Skillman Ave. In this zone, 90% of the spans are achieved by spans under 120 feet.

Structural Span Summary

A summary of the Structural Spans were broken down by zone in Table 4.

Table 4 – Structural Span Lengths - Percentage by Zone

Span Range (ft)	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Zone 9
0 To 30	1%	1%	0%	0%	0%	1%	1%	1%	4%
30 To 40	5%	1%	1%	2%	1%	3%	3%	3%	3%
40 To 50	9%	4%	2%	10%	13%	7%	4%	8%	28%
50 To 70	27%	43%	3%	30%	1%	16%	10%	26%	66%
70 To 90	30%	8%	46%	23%	4%	31%	10%	22%	0%
90 To 100	11%	4%	3%	2%	24%	17%	2%	6%	0%
100 To 120	12%	14%	14%	1%	32%	14%	13%	26%	0%
120 To 140	4%	19%	13%	3%	5%	3%	6%	6%	0%
140 To 160	1%	7%	5%	5%	5%	1%	9%	2%	0%
160 To 180	0%	0%	5%	6%	7%	5%	4%	1%	0%
180 To 200	0%	0%	3%	8%	3%	1%	19%	1%	0%
200 To 450	0%	0%	3%	8%	4%	2%	19%	0%	0%

Refer to Appendix A.5.I for an overall plan showing heat maps of different structural spans across the site.

IV. Edge Conditions

An important aspect of designing the overbuild deck is to analyze how the deck can be accessed from all of the major streets and bridges. The goal is to optimize accessibility and to connect the portion of Queens north of the site with the portion of Queens south of the site as well as providing access from each of the bridges that cross the site. Refer to Appendix A.5.J for typical existing edge conditions along Northern Blvd, Skillman Avenue and the NYCDOT Bridges

Northern Boulevard

Along Northern Boulevard, the sidewalk elevation remains relatively flat across the site, ranging approximately from Elevation 10’-0” to 20’-0” NAVD88. The existing top of rail is set almost in line with the elevation at the sidewalk. Because the top of rail elevation is so close to the sidewalk elevation, this will create challenges for access to the overbuild deck. Also in some areas, such as Zone 1, the first set of tracks is directly adjacent to the property line which does not allow space for structure. If this area is to be decked, it would result in a deep structural solution that sits high above the sidewalk elevations. Creative solutions will have to be developed in order to find ways to deal with these transitions.

Skillman Avenue

The sidewalk elevation along Skillman Avenue sits at approximately Elevation 30'-0 NAVD88 near Thomson Avenue and grades up to approximately Elevation 70'-0" near 39th Street. The gradual slope up occurs over 3500 feet. It was determined that a set of along-track feeders runs adjacent to the first set of tracks in Zone 8 . Due to the along track feeders, the first structural span over tracks along the south side of the site requires the maximum clearance of 35'-6" to bottom of structure. The gradual slope combined with a 40'-0" to 60'-0" strip of terra firma adjacent to Skillman allows for a transitional zone to negotiate the elevation difference between the sidewalk and the higher elevations required at the deck due to the along track feeders. The platform can either slope up or be transitioned using the architecture and landscaping.

NYCDOT Bridges

The NYCDOT Bridges which cover the site, are along Thomson Avenue, Queens Boulevard, Honeywell, and 39th Street. At the existing conditions for each of these bridges, the current clearance between top of rail and the bottom of the bridge structure are well below the minimum clearances that are being held across the site for the deck design. This results in a significant range of differential elevations between the first span of structure adjacent to the bridges and the top of the bridge elevations. In order to address the difference in elevations, we anticipate that a vertical clearance variance will need to be applied to Amtrak and LIRR in order to provide a transitional zone in which the structure can be lower than the typical minimum clearance. At the existing conditions, the worst case clearances based on the existing NYCDOT bridge drawings below the bridges are as follows:

Table 5 - Existing Clearances at NYCDOT Bridges

Bridge	Approx. Lowest Clearance
Thomson Avenue	17'-1"
Queens Blvd	16'-2"
Honeywell	16'-7"
39th Street	19'-0"

During the concept design, several sections will be studied across each of the bridges in order to determine the variances required and the extents in plan of the transitional zones. As part of this study, several different criteria will be considered. The goal will be to ensure that the bottom of the platform deck is not lower than the existing low point at each bridge. The top of deck will be steeped up in order to achieve the minimum LIRR and Amtrak criteria as quickly as possible, however stepping of the top side of the deck will be limited to a slope of 1:20 for pedestrian and car access. In order to maximize flexibility for access from the bridge, it will be also assumed that the first 60 feet of deck adjacent to the bridge will remain flat. Studies will also be performed to understand the impact of the deck to the existing catenary contact and messenger wires.

In order to achieve this criteria, several strategies will be studied. Alternate structural solutions will be looked at to achieve a thinner structural deck including closer spacing framing and additional columns. Reduced loading and openings in the deck may also need to be considered in order to achieve a thinner structural solution.

V. Structural Matrix

Steel and precast concrete options were investigated for the structure of the overbuild deck over the LIRR and Amtrak rail yards below. Based on a review with the design team, a baseline loading scenario was determined in order to provide a high level of flexibility. This loading scenario consists of the following loading:

Superimposed Dead Load =	600 psf Build-up or Equivalent Building Load
	30 psf Hung Mechanical Below (Support of Rail Yards)
Live Load =	300 psf Equivalent Roadway Loading

This loading would allow for up to 4 feet of soil build-up for landscaping or build-up to negotiate differential grading elevations with access for either pedestrians or vehicles. Alternatively, this loading scenario is equivalent to a high density of low-rise buildings consisting of either 10-story lightweight wood construction residential buildings or 5 story flat plate concrete residential buildings. This would also allow for 7-story steel office buildings or 5-story steel retail buildings. See Figure 4 below.

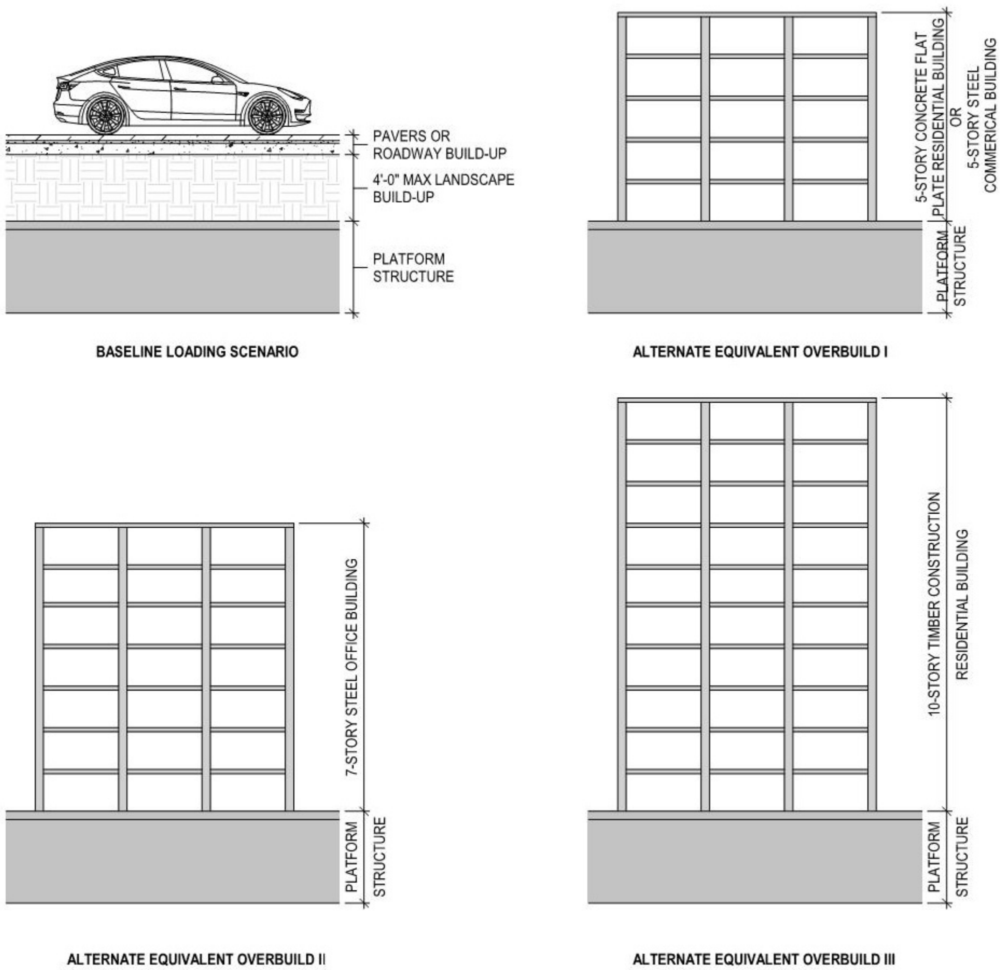


Figure 4 - Baseline Loading Scenario

The following solutions described is consistent with the loading requirements in the baseline load scenario. However, there are some challenging areas on the site where the spans greatly exceed 200 ft. These areas occur where the tracks merge due to switching or where the ESA underground tunnels reduce the available space for structure to land. At these conditions, large transfers ranging from 20 to 40 feet deep may be required and will need to be coordinated with any building or landscape planned above. In order to support the deeper long span structure, 36"x36" to 48"x48" solid mega columns will be required. See Figure 5 below.

These areas will need to be further studied between Thornton Tomasetti and HNTB to determine if additional columns could be added by adjusting future proposed track layouts to accommodate these structural elements. Another option would be to build into the design criteria a much lighter loading in these areas to reduce the structure required or plan for open areas in the deck.

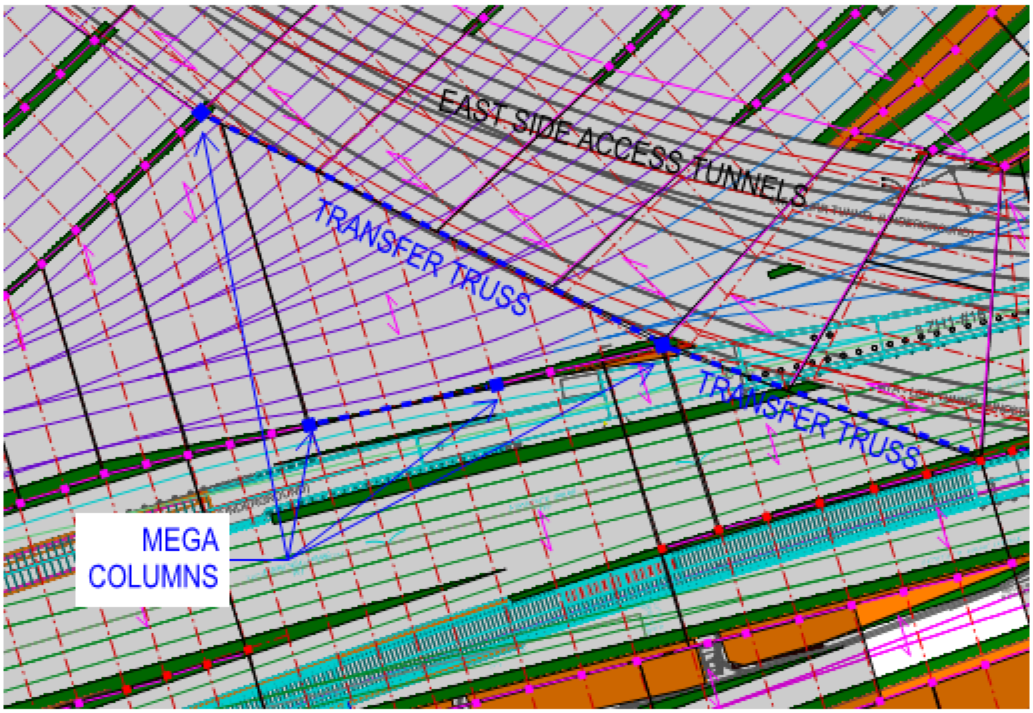


Figure 5 – Long Span Areas next to East Side Access

In addition to the baseline loading scenario, studies of less dense but taller buildings has been reviewed in parallel with the larger design scheme to analyze the structure required. For mid-rise buildings from 5 to 15 stories, upgrading the deck structure is possible, however there may be tradeoffs to decking large areas for the increased flexibility, including costs and constructability. For high-rise buildings from 15 to 40 stories, 2 to 3 story steel transfer structures may be required in the future buildings to transfer the building grids onto the platform columns. These structural solutions are further illustrated in the Potential Early Investments design when the building typologies are set.

Precast Concrete Structural Solution

A precast concrete structural solution would consist of cast-in-place concrete columns and cast-in-place pier caps parallel to the tracks. Precast shells can be used as forms in order to save time constructing the columns and beams. The deck spanning between girders would consist of precast structure varying in type from hollow-core plank, bulb tees, precast NEXT beams, concrete box girders and concrete segmental girders depending on the structural spans. In all scenarios, a final topping slab would be cast to tie the structure together and provide a solid diaphragm.

Figure 6 - Hollow Core Precast Plank

Figure 7 – Precast NEXT Beams

Figure 8- Precast Bulb Tee

Figure 9 - Precast Concrete Segmental Girder

Figure 10 - Precast Concrete Box Girder

Steel Structural Solution

A steel structural solution would consist of steel column and girders parallel to the tracks. The deck would consist of steel members varying in type from traditional wide flange shapes, built-up plate girders to single and double trusses. The first level of deck above the tracks would consist of 18” to 21” deep precast hollow core planks spanning 25’-0” to 30’-0” parallel to the track with a final topping slab to tie the structure together. The precast concrete planks would be used for the first layer of deck above the tracks in order to quickly cover the tracks and provide a protected working space. The second level of deck can be either precast concrete planks plus topping or slab on metal deck.

Figure 11 - Standard Rolled WF Beam + Precast Plank

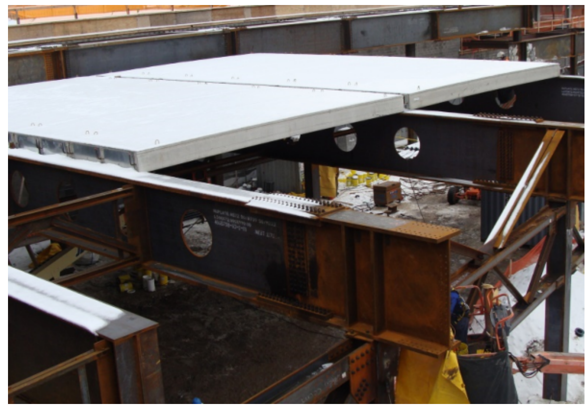


Figure 12- Plate Girder + Precast Plank

Figure 13 - Truss and Plank

Figure 14 - Double Truss

Precast Concrete vs Steel

In both the steel and precast concrete scenario, for spans greater than 90 feet, the structure would allow for space within the superstructure to run mechanical services or to create occupied space for storage where the depth is sufficient. In the precast concrete solution, this opportunity is available when concrete box girders or concrete segmental girders are used. In the steel solution, at deep plate girders and at the single and double truss solutions, 2 levels of decking can be provided at the top and bottom flanges or at the top and bottom chords of the truss, in order to create this space.

The advantage of a precast concrete deck is that precast elements can be set quickly. In the precast concrete scenario, the precast deck is also the main North-South structural span whereas in the steel scenario, the steel structure spans the main North-South direction with shallow precast concrete planks spanning the shorter East-West direction. This would result in less crane picks for the precast solution. Also, being able to set the planks quickly is advantageous as it immediately provides a working surface for the overbuild above and protection for the tracks below. It could also potentially lead to less track closures. In some cases the precast concrete solution also results in thinner structural depths which is beneficial to the top of structure transitions within the deck and at edge conditions to Skillman Ave, Northern Blvd and the NYCDOT Bridges.

The advantage of the steel solution is that steel is lighter than the long span precast concrete elements. This provides advantages in terms of constructability as smaller cranes can be used. This may also lead to opportunities to allow staging to occur off of the existing NYCDOT bridges. In comparison, the precast structures will require bigger cranes and potentially more double crane scenarios in order to lift the longer spans. The crane loads will also likely be too high to stage off of the NYCDOT bridges.

Refer to Appendix A.5.K for a Structural Matrix Chart showing different precast and steel solutions depending on the structural spans.

Lateral Loading

In addition to gravity loading (self-weight, superimposed dead load, live load, snow load) the platform must also support lateral loading from wind, earthquakes and thermal expansion and contraction.

Wind loads are dependent on the site location and wind speed as well as the overbuild height and density. Because the actual program and build out are still unknown, a sensitivity analysis was performed varying the building heights from 5 to 70 stories (60 ft – 710 ft) and development densities ranging from a FAR of 2.5 to 5.0 (FAR based on gross decked area). Table 6 provides a summary of the wind sensitivity analysis to building height and density.

Wind loads were analyzed using the New York City Building Code 2014 using a 98 mph 3 second wind gust. The code provides an opportunity to reduce wind forces by up to 20% when code based loading is shown to be conservative by a wind tunnel study. Ultimately a wind tunnel study will be required for the site taking into account the master plan zoning. Depending on the platforms structural lateral system wind may not be the controlling load case, so the reduction in loading may not influence the design.

Table 6 – Wind Sensitivity Analysis – Base Shear *(psf)*

Story	Height *(ft)*	FAR					
		2.5	3.0	3.5	4.0	4.5	5.0
5	60	5.5	6.6	7.7	8.9	10.0	11.1
10	110	5.7	6.8	8.0	9.1	10.2	11.4
30	310	6.6	7.9	9.2	10.5	11.9	13.2
50	510	9.0	10.8	12.6	14.4	16.1	17.9
70	710	10.1	12.1	14.1	16.1	18.1	20.1

Seismic loads are determined by several factors including site location, site class, importance factors, and structure type. Table 7 provides the design factors used to determine seismic loading.

Table 7 – Seismic Design Factors

Short Period Acceleration – S_S	0.281[1]
Long Period Acceleration – S_1	0.073[1]
Site Class	D, E[2]
Importance Factor – I_E	1.25
Response Modification Factor – R	3.0

[1] Short and Long Period Acceleration per ASCE-07. Site specific values strongly recommended.

[2] See Langan Geotechnical Memorandum for locations of site classes D and E

Seismic Loading in general decreases as building height increases, but increases with mass. It was found that the "Base Build" condition, where the platform is constructed with either plaza loading or 5 story buildings created the highest seismic loading of 108.2 psf of base shear, approximately five times higher than the highest wind loading base shear. Therefore in almost all cases the seismic loading on the overbuild platform will control the lateral loading regardless of the overbuild condition unless the platform can be seismically isolated (see section on base isolation).

Thermal changes of the structure when restrained can result in substantial forces and stresses in the structure. It will be critical to divide the platform into isolated regions with expansion joints to allow the structure to freely expand and contract. The following are the recommended thermal changes based on ambient fabricated and erection temperature of 60° F.

During Construction: +/- 60°F (0°F to 120° F)

After Completion: +/- 40°F (20°F to 100° F)

The structure will be susceptible to the highest temperature swings during construction when steel and concrete are exposed directly to the elements and no thermal mass from the overbuild is available to limit temperature variations. The structural isolation joints will be designed to allow the construction movement, while the finished expansion joints will be designed to allow movement of the completed structure. Expansion joints must also account for both seismic and wind movements; it is estimated joints will need to allow for approximately 6 in to 8 in of movement at the platform level.

Best practice is to provide isolation joints approximately 300 ft to 600 ft on center. Joints will be aligned to major column lines below deck. Ideally isolation joints can also align to fixed elements above the deck like roadway curbs minimizing their appearance and interference with future overbuild. Figure 15 below provides a proposed layout of Sector B expansion joints.

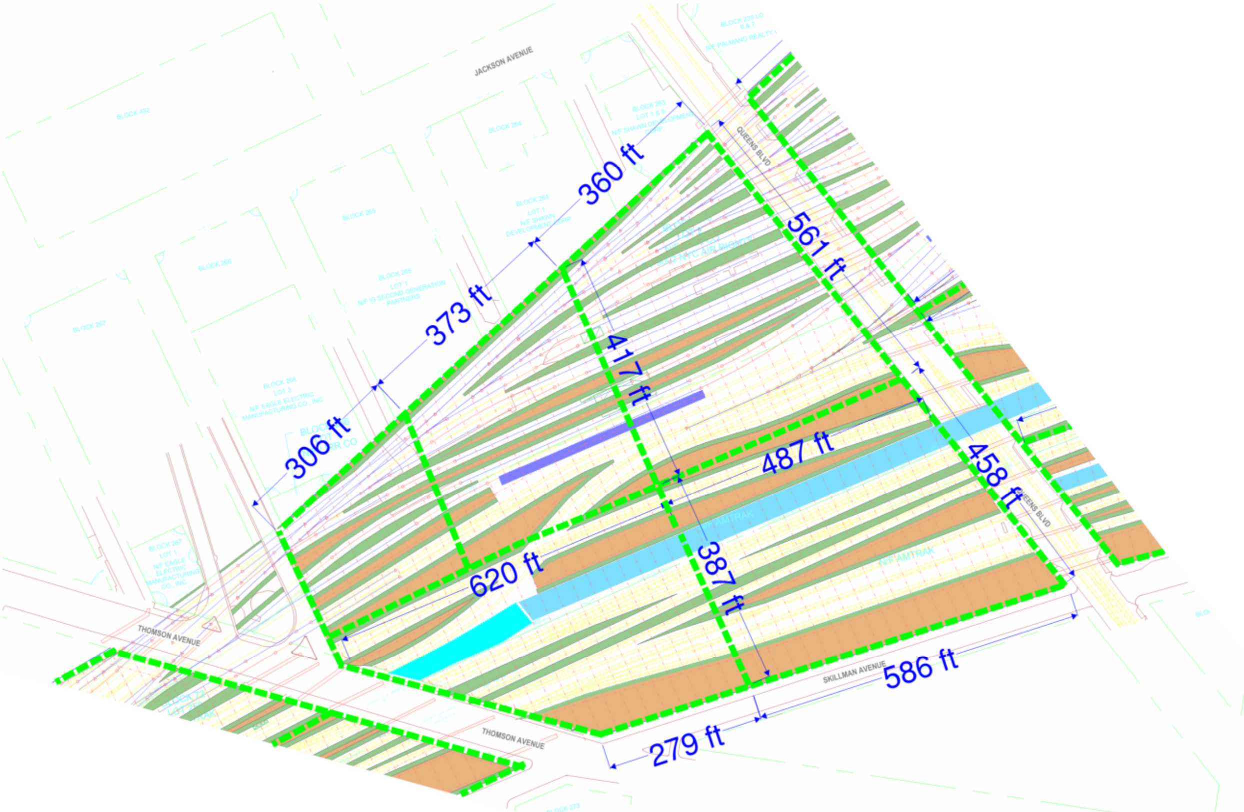


Figure 15 – Proposed Isolation Joints Sector - B

Lateral Design

The lateral design and lateral loading will be an iterative process with each informing the other. In most cases unless base isolation is adopted for the project, seismic design will govern the lateral design. To simplify the lateral design, cost for the platform and provide the most versatility for the design of the overbuild, it is recommended to use a response modification factor of 3.

The structure supporting the platform will be a combination of columns and walls most likely using reinforced concrete for durability, fire protection and crash wall requirements, though steel options have also been provided for pricing. Columns would be placed between tracks at approximately 25 ft to 30 ft on center as described previously. Columns would sit on caisson or pile caps as outlined in Section II - geotechnical report. Columns would be linked together at their tops parallel to the track by pier caps, see Figure 16.

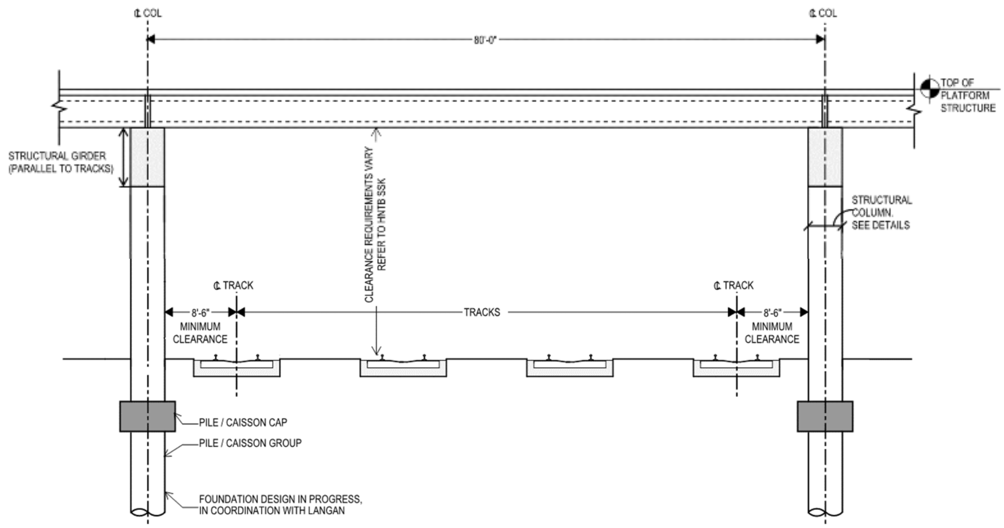


Figure 16 – Proposed structural cross section

Lateral loads parallel to the track would be resolved by the concrete shear walls between the tracks or by moment frames created by the columns and pier caps running parallel to the tracks.

Perpendicular to the track there are three options to resolve the lateral loads. Each option has benefits and draw back as outlined in Table 8.

Table 8 – Lateral Framing Design Options

Option A – Fixed Column Base / Fixed Column Top	
Pros	Provides highest stiffness, reduced column sizes, smallest expansion joints
Cons	Larger foundation elements, more robust column connections
Option B – Pinned Column Base / Fixed Column Top	
Pros	Reduced foundation elements
Cons	Larger columns sizes
Option C – Fixed Column Base / Free Column Top	
Pros	Lightest and simplest structure
Cons	Base isolation initial cost and maintenance, Largest expansion joints

For a baseline structural concept Option B has been chosen to resist lateral loading perpendicular to the track. Option B would be the most typical construction typology though other options should be simultaneously reviewed as there may be substantial initial cost savings for the structure and foundations. Typical column sizes for Option B would be 36 to 48 inches square in concrete or 20 to 36 inches square built out of 2 to 4 inch thick steel plates, see Figure 17.

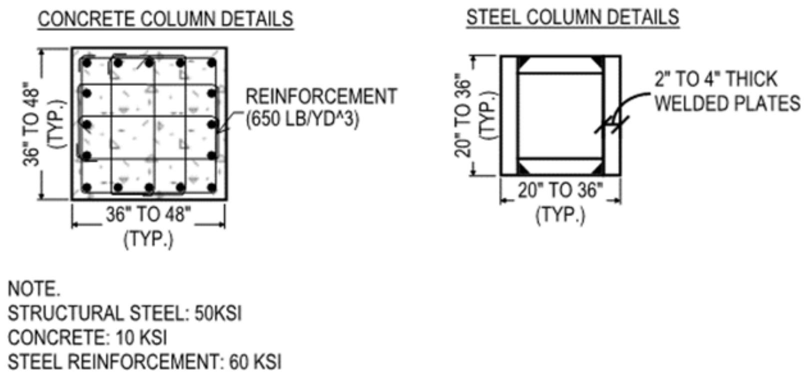


Figure 17 – Typical Column Sizes

Base Isolation

Base isolation is very common in bridge construction providing a significant reduction in the transfer of lateral loading and allowing for increased thermal expansion and contraction. Base isolation has also become more common in building construction in high seismic areas, for structural retrofits and for acoustic and vibration isolation.

There are two main types of base isolation, lead core rubber bearing Figure 18 and Friction Pendulum Dampers Figure 19. Lead core rubber bearings are the most common on bridges, their initial cost is less, but to be most effective the overbuild of the structure should be known. Friction pendulum dampers have more flexibility for future overbuild but are less common and would have a higher initial cost.

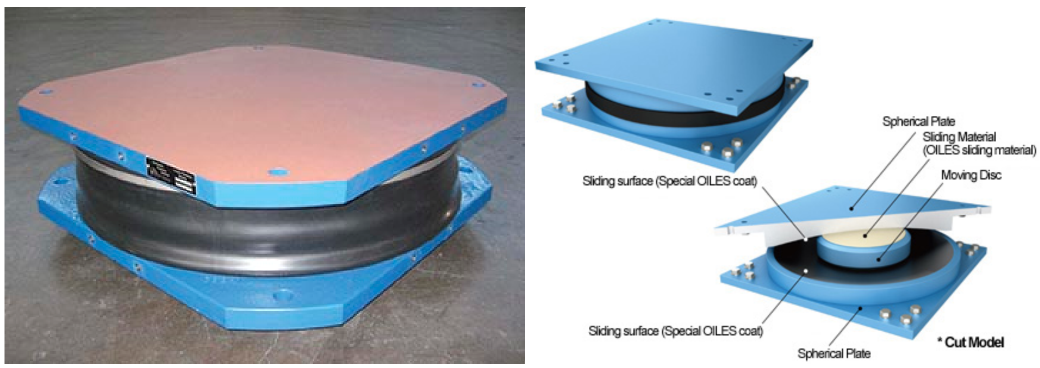
Both options could significantly reduce the seismic loading, which in turn would allow for significant reduction in column and foundation sizes to resist lateral loading. There would be an increase in expansion joint sizes, but a decrease in the quantity of expansion joints. Bearings have an added benefit of simplifying the connection between the structural deck and column pier caps.

A major hurdle in the implementation of base isolation would be the life span and replacement of the base isolators. Base isolators would need a regular maintenance and inspection program and would need to be replaced after their design life of 50 years. The structure would be designed to allow jacking points at each bearing pad, so pads could be removed and replaced. Agreements would need to be made with railroad authorities to allow for inspection and maintenance of bearings in the future.

It would be beneficial to understand the upfront cost of using base isolation and structural savings compared to long term cost of maintenance and replacement of the bearings. If costing estimates are favorable it may be appropriate to further study Option C for a lateral design base line as opposed to Option B.

Figure 18 – Lead Core Rubber Bearing

Figure 19 – Friction Pendulum Damper



VI. Heat Maps

Combining the horizontal and vertical clearance design criteria discussed in Section II.a. several heat maps were developed taking into account MTA and Amtrak clearances, structural span evaluations and structural matrix studies. This was done in order to explain the top and bottom of structure conditions across the site.

These heat maps were developed using integrated modeling so that when assumptions change or decisions are made, the heat maps can be updated interactively.

Initially, the heat maps were developed based on minimum and maximum vertical and horizontal clearance requirements as discussed in Section II. At Zone 1 - LIRR Mid-day Storage, a 22'-0" clearance from top of rail to bottom of structure has been assumed. At Zones 2 through 9, a low and high clearance was set based on clearance requirements for the overhead catenary system (OCS) and cross track feeders as determined by HNTB. For the low clearance, 27'-9" was assumed because it satisfies the Amtrak minimum clearance plus an additional 1'-0" for decked area requirements. As discussed in Section II, this minimum clearance can potentially be reduced pending Amtrak approval. For the high clearance, the proposed minimum clearance at cross track feeders as determined by HNTB is 35'-6". This vertical clearance was assumed for the high clearance at the cross track feeders. The objective is to hold this maximum clearance to a dimension as low as possible to reduce the top of structure transitions.

Heat Maps were developed for the following scenarios:

- Bottom of Structure at Low Clearance
- Bottom of Structure at High Clearance

- Top of Structure at Low Clearance – Steel Option
- Top of Structure at High Clearance – Steel Option
- Top of Structure at Low Clearance – Precast Option
- Top of Structure at High Clearance – Precast Option

The heat maps were developed for the different scenarios to form a holistic picture of the constraints. When regions for deck coverage are selected, a finer grain analysis will need to be done to understand the existing conditions of the OCS and cross track feeders as well as any future work. This analysis will be finalized into one heat map. Refer to Appendix A.5.I for the heat maps of the different scenarios.

VII. Threat and Vulnerability Assessment

A threat and vulnerability assessment was conducted by the engineering team and the materials were shared with MTA, Amtrak, FDNY and NYPD. Given the security sensitive nature of this information the analysis, materials and appendix are confidential.

VIII. Major Fire Life Safety & Ventilation Analysis

a. Ventilation and Fire Protection Systems

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 introduction of an overbuild structure creates an enclosed space at train level. This necessitates design solutions that address ventilation and fire safety, while also complying with Amtrak's Design Policy for Overbuild of Amtrak's Right-of-Way and project-specific requirements of Amtrak and LIRR.

Potential design solutions will depend on the exact nature and extent of the enclosed space, defined by several factors:

- Extent of Sunnyside Yard that is covered
- Location of any deck openings
- Whether the existing East River Tunnel portals are covered
- Whether the Mainline is covered
- Whether walls are continuous, which would subdivide the space

Environmental Management Ventilation System
Management of train heat and other air quality impacts from diesel locomotives and maintenance operations would be provided by special operation modes for emergency ventilation system. Requirements for control of diesel emissions are provided in the ASHRAE HVAC Applications Handbook. Future analyses will consider temperature control during maximum train storage with running equipment and peak outside temperatures, and requirements for outside air exchange.

Emergency Ventilation System
Ventilation systems will need to be designed to ventilate the overbuild deck from ventilation plants installed on top of deck. For this work the design team followed the 2014 New York Fire Code. NFPA 130 was also assumed to be applicable to any area that includes passenger terminals and transit ways used for public-occupied trains. Further work will need to be done with FDNY and the Rail Entities to determine the appropriate code or design requirements for future phases. Ventilation systems will be required to provide a tenable environment based on the following criteria:

- Smoke Obscuration kept such that doors and walls are discernable at 10 m (2017 ed. NFPA 130 B.2.1.3)

- Pedestrian temperature exposure kept at or below values described in Table B.2.1.1 of 2017 ed. NFPA 130

Ventilation systems to mitigate fire hazards within the overbuild will be configured as a zoned ceiling exhaust system that utilize stratification of hot smoke at the ceiling. Ventilation plants would be constructed inside ventilation plant buildings at key locations on the overbuild to accommodate each ventilation zone's capacity demands. Reversible tube-axial ventilation fans would provide exhaust or supply from under the overbuild with discharge stacks located at a minimum of 10' above ventilation plant buildings finished grade on top of deck. Figure 20 provides estimated ventilation zones within the Yard with the approximate ventilation plant buildings locations.

Figure 20. Estimated Overall Ventilation Plant Building and Egress Stairs Locations (Preliminary)

Future evaluations will consider the phased development of the overbuild to provide proper ventilation during construction, during all phases of deck development, and in the final completed overbuild condition.

The ventilation fans would be configured in duplex arrangement to provide the required ventilation demand for each ventilation zones. The total number of ventilation plants would also be configured to provide equipment redundancy for unexpected equipment failures or maintenance required shutdown conditions. The primary power supply, as well as the potential need for secondary feeders or use of stand-by generators, will also be considered. The emergency ventilation fans can also be used at a low speed to provide necessary ventilation to support maintenance operations and heat dissipation. The current use of diesel locomotives in Sunnyside Yard is minimal, and emissions from self-propelled locomotives are likely to become cleaner as the phasing of overbuild development progresses. In the absence of significant numbers of diesel trains, the emergency ventilation condition will likely govern design.

Ventilation plants would be sized according to fire scenarios applicable to required standards and to avoid the occurrence of plug-holing. Initial calculations estimate that two 500 kCFM ventilation plants would be required per each ventilation zone with each of the two plants configured with two 250 kCFM tube-axial ventilation fans for equipment redundancy. Figure 21 provides the schematic diagrams of how the ventilation fans work to exhaust smoke from under the overbuild in several scenarios.

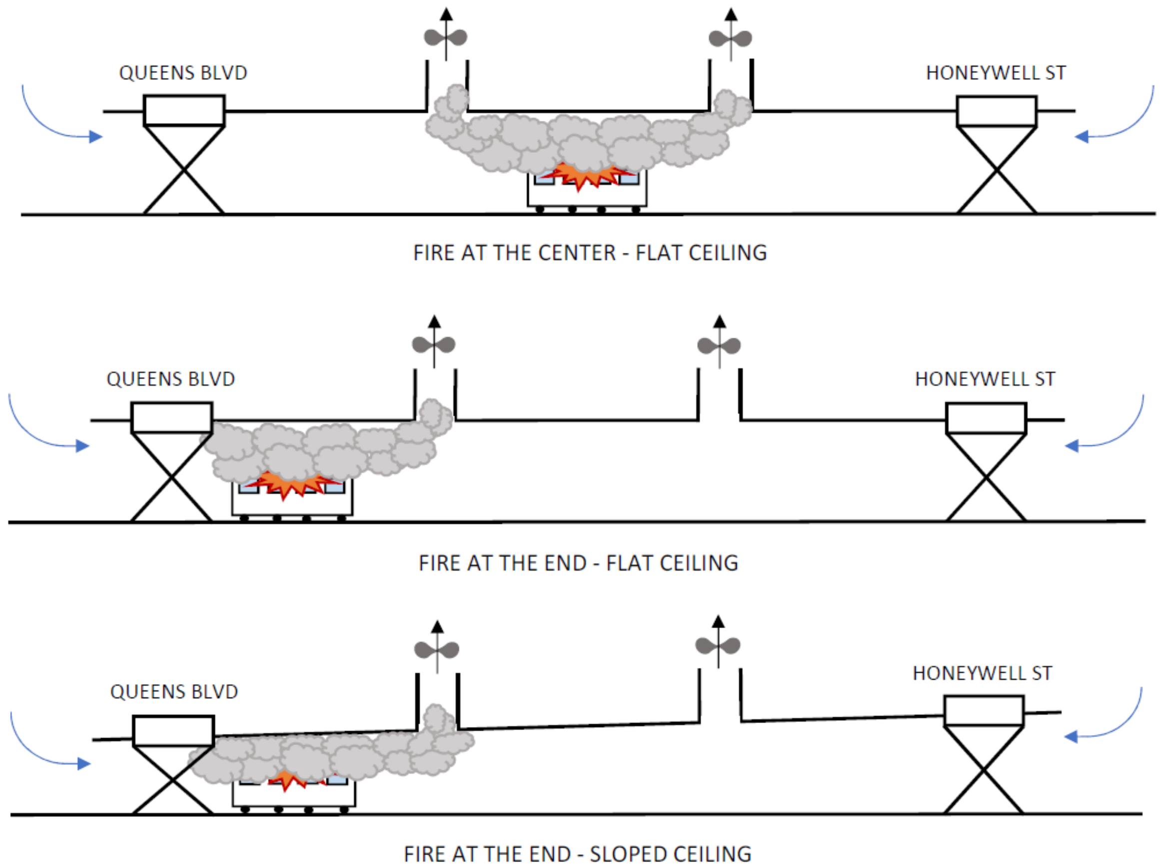


Figure 21. Schematic Diagram of How Exhaust System Pulls the Smoke from Under Overbuild

Distribution plenum would be configured to exhaust smoke from under the overbuild via several ventilation terminal openings (4' x 4' typ.) through the duplex ventilation fans and out from discharge stacks located at the top of ventilation plant buildings. There would be one distribution plenum per ventilation plants. Figure 22 provides enlarged plan view of ventilation zone at the mainline trackway between Queens Boulevard and Honeywell Street with the approximate location of ventilation plant buildings, distribution plenum, and ventilation terminal openings.

Two ventilation plant configurations are considered. Horizontal ventilation plant, as shown in Figure 23 requires ventilation plant building with lower height but bigger building footprint. Vertical ventilation plant, as shown in Figure 24 requires ventilation plant building with smaller building footprint but higher height.

Ventilation discharge stacks at the top of ventilation plant buildings are designed to have a drainage system to prevent rainwater accumulation inside the axial fans. Figures 23 and 24 provide the schematic diagrams of discharge stacks drainage system on both horizontal and vertical ventilation plant configurations respectively.

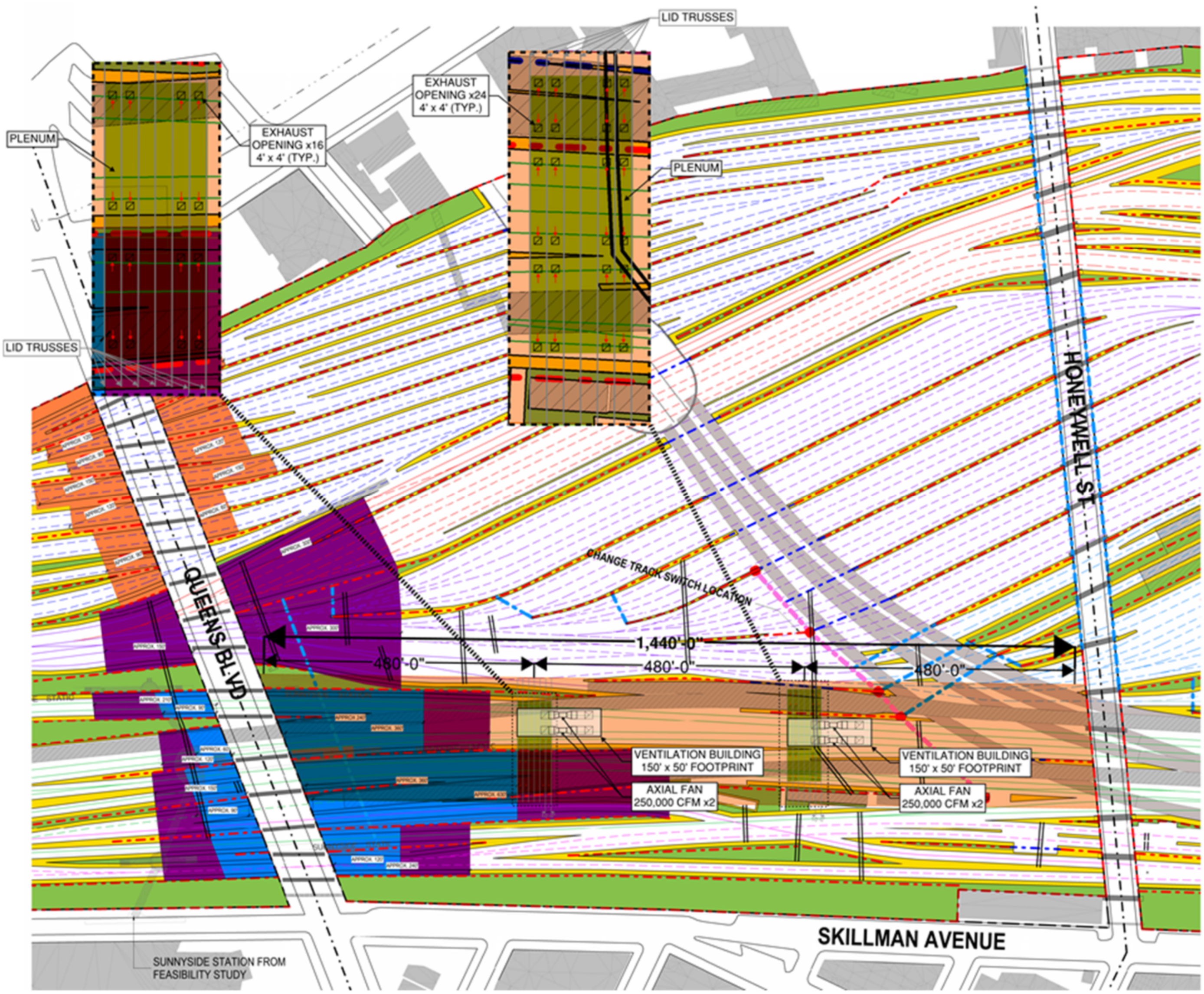


Figure 22. Enlarged Plan View of Main Line Trackway Ventilation Zone between Queens Boulevard and Honeywell Street.

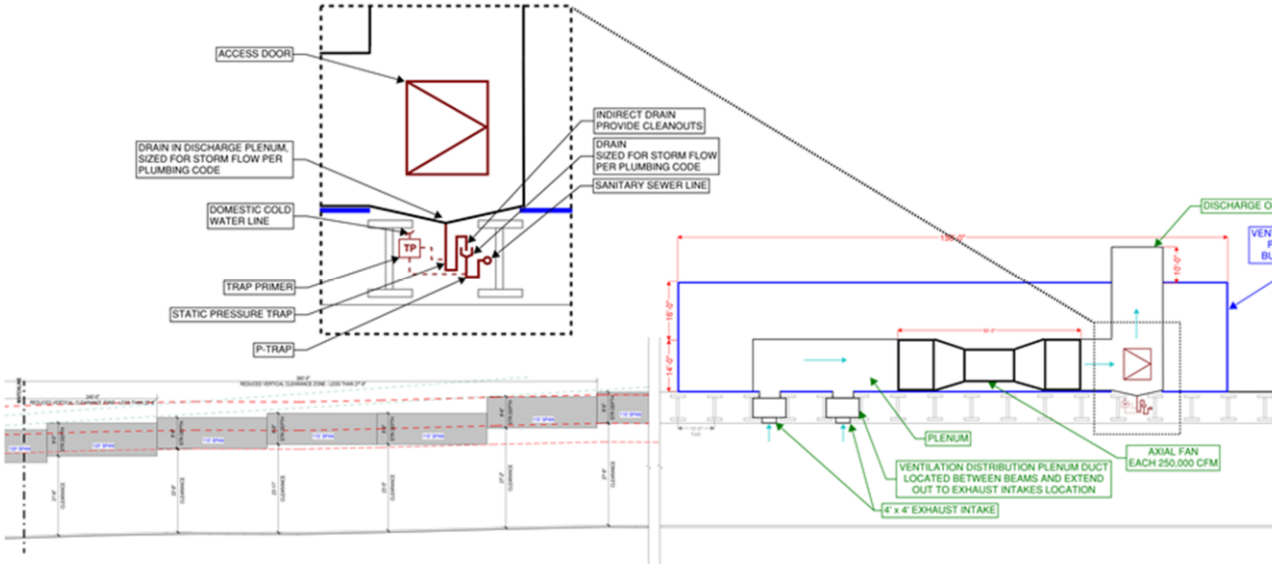


Figure 23. Horizontal Ventilation Plant Configuration

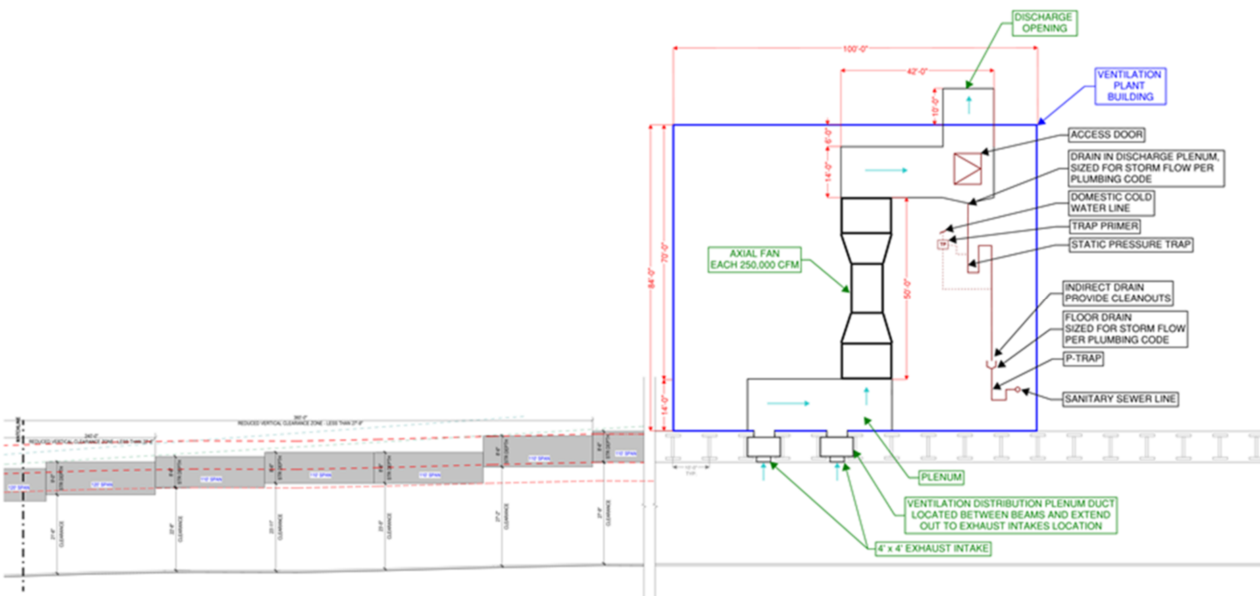


Figure 24. Vertical Ventilation Plant Configuration

Ventilation fan plants would be designed to meet Amtrak and MTA design guidelines including but not limited to:

a) Preference for horizontal flow configuration of axial reversible fans to facilitate equipment removal and maintenance operations with the following features:

   i) Tube-axial fan equipment shall be removable from facility as one unit including power, instrumentation and controls terminal boxes.

   ii) Removal of tube-axial fan shall not require major disassembly of other equipment components.

   iii) Ventilation plant shall include trolley beams configured for major equipment removal.

   iv) Equipment shall be configured for maintenance from plant floor whenever feasible.

   v) Equipment shall be configured such that entire assembly including terminal boxes can be removed through hatch directly to street.

b) Tunnel Ventilation Fan Plant and other support facilities design concepts:

   i) Utility service electrical equipment shall be located in a separate room (2 hour rated construction) from control equipment used for local control of the plant for maintenance.

   ii) Equipment for systems other than that of the fan plant (e.g. tunnel lighting, signals) shall not be installed in the fan plant

   iii) Fan plant facility shall be designed with two means of egress

   iv) Air plenums shall not be used to access any rooms constructed within the fan plant.

   v) Portable fire extinguishers shall be provided in fan plant.

   vi) No equipment shall be mounted directly to any floor. Concrete pads shall be provided and equipment shall be anchored to floor.

   vii) Fan plant shall include separate enclosed local control room configured such that view ports would allow observation of all moving equipment (fans, and automatic dampers).

   viii) Fan plant would include redundant power supply from either separate power substation or emergency generator with automatic transfer switch (including proper source transfer configuration).

   ix) Sound attenuation equipment sufficient to limit fan noise transmission for the purpose of maintaining acceptable noise levels to enclosed yard areas and ambient areas on top of lid.

c) Ventilation discharge stack design including integration into city scape and adjacent building construction with the following design features:

   i) Limited noise transmission to ambient from ventilation equipment.

   ii) Ventilation discharge protection from rain water and storm drainage flows.

   iii) Ventilation discharge location to limit smoke re-entrainment into adjacent ventilation plant operating in supply mode.

   iv) MTA yard areas where Amtrak passenger coaches are not allowed to operate, design fire load shall include medium growth fire to peak heat release rate of 5 MW with a radiation energy component of 30%.

   v) Push/pull ventilation systems designed for stratified smoke will be designed to maintain tenable environment with 10-meter local visibility to reflective surfaces below 6' elevation.

Smoke exhaust would be gathered by an exhaust distribution plenum system that would be integrated into the structural interstitial space above rail yard ceiling surface. Exhaust openings through ceiling would be configured to distribute mass flow and prevent inefficient smoke exhaust conditions.

Structural fire durability provisions such as thermal protection board and fire sprinklers would need to be incorporated into design of plenum exhaust distribution system in the event exhaust is not conveyed in ductwork.

Fire Protection Systems

Overbuild construction will require existing structures within the overbuild to incorporate additional or updated code compliant egress facilities from inside the enclosed rail yard environment to public space on top of the overbuild. Wayside structures would also require design elements to mitigate additional acoustic and air quality demands created by enclosed space under lid structure.

Fire department response equipment access into the rail yard needs to be accounted for in yard planning. Figure 25 provides schematic diagram of the fire protection system used within the Yard area. Based on the existing fire hydrant locations, Figure 26 provides an overall plan view of the Yard area with preferred fire department connection locations and standpipe network to reach each fire hose valves located in the egress stairs locations.

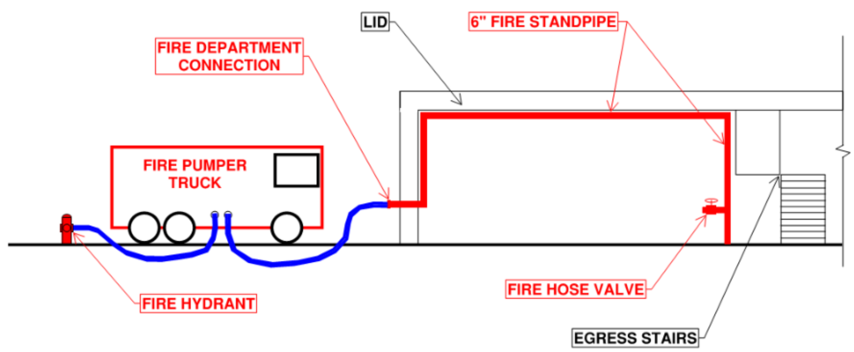


Figure 25. Fire Protection System Schematic Diagram

Figure 26. Overall Fire Protection System with Standpipe Network within Yard Area

Fire protection systems will need to be designed and installed to meet the requirements of FDNY, Amtrak, MTA and the building codes of New York State and New York City. For this early stage of the deck design the engineering team used NFPA 130, however neither the Amtrak policy for Overbuild nor NFPA 130 specifically address covered railyards, but they do address tunnels, which are likely applicable to the Mainline and loop tracks. These documents, in coordination with the railroads and agencies, will guide analyses of the storage track areas elsewhere in the Yard using computer modeling of fire scenarios.

A standpipe system will be considered for firefighting in the enclosed railyard, and fire department connections (FDC) for the New York Fire Department provided on the surface. This will be provided where physical factors prevent or impede access to the water supply. The design of the standpipe system will be based on the availability of fire hydrants based on their proximity to the Yard as well as available emergency access locations.

Fire Sprinkler System
A dry type automatic sprinkler system and dry type fire stand pipe system could be provided. If so, it is likely that sprinklers will be mounted on the underside of the deck within 6” of the deck. At this stage of the design and engineering analysis a wet sprinkler system is not recommended as it would require more maintenance and would be susceptible to freezing, and railway operators typically discourage wet water pipes crossing over live railways. This assumption should be revisited with FDNY, Amtrak and MTA as design of the deck progresses in subsequent phases of work. A standpipe system will be provided, including Siamese connections for firefighting in the enclosed railyard, and connections for FDNY will be provided on the surface. Sprinkler heads will be located underneath the overbuild and spaced along the tracks to provide coverage to trains in the event of a fire (See Figure 27).

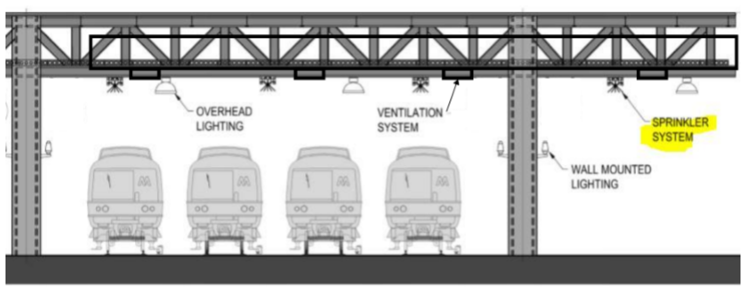


Figure 27: Sunnyside Yard Section View w/ Sprinklers

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

b. Conceptual Engineering Analysis of Fire Dynamics

In order to realistically evaluate fire characteristics and fire movement below the deck area, Computational Fluid Dynamics (CFD) simulations will be performed for this study using Fire Dynamics Simulator (FDS) software created by National Institute of Standards and Technology (NIST).

Figure 28 describes the deck area highlighted in orange which is modeled for the CFD analysis. This ventilation zone is part of the Mainline track section of yard and is selected for further CFD study due to its higher traffic frequency and due to its approximate low ceiling clearance. Simplified crash walls separation between several tracks within the region are modeled to create more realistic representation of the CFD study area as shown by cropped CFD model of Figure 29. Due to those crash walls separation, simplified ventilation stacks are created to represent evenly distributed total ventilation terminal openings area. Two ventilation stacks (10’x10’) are modeled at one-third zone length distance from Queens Boulevard. Three smaller ventilation stacks (8’x8’) are modeled at one-third zone length distance from Honeywell Street.

Due to variety of ceiling clearances between ground and the concrete slab of the lid, two different lid configurations are modeled and studied:

- In the staggered lid configuration as shown in Figure 30, lid is assumed to slope down towards Queens Boulevard. with lowest ceiling clearance of 17’-5” and highest ceiling clearance of 27’-9”.
- In the flat lid configuration as shown in Figure 31, lid is assumed to be flat thus the overall study area has uniform 27’-9” ceiling clearance. Both west end (Queens Boulevard) and east end (Honeywell Street) of the two CFD models are open without any walls (natural ventilation).

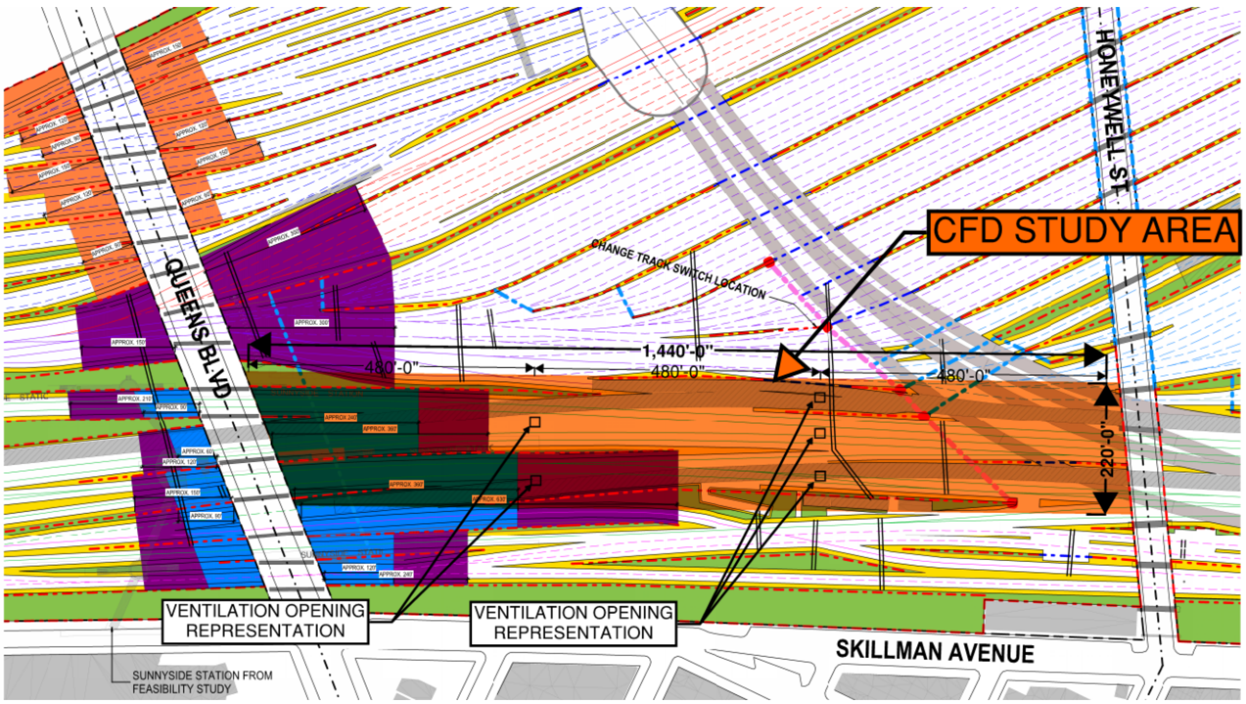


Figure 28. Plan View of CFD Test Study Area

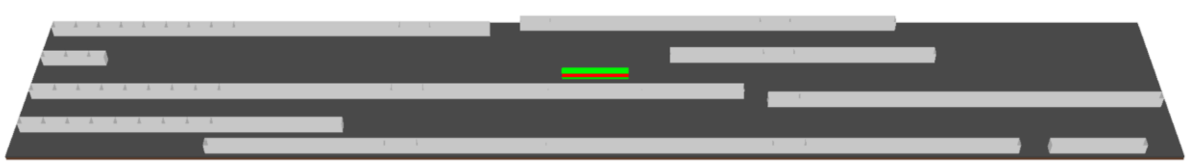


Figure 29. Cropped CFD Model with Simplified Crash Walls Configuration

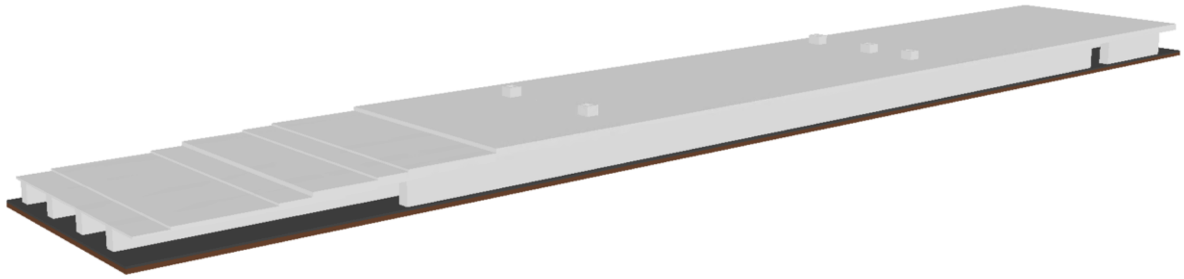


Figure 30. CFD Model Representation of Staggered Lid Configuration

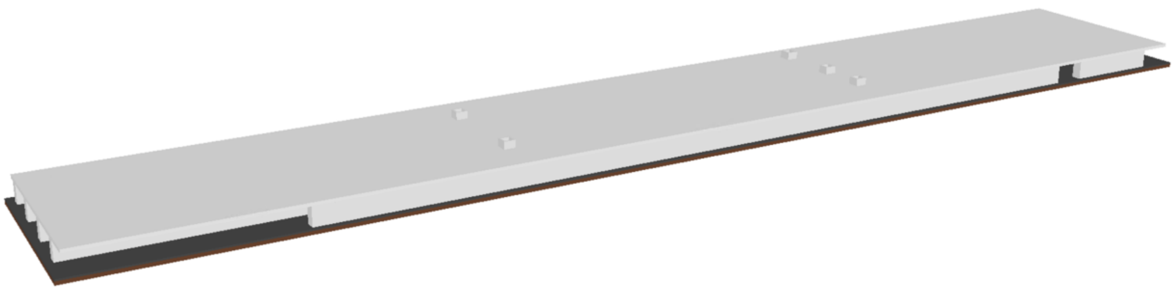


Figure 31. CFD Model Representation of Flat Lid Configuration

Fire design scenarios proposed in this study are recommended based on rail and other vehicles operating within train platform gallery region under the train shed area of the station. These design fire scenarios are consistent with the “Overbuild of Amtrak right-of-way design policy”. Two typical possible fire scenarios (train fire below platform concourse within train shed area, and locomotive fire) are described below,

1. <u>Train Fire Below Rail Yard and Operations Area Lid</u>

In this scenario, the fire is assumed to start maliciously from a passenger seat in a stationary train below platform concourse within rail yard and operations lid area. If fire is ignited maliciously, the initial fire source may involve the use of a limited amount of accelerant. The fire is assumed to be directly adjacent to a non-incident train such that the fire can spread from one passenger coach to another and reach peak heat release rate of 52MW with three periods of growth. Within the first three minutes, the fire reaches 5MW of HRR and remains constant for the next seven minutes. The fire then linearly grows to 10MW of HRR within three minutes and remains constant for the next seven minutes. After the constant period, the fire then linearly grows again to 52MW within six minutes and remains constant until the conclusion of simulation at thirty minutes. Table 9 and Figure 31 provide the full breakdown list and graph of the fire growth rate applied in this study.

Time (s)	Heat Release Rate (MW)	Heat Release Rate (MBTU/hr)
0	0	0
180	5	17.060
600	5	17.060
780	10	34.120
1200	10	34.120
1560	52	177.476
>1560	52	177.476

Table 9. Table of Fire Growth Rate Applied in This Study

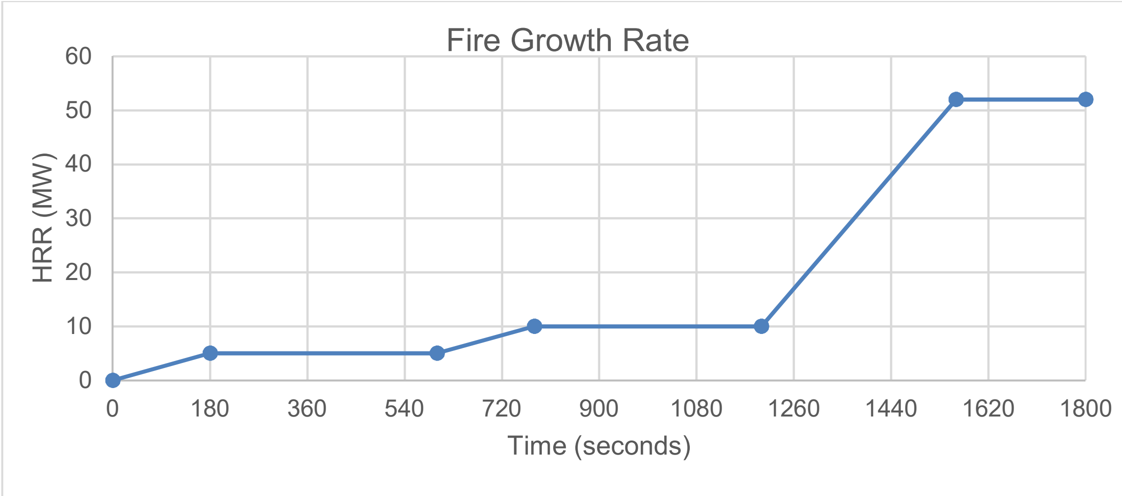


Figure 31. Chart of Fire Growth Rate Applied in This Study

2. Locomotive Train Fire

In general, a locomotive fire load is not a credible fire load for design of ventilation systems for the following reasons:

- Fuel system is circulating diesel fuel which has a relatively high flash point temperature and relatively low rate of evaporation.
- Locomotive will have qualified operating personnel operating the controls and trained to intervene during a developing fire incident.
- Track ballast within the rail yard area will not allow liquid fuel to generate fuel pool surface area and sufficient combustion air access to support heat release rates larger than Amtrak passenger coach fire hazard guidelines
- Diesel fuel storage cell rupture and impulse drainage event has a low probability of occurring
- Oxygen limited conditions inside fuel cell minimize probability of fire incident within the diesel fuel storage cell.

However, if the locomotive equipment is not maintained/constructed/operated according to Title 24 CFR Part 238 there may be additional fire hazards present including the combustible energy contained within the diesel fuel tank. This additional combustible energy has the potential to substantially increase required size for emergency ventilation system. The railroads should take preventative measures to ensure staff and contractors are properly trained in maintaining, constructing and operating per said requirements to avoid this increased risk.

c. Structural Fire Durability

Design for structural fire durability will be defined by several factors including but not limited to:

- NFPA 130 – Standard for Fixed Guideway Transit and Passenger Rail Systems
- NFPA 502 – Standard for Road Tunnels, Brides and other Limited Access Highways, sections on air right structures
- ASTM E119 – Standard Test Methods for Fire Tests of Building Construction and Materials
- ASCE\SEI\SFPE 29-05 – Standard Calculation Methods for Structural Fire Protection

A fire durability analysis for the overbuild deck will determine the structural and fire protection systems configuration required to prevent progressive collapse of the overbuild deck in the event of a design fire incident. Systems will be designed to maintain structural integrity without collapse when exposed to elevated temperatures caused by a fire within the overbuild. Industry-accepted design methods will be employed including Computational Fluid Dynamics (CFD) to predict the surface temperature of the overbuild support structure over time in order to determine if there is a possibility structural failure. Such an analysis will be based on the peak fire heat release rate and growth rate described in the Fire Dynamics section above, as well as the thermal conductivity of the material. Structural fire durability would be provided by either ceiling surface constructed between structural members and yard space below or systems applied directly to lid structural members (i.e. spray fire proofing, Point-to-Point (PPP) fiber). Fire durability design criteria for fire protection thermal insulation board will depend on ceiling elevation geometry for the Yard. Water based overhead fire protection sprinkler systems can also be designed to provide structural fire protection.

d. Site Fire Life Safety

The design for the Fire Life Safety system within the overbuild deck will need to be agreed upon by the MTA and the FNDY for future phases of the Master Plan. For this early conceptual work the engineering team followed the 2014 New York Building, and Fire Code to inform the design approach for Fire Life Safety systems within the proposed deck. NFPA 130 was used as it is applicable to areas that include passenger terminals and transit ways used for public occupied trains. Using this standard, the design of egress elements will be based on, but not limited to, the following criteria:

- Means of Egress is continuous to a public way (2014 ed. NYCBC 1007.2)
- Occupancy classification of buildings as defined by Chapter 3 of 2014 ed. NYCBC
- Fire-resistance rating of enclosed exits based on section 1019.1 of 2014 ed. NYCBC
- Standpipe system shall be provided in enclosed trainways where physical factors prevent or impede access to the water supply or fire apparats, where required by the jurisdiction. (2017 ed. NFPA 130 6.4.5.1)

Overbuild construction will require the addition of code compliant egress facilities from existing structures within the overbuild to a public way space on top of the overbuild. Access and egress provisions must address normal use, emergency services access, and evacuation of Sunnyside Yard. Stairways must be enclosed and fire-rated. Amtrak and NFPA require that the distance to a stairway should not exceed 800’. Locations of stairways must be coordinated with the locations of support walls for the overbuild and with railroad infrastructure.

Above deck level, headhouses for stairways must be coordinated with the development plan. Stand-alone headhouses may compromise the value of open spaces, so 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, but 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 will be necessary if employee parking is located on the deck, or if certain railroad functions such as support facilities, offices, or warehousing are in buildings above deck level. Elevators will also be necessary. Buildings under the overbuild deck will be provided with enclosed staircases located adjacent to the building that will lead to openings in the overbuild deck above, allowing patrons to traverse vertically to a public way. Common Stairways will also be needed to provide access between the deck above and the Yard.

Lighting will be required under the deck to support normal yard operations. Emergency lighting with emergency power and backup generation will also be required to meet applicable codes and guidelines. Amtrak requires illumination levels of track and walking surfaces of at least two (2) foot-candles with a train in position on an adjacent track. Lighting fixtures are expected to be mounted on the underside of the deck or on support walls. Temporary lighting will be required during deck construction.

IX. Constructability

Sunnyside Yard is a very active railyard used by Amtrak, NJ Transit, LIRR and General Motors with NYCDOT Bridges and the New York City Transit No. 7 line spanning over the yard. Construction within the yard needs close coordination with these entities with proper consideration for clearances and train operations to determine possible outages to perform work. An in-depth understanding of existing and future conditions, such as geologic profiles and proposed building typologies, will help identify the types of structures to build and appropriate types of equipment, access and construction staging.

With the Amtrak Master Plan under review and set for modifications, details of the overbuild can be coordinated into the assumptions and design criteria of the new Amtrak Master Plan currently in progress. This will benefit the constructability of an overbuild by integrating needed clearances for columns and equipment as well as optimal span lengths for the deck. Also, depending on the schedule for each project, foundations and columns for an overbuild can be constructed ahead of time under the capital projects of the Amtrak Master Plan.

One example to draw on is the Manhattan West project where they used a custom-built launching gantry to position precast/post-tensioned beam spans above 15 live rail lines and their electrified catenary power lines (See Figure 32 below). These beams will support a public plaza and parking structure between two high-rise buildings. This approach eliminates the need for intermediate columns and re-supporting overhead catenary. This is a unique case at the West Side Yard where the height of catenary power lines is not as variable as it is for Sunnyside Yard. At Sunnyside, the deck height needs to be carefully considered to accommodate both the variable topography and the transition points along the perimeter of the yard and at the NYCDOT bridges.

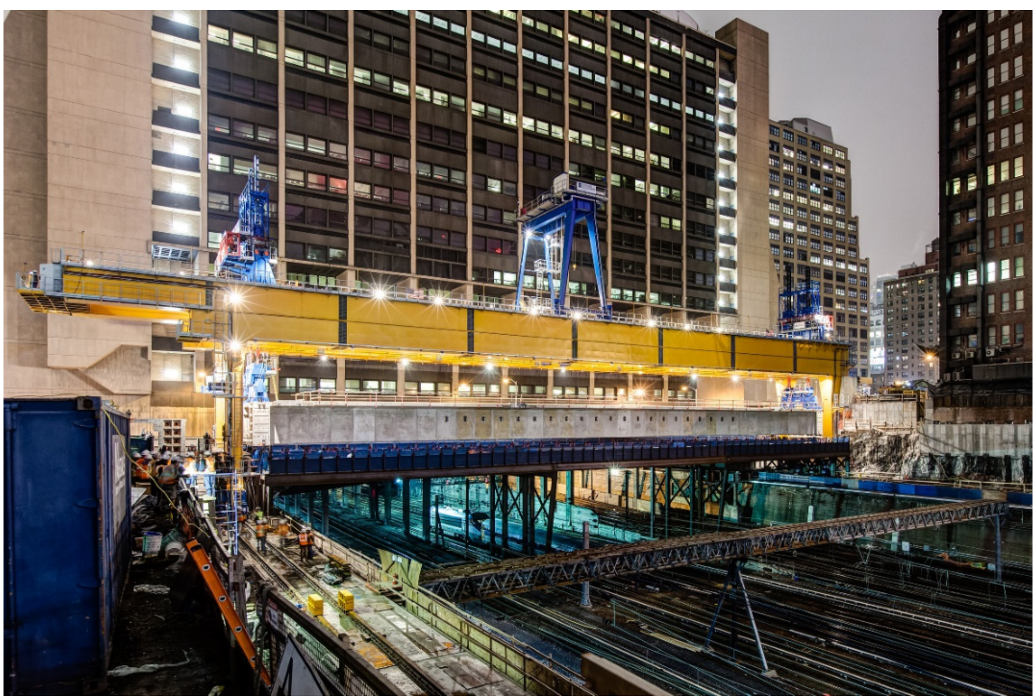


Figure 32: Manhattan West

Concrete Superstructure

Just as important as the load demands, the design of the superstructure needs to consider constructability. Mobilization of material, assembly and crane picks determine the feasibility of the proposed superstructure. The topography and constraints within the yard differ from one zone to another. Where steel superstructure may work at one location, a concrete one may work for another.

Precast concrete components provide many advantages over steel. By avoiding the use of any cast in place concrete, the precast component can be installed quickly, efficiently, and safely, all while minimizing track outages. Once the concrete unit is installed, it provides a good work surface area for construction staging, while also providing protection for the track and sensitive systems below. On the other hand, precast solutions can be considerably heavier than their steel counterparts, requiring innovative solutions in order to construct them.

The deck spanning between girders would consist of the precast component, which is available in a variety of unique shapes. Examples include hollow core precast plank, bulb tee girders, and NEXT beams for shorter spans, box tub Girders for intermediate spans, and post tensioned box girders for longer spans (See Section V - Structural Matrix).

Due to limited site access and maneuverability, significant coordination will be required for the delivery and placement of the precast units. For components up to 50 ft in length, delivery from a precast concrete manufacturing facility is relatively simple, requiring little coordination with NYCDOT. Spans between 50 ft to 100 ft will require special permitting and planning. Delivery from the site’s loading area to a precast component’s final installed location will also require a clear lifting plan and path.

Placement of heavy lifting equipment (tower cranes, gantry cranes, etc.) as well as maximum lifting capacity limitation will be a challenge, and as such, attempts to deliver the components as close to their final locations should be made. In some cases, however, this may not be possible. One possible solution would be to manufacture precast units on site and position. A temporary precast concrete plant can be set up, with workers assembling forms and steel reinforcement in a staging area adjacent to the components’ installed location. A ready mix truck could then be delivered onto the job site, pouring concrete that would then be allowed to cure under controlled conditions until ready to be set in place. This option would eliminate the need for special truck permitting from NYCDOT.

For larger spans requiring the use of a post-tensioned box girder, individual components can be delivered in 10’ lengths using a typical tractor-trailer and assembled on site. These box girders also combine the deck and superstructure into a single system, reducing the time required to complete the installation. The larger depth of the post-tensioned box girder spans also allows for the storage of utilities and mechanical equipment within the interior of the unit as well. Installation of these structures can be tailored to fit the site conditions. In order to avoid using false work which would interfere with the tracks below, a launching gantry can be employed to help connect the individual components prior to any post tensioning. In Figure 33 below, a segmental concrete structure is being placed with the use of a launching gantry, supported from the two adjacent cast in place columns. Once the post tensioning has been installed, the gantry can be moved onto the next span and the process can continue. Some launching gantries make use of the existing spans for support, so that the new span can be cantilevered over onto the next support. Though this construction technique is popular globally, there may be significant lead-time to allow a U.S. contractor to become familiar with this method, especially on the East coast where these types of bridges are not often built.

Figure 33: Launching Gantry (Source: Huada Crane)

Steel Superstructure

Using steel components for the superstructure also offers many advantages compared to precast concrete. A typical steel structure would consist of a steel column and girders perpendicular to the tracks. The deck would be supported by various steel components, from wide flange shapes, built up plate girders, and trusses. A concrete topping slab would tie the structure together, provide a working surface, and protect the tracks below. Steel is lighter than precast concrete, allowing for more flexibility in fabrication, assembly, delivery and site installation. For example, whereas crane capacities may be an issue for a precast concrete element, steel may be light enough to eliminate this concern. In some instances, steel sections can be more compact compared to the precast components, allowing for greater maneuverability on site, which leads to simpler installation.

Steel has the added benefit of a more experienced workforce in the region. Field assembly of trusses and connections are routine and can be performed with confidence. For areas of the project where clearances and accessibility are limited, steel components can be delivered by piece, and assembled in their final installation location. For example, the installation of the deep transfer trusses over the EAS tunnels may necessitate this technique. The transfer trusses will be too large and too heavy to be lifted in place as a single assembly. One possible solution includes erecting a temporary work surface to protect the tracks and catenary structures below, and using a mobile crane off the Honeywell Street Bridge to maneuver the initial individual truss components into place, where they would be field connected. As construction continues, for areas outside the reach of a crane from the bridge, individual components can be delivered during coordinated, temporary track outages.

If access to a significant portion of the yard was made temporarily available, use of self-propelled modular transports (SPMT) could be used to position and install fully assembled truss assemblies (See Figure 34 below). The use of SPMTs means that the entire assembly could be erected in advance of the installation, requiring only a short window to move the structure into place and install, accelerating the overall project. However, using SPMTs over the existing track structure would require significant preparation including placement of geomats to protect existing railroad steel. The presence of an electrified third rail also presents a challenge. Overall, these difficulties may make overhead construction the preferred practice.

Figure 34: SPMTs at Work (Source: Alatas Big Lift)

Railroad Infrastructure

Tracks

Construction activities adjacent to active tracks will require either on-track protection (e.g., flagging or established working limits), or a short- or long-term track outage. The type of protection will be dependent on the type of construction activities. Typically, activities allowing for the quick removal of personnel and equipment from within the fouling limits (any activity within 15 ft of the centerline of track) can be adequately protected with flagging protection. Work requiring on-track equipment, or with the potential to disturb the integrity of the track structure, will require full track outages. In certain cases, protection will need to be provided for tracks adjacent to the out of service track. In all cases a site specific workplan will need to be developed and approved by the operating railroad to determine the appropriate protection.

For the Mid-Day Storage Yard and Sunnyside Yard, it is assumed that long term continuous outages on the storage tracks will be granted for the installation of foundations adjacent to the tracks. Specifically, in the case of Sunnyside Yard, it is assumed that these outages would be coordinated with the implementation of the Amtrak Master Plan, thereby allowing construction of the overbuild foundations to utilize the already required outages for the proposed track modifications. Construction activities within the fouling limits of the switches and ladders, where the storage tracks connect back to the mainline tracks, would be limited to nights and weekends, depending on the location.

For construction activities on the Main Line or Loop Tracks, single track outage work windows are anticipated to be limited to nights and weekends. For any other outage requiring multiple track outages, work windows would likely be limited to weekends only.

To maximize construction access, “construction safe zones” will be established in certain areas adjacent to active tracks. These zones will require installation of a semi-permanent barrier to separate work zones from active tracks. The barriers can be located no less than 8.5’ from the centerline of active tracks. Construction equipment with the potential to extend across the barrier (e.g., a crane boom), would be prohibited or would require additional protection. For construction activities taking place within the “construction safe zone” a work plan would need to be developed and approved by the operating railroad.

Signals

Decking over Sunnyside Yard will involve relocation of power and signal cables and ConEd feeders. It is not currently anticipated that a reduction of signal bridge elevations within the interlockings will be required, however this will be further evaluated as design progresses.

Overhead Contact Systems (OCS)

Most storage, loop, siding, and main tracks have overhead contact systems (OCS) to supply energy to trains. OCS wires are supported on portal, cross catenary, cantilever, or pull-off structures which also support multiple along- and cross-track feeders for catenary feeding and electrical sectionalizing purposes.

Decking over the Yard would require the transfer and relocation of OCS wires onto the deck and removal of most OCS structures. Some of the OCS wires, including the along-track feeder, would have to be relocated in underground duct banks or micro tunnels; the cross-track feeders would be insulated in conduits mounted on the deck.

The relocation of OCS wires would be completed in two stages. First, OCS wires would be re-profiled to lower the system height (distance between the messenger wire and contact wire measured at every registration support) while maintaining the same contact wire elevation to prevent impact to the existing multiple crossovers, turnouts, and overlaps where many different OCS wires cross each other. Lowering the OCS system height would significantly reduce the span length (distance between consecutive supports) and temporary catenary support structures closely spaced would be required throughout the Yard. This would allow sections of the deck to be constructed between the OCS structures. In the second stage, OCS wires would be relocated and supported from the deck. Due to limited track outages and the need to maintain train operations, long term coordination and planning will be necessary.

Substations

The Yard operations have traction power (AC and DC) substations and facility house power substations with high voltage distribution feeders throughout the Yard. In addition, the Amtrak Sunnyside Yard Frequency Converter Facility maintains 25 Hz traction power as part of its system power grid. Amtrak has examined the feasibility of relocating the existing Sub 44 (traction power and signal power) into a vacant area near Thompson Avenue on the south side of the Yard. While the exact location is unknown at this time, deck wall foundations will need to be considered in connection with any new substation and associated feeders.

It is not anticipated that decking over the Yard will require any replacement of substation facilities to accommodate column construction for either traction power or facility house power. However, feeders supplying the substations or distribution feeders may need to be relocated. Construction of replacement feeders will have to be coordinated with rail operations and in some cases replacement feeders constructed and cut in during allowed outages before existing feeder conductors can be removed. The preliminary and final staging will further developed as design progresses.

Additional Constraints & Challenges

Clearances

A discussed in Section II and III and shown in Appendix A.5.H, the yard was evaluated for areas where the minimum physical clearance between centerline of track to face of column was met (8'-6") shown in green and areas where the minimum constructability clearance between centerline of track to face of column was met (16'-0") shown in orange. The minimum constructability clearance would allow work to occur with a partial height barrier in place between the work zone and tracks with minimal disruption to operations.

Existing Conditions

As noted in Section II, there are contaminated plumes within the yard containing PCBs, SVOCs and lead. This will be a constraint when building foundations within the yard as proper dewatering, containment, and disposal need to be in place during construction. Also, existing water and gas mains, telecommunication conduits, electrical duct banks, transformers and vaults, oil lines, and sanitary and combined sewers are present throughout Sunnyside Yard. Relocation and temporary supports for these utilities may be required when building foundations.

Existing structures including but not limited to Amtrak facilities, MTA ESAEast Side Access tunnels, MTA Mid-Day Storage Yard platforms/pedestrian bridge, substations and NYCDOT Bridges are physical constraints that need to be properly located and categorized as permanent or possible for relocation. For those that are permanent such as the MTA ESAEast Side Access tunnels and NYCDOT bridges, coordination with MTA and NYCDOT is critical to identify allowable clearances for foundations.

Access & Equipment / Transport of Material

Current vehicular access to the yard include Northern Boulevard near the Mid-Day Storage Yard and High Speed Rail Shop, ramp at 39th street bridge, 39th street and Skillman Avenue, 31st street and Skillman Avenue and a gate underneath Long Island Expressway west of the yard (See Appendix A.5.L). Along the south, the fence along Skillman Avenue can be removed to provide access to the yard. There is a wide embankment adjacent to Skillman Avenue before the loop tracks that can be used as a launching pad for temporary structures spanning over the tracks to transport material. Depending on the size and weight of materials, existing NYCDOT Bridges can also be used to transport material into the yard. Coordination with and approval from NYCDOT OCMC will be required for lane closures along Skillman Avenue and the bridges.

Staging / Laydown Areas

Construction staging and laydown areas within the yard are very limited. Currently, Zones 5 and 6 show the most flexibility for construction staging. Coordinating the schedule of deck installation phases together with the Amtrak Masterplan will be helpful to take advantage of the easements and laydown areas that will be used for the Amtrak Master PlanMasterplan. Another option is to use the deck for staging and laydown as construction progresses. This works well with using Skillman Avenue as an access point where the contractor builds temporary structures along the embankment as part of mobilization.

TABLE 10 – CONSTRUCTABILITY EVALUATION MATRIX

Zone		1	2	3	4	5	6	7	8
Accessibility	Ground Level	Northern Blvd west of Honeywell St	Honeywell St ramp or from 42nd Pl/43rd St off of Northern Blvd; (Note: Honeywell St ramp is narrow and will limit size of deliveries)	Limited access from Zone 2 or 4. Requires crossing tracks at grade.	39th St ramp and circuitous route through Zone 4 and 5; requires crossing tracks at grade to access portions (Note: 39th St ramp is narrow and will limit size of deliveries)	39th St ramp and circuitous route through Zone 6 (Note: 39th St ramp is narrow and will limit size of deliveries)	39th St ramp (Note: 39th St ramp is narrow and will limit size of deliveries)	Very limited access at West end between Thomson Ave and Queens Blvd; at East end Northside of mainline tracks has some access from Zones 3 to 6; Southside has limited access due to loop tracks	Northside access is limited due to the main line tracks; Southside access is available from Skillman Ave between Thomson Ave and Queens Blvd and Skillman Ave just West of 39th St; Westside access from 43rd St north of 37th Ave
	Erection[1]	Traditional cranes can currently be staged at ground level, however the future LIRR storage yard will eliminate this option in the future	Currently traditional cranes can be staged at ground level; access is somewhat limited from Honeywell St for the West end and precaution will need to be taken with existing catenary structures	With existing conditions the use of traditional cranes at ground level will be limited; consider erecting this section from above working from Honeywell St, using gantry cranes, launching the superstructure or using lateral slides; consider staging construction with the reconfiguration of the Amtrak yard	The Northwestern portion of Zone 4 has tracks however currently the majority of this zone is accessible by crane; it would be advantageous to cap this portion of the yard before Amtrak installs additional tracks	Currently Zone 5 is used primarily for storage and is accessible by crane; it would be advantageous to cap this portion of the yard before Amtrak builds additional tracks and facilities; the southern portion has high voltage power lines, but this hazard can be mitigated even using traditional crane erection procedures	Currently Zone 6 is used primarily for storage; the area is currently easily accessible by crane and it would be advantageous to cap this portion of the yard before Amtrak builds additional tracks; the southern portion has high voltage power lines, but this hazard can be mitigated	Limited track outages will be available to cap over the mainline tracks; traditional crane erection will be limited based on these windows; consideration should be given to gantry cranes which can allow progressive installation of the superstructure without the use of shoring towers below	Limited track outages will be available to cap over the loop tracks; traditional crane erection will be limited based on these windows; in the southern portion especially consideration should be given to gantry cranes which can allow progressive installation of the superstructure without the use of shoring towers below
Foundations	Shallow	Feasible however it is ideal to limit ground disturbance due to contaminated soil throughout the site	Not ideal due to proximity to tracks and contaminated soil on site	Tracks throughout the entirety of this zone prohibit the use of this foundation type	Tracks throughout portion of this zone prohibit the use of this foundation type	Feasible however it is ideal to limit ground disturbance due to contaminated soil throughout the site	Feasible however it is ideal to limit ground disturbance due to contaminated soil throughout the site	Tracks throughout the entirety of this zone prohibit the use of this foundation type	Tracks throughout the entirety of this zone prohibit the use of this foundation type
	Caissons	Currently feasible in this zone because of the open space available for staging	Currently feasible in this zone because of the open space available for staging	Are not feasible due to the space limitations between the tracks; this method will also fowl the tracks and ballast from spoilage from the augering; front end loaders and bins would need to be loaded on flat cars to remove spoilage from site	May be of limited use due to the proximity to tracks	Currently feasible in this zone because of the open space available for staging	Currently feasible in this zone because of the open space available for staging	Are not feasible due to the space limitations between the tracks; this method will also fowl the tracks and ballast from spoilage from the augering; there is a possibility that front end loads and dump trucks could be staged to the north to remove spoilage	Are not feasible due to the space limitations between the tracks; this method will also fowl the tracks and ballast from spoilage from the augering; there is a possibility that front end loads and dump trucks could be staged to the south to remove spoilage
	LBE (Barrette)	Are a feasible option, although the technique hasn't been completely embraced in New York City	Are a feasible option, although the technique hasn't been completely embraced in New York City	Are a feasible option, although the technique hasn't been completely embraced in New York City; this technique is especially useful in areas with tight headroom and limited	Are a feasible option, although the technique hasn't been completely embraced in New York City	Are a feasible option, although the technique hasn't been completely embraced in New York City	Are a feasible option, although the technique hasn't been completely embraced in New York City	Are a feasible option, although the technique hasn't been completely embraced in New York City; this technique is especially useful in areas with tight headroom and limited	Are a feasible option, although the technique hasn't been completely embraced in New York City; this technique is especially useful in areas with tight headroom and limited

				space to install deep foundations				space to install deep foundations	space to install deep foundations
TABLE 10 – CONSTRUCTABILITY EVALUATION MATRIX									
Zone		1	2	3	4	5	6	7	8
Columns/Piers		Some access challenges, including existing rail & catenary, for heavy equipment. Max track envelope spacing may limit design.	Some access challenges, including existing rail & catenary, for heavy equipment. Max track envelope spacing may limit design.	Significant access challenges, including existing rail & catenary, for heavy equipment. Max track envelope spacing may limit design. Longer spans will require larger columns.	Moderate access challenges, including existing rail & catenary, for heavy equipment. Max track envelope spacing may limit design. Longer spans will require larger columns.	Some access challenges, including existing rail & catenary, for heavy equipment. Max track envelope spacing may limit design.	Some access challenges, including existing rail & catenary, for heavy equipment. Max track envelope spacing may limit design.	Moderate access challenges, including existing rail & catenary, for heavy equipment. Max track envelope spacing may limit design. Longer spans will require larger columns.	Moderate access challenges, including existing rail & catenary, for heavy equipment. Max track envelope spacing may limit design. Longer spans will require larger columns.
Superstructure	Concrete	Some access challenges, including existing rail & catenary.	Some access challenges, including existing rail & catenary.	Significant access challenges for structure and erection. Will require innovative techniques to construct.	Moderate access challenges for structure and erection. Potential to launch some construction from Honeywell St. Bridge.	Some access challenges, including existing rail & catenary.	Some access challenges, including existing rail & catenary.	Moderate access challenges for structure and erection. Potential to launch some construction from Skillman Ave.	Moderate access challenges for structure and erection. Potential to launch some construction from Skillman Ave.
	Steel	Some access challenges, including existing rail & catenary.	Some access challenges, including existing rail & catenary.	Significant access challenges for structure placement and erection. Will require innovative techniques to construct.	Moderate access challenges for structure and erection. Potential to launch some construction from Honeywell St. Bridge.	Some access challenges, including existing rail & catenary.	Some access challenges, including existing rail & catenary.	Moderate access challenges for structure and erection. Potential to launch some construction from Skillman Ave.	Moderate access challenges for structure and erection. Potential to launch some construction from Skillman Ave.

[1] Traditional cranes are defined as tower, crawler and truck-mounted cranes for the purposed of this report

Level of Complexity:

Low   Moderate   High

APPENDIX A.5.A

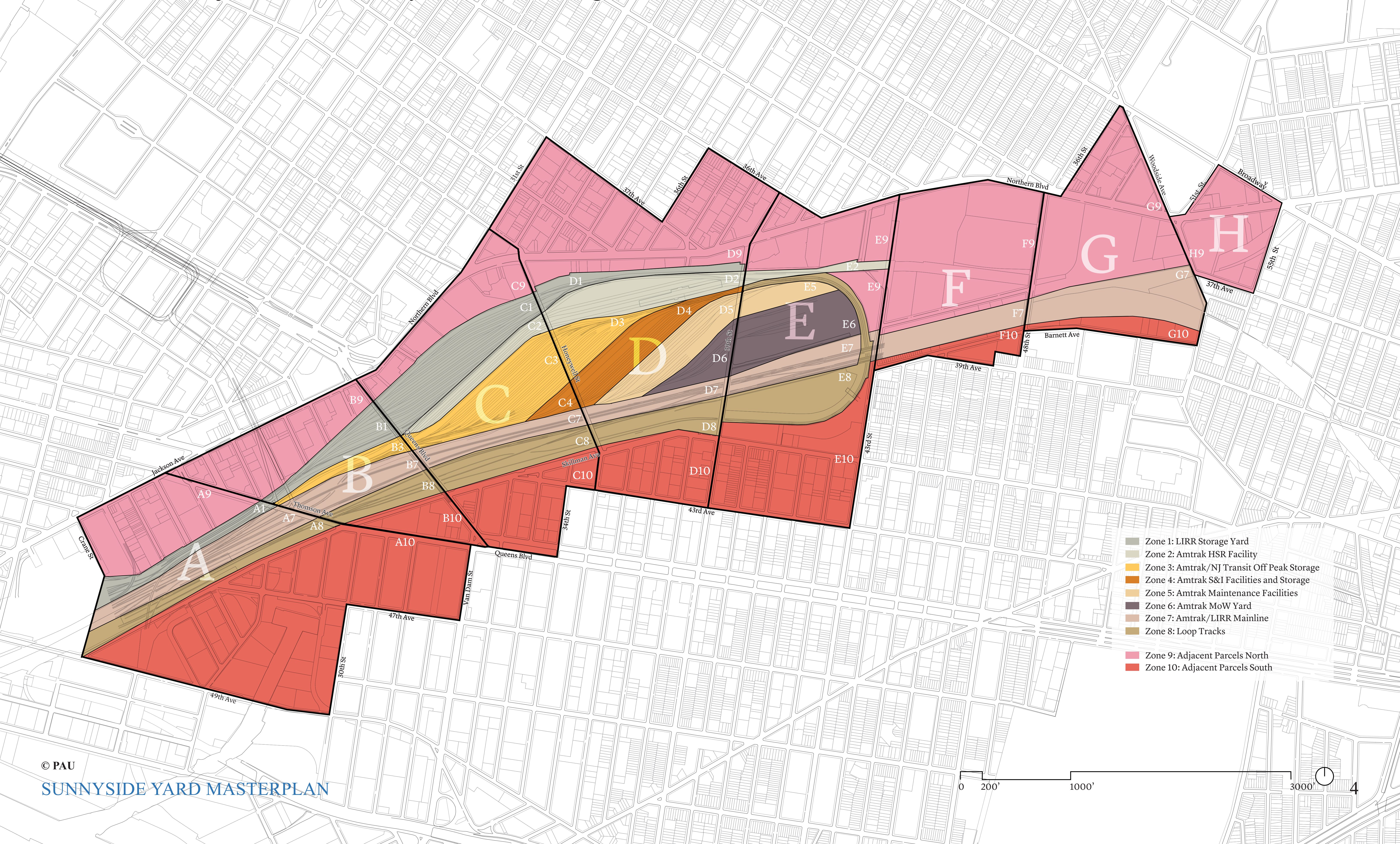
ZONE AND SECTOR MAPS

ATTACHMENT 1
ZONE MAP

1. LIRR STORAGE YARD
2. AMTRAK HSR FACILITIY
3. AMTRAK/NJ TRANSIT OFF PEAK STORAGE
4. AMTRAK S&I FACILITIES AND STORAGE
5. AMTRAK MAINTENANCE FACILITIES
6. AMTRAK MoW YARD
7. AMTRAK/LIRR MAINLINE
8. LOOP TRACKS
9. GM PROPERTY

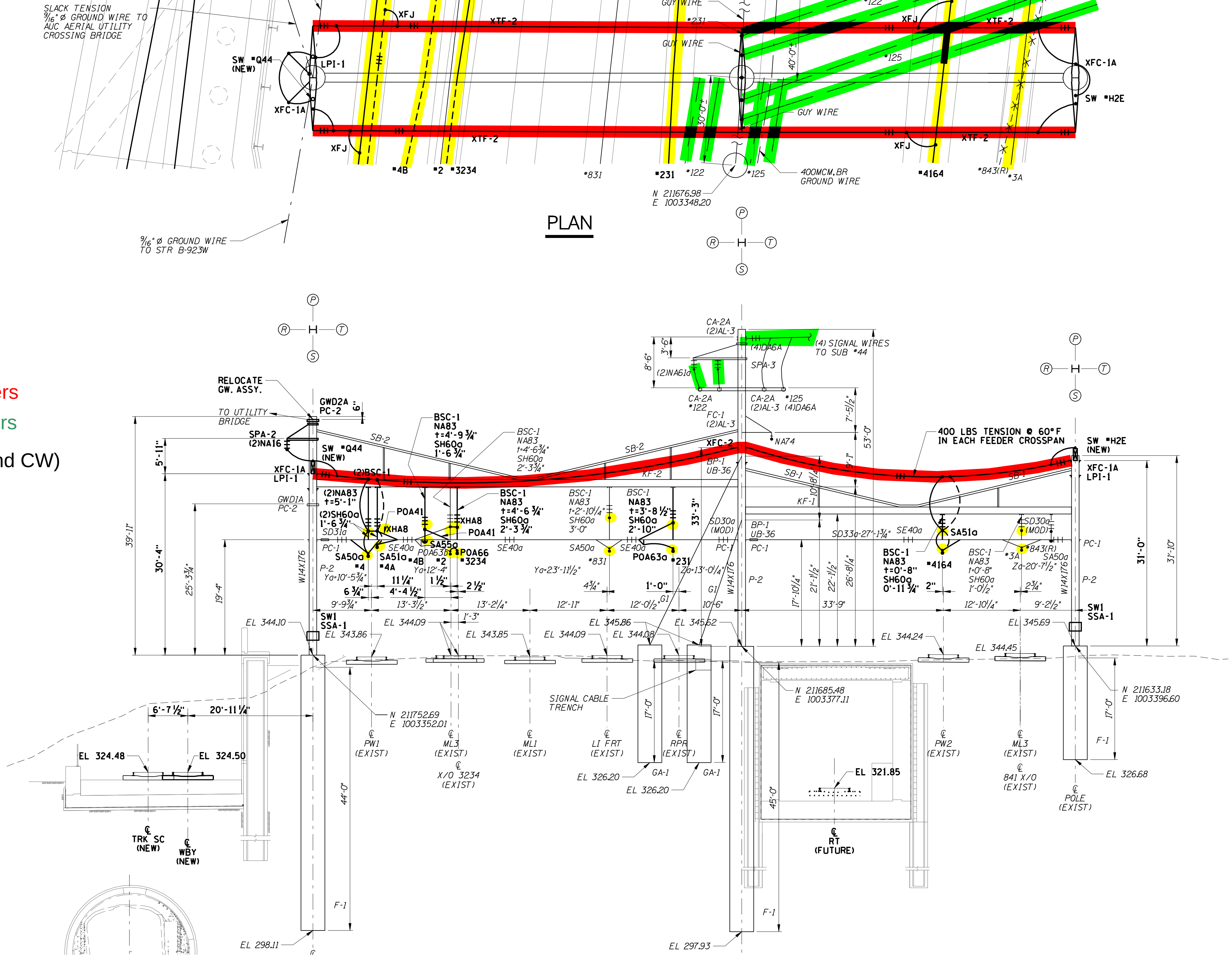
Master Plan Project Site Boundary - Subarea Designations

DRAFT - CONFIDENTIAL: DO NOT CIRCULATE



APPENDIX A.5.B

OCS AND SIGNAL STRUCTURES

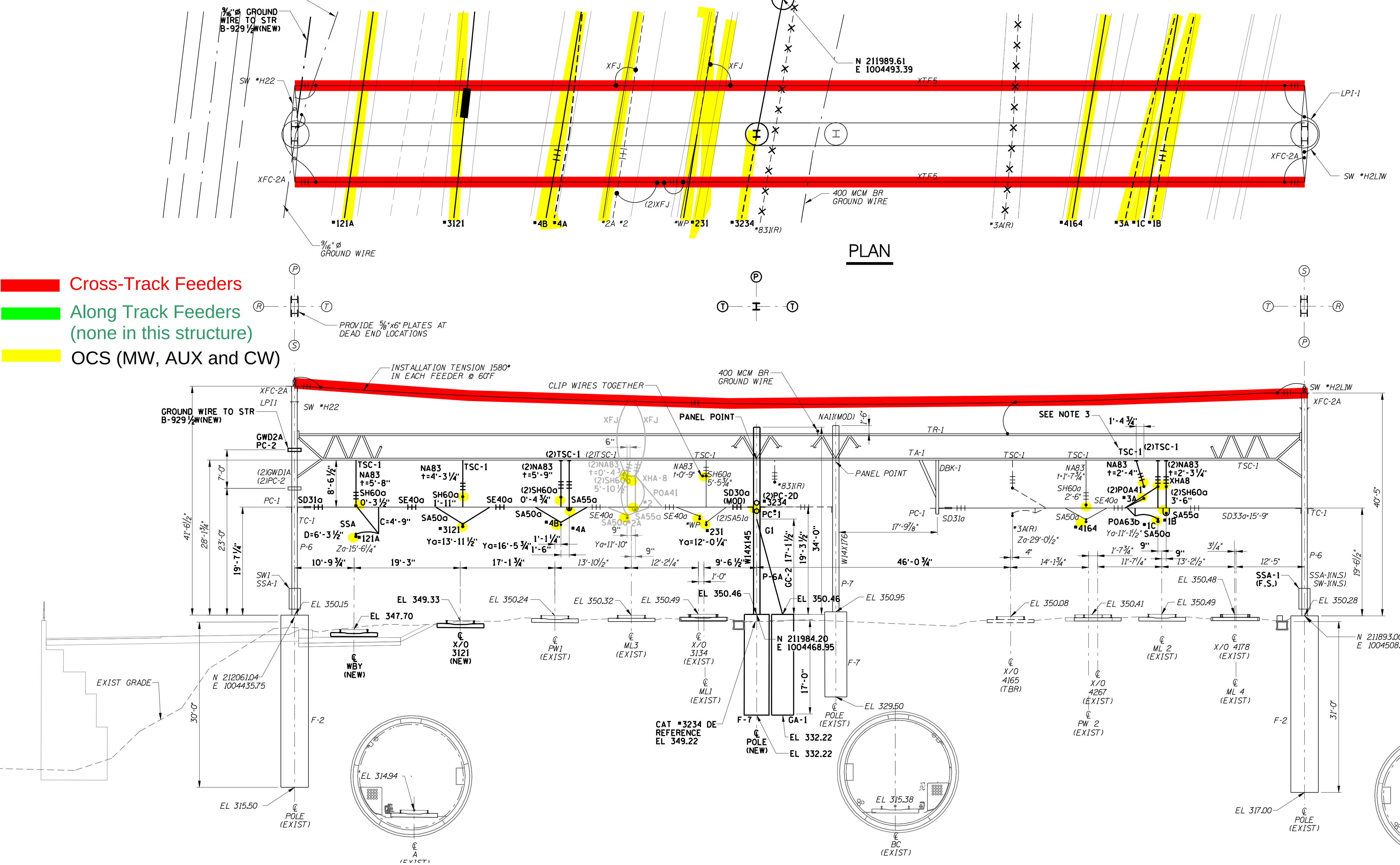


Cross-Track Feeders

Along Track Feeders

OCS (MW, AUX and CW)

SAMPLE K-FRAME OCS STRUCTURE



SAMPLE TRUSS OCS STRUCTURE

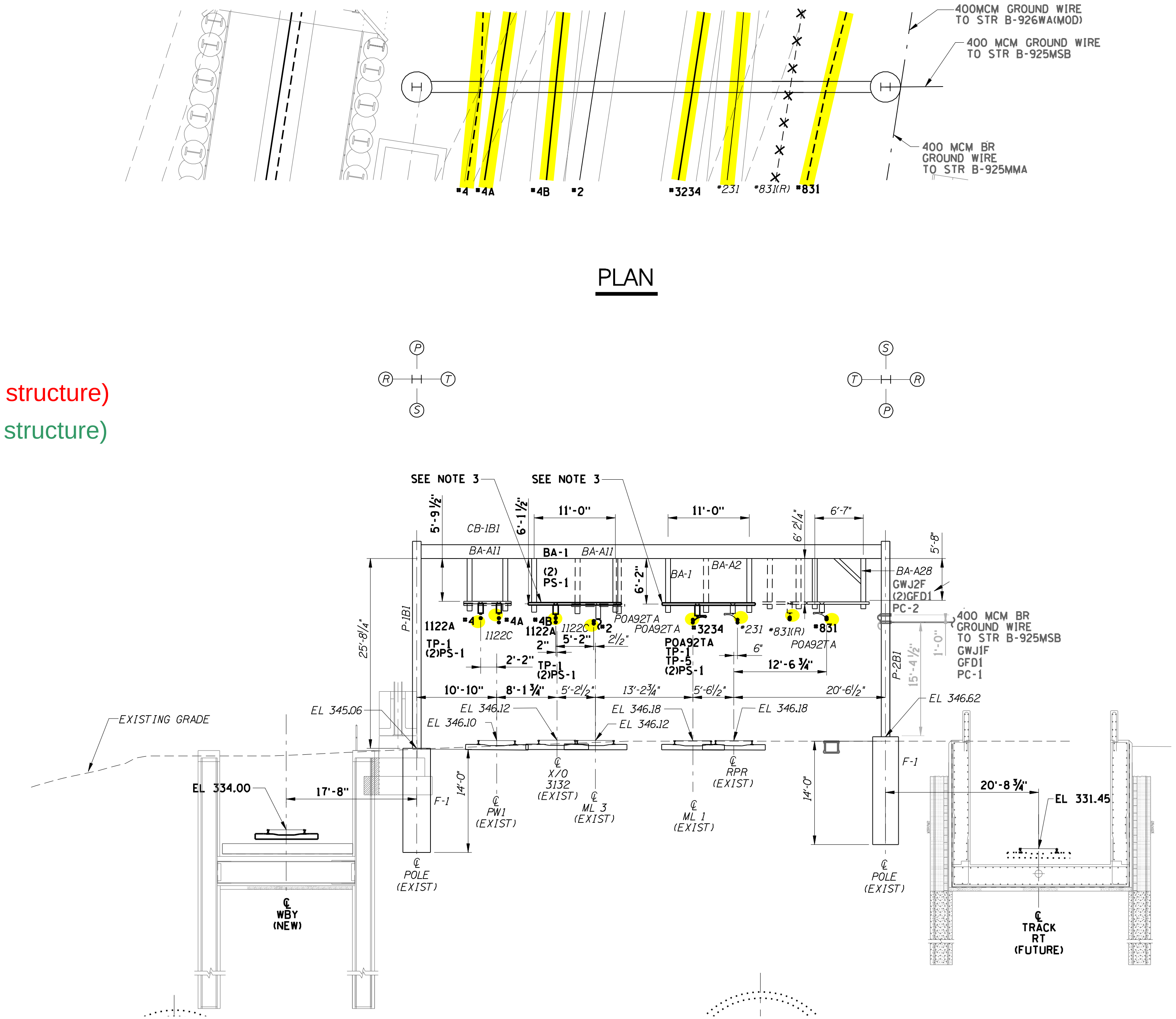
LOADING DIAGRAM

NTS

Cross-Track Feeders (None in this structure)

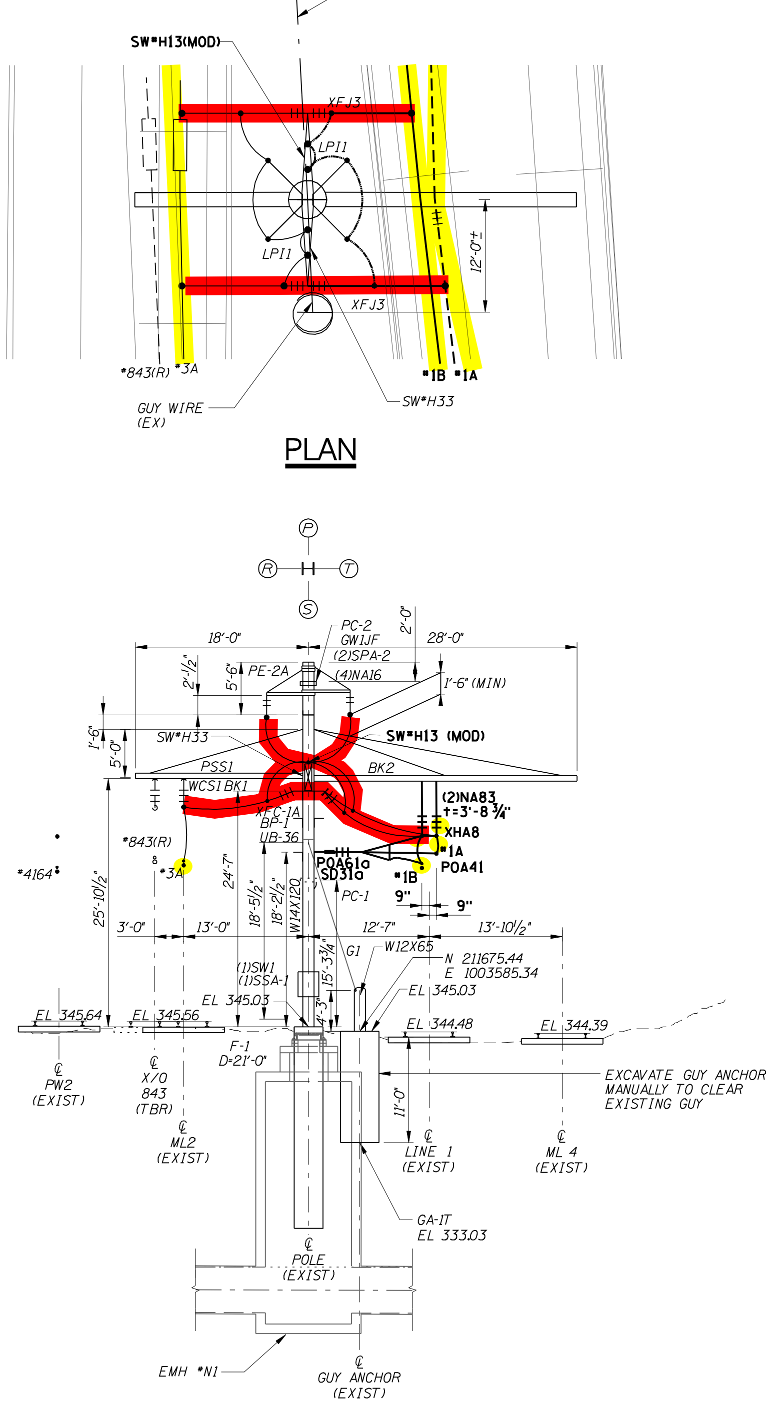
Along Track Feeders (None in this structure)

OCS (MW, AUX and CW)



HNTB

SAMPLE BEAM OCS STRUCTURE



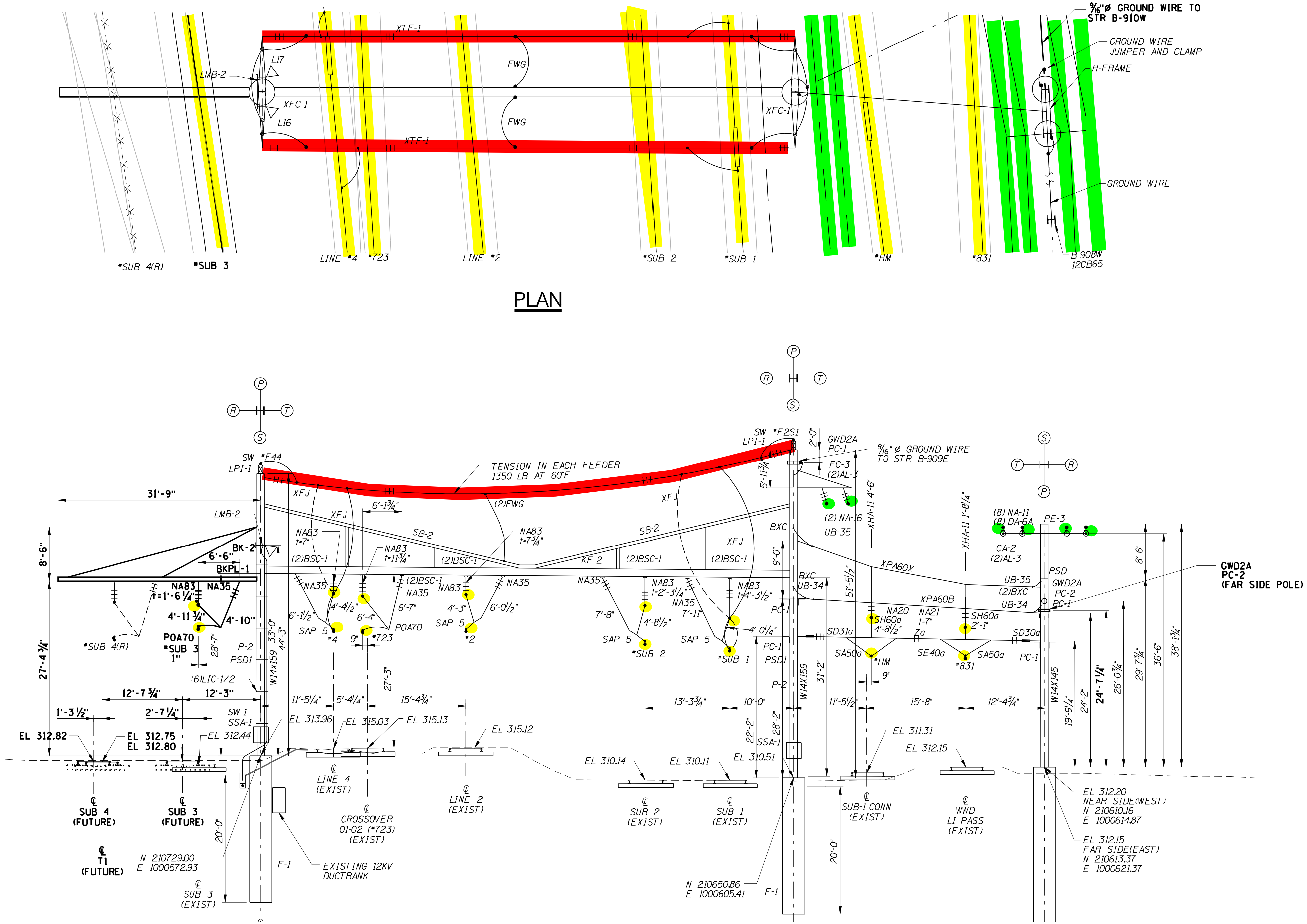
Cross-Track Feeders

Along Track Feeders (None in this structure)

OCS (MW, AUX and CW)

HNTB

SAMPLE DOUBLE CANTILEVER OCS STRUCTURE



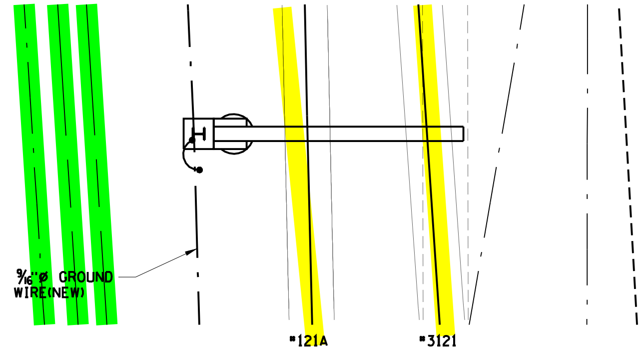
Cross-Track Feeders

Along Track Feeders

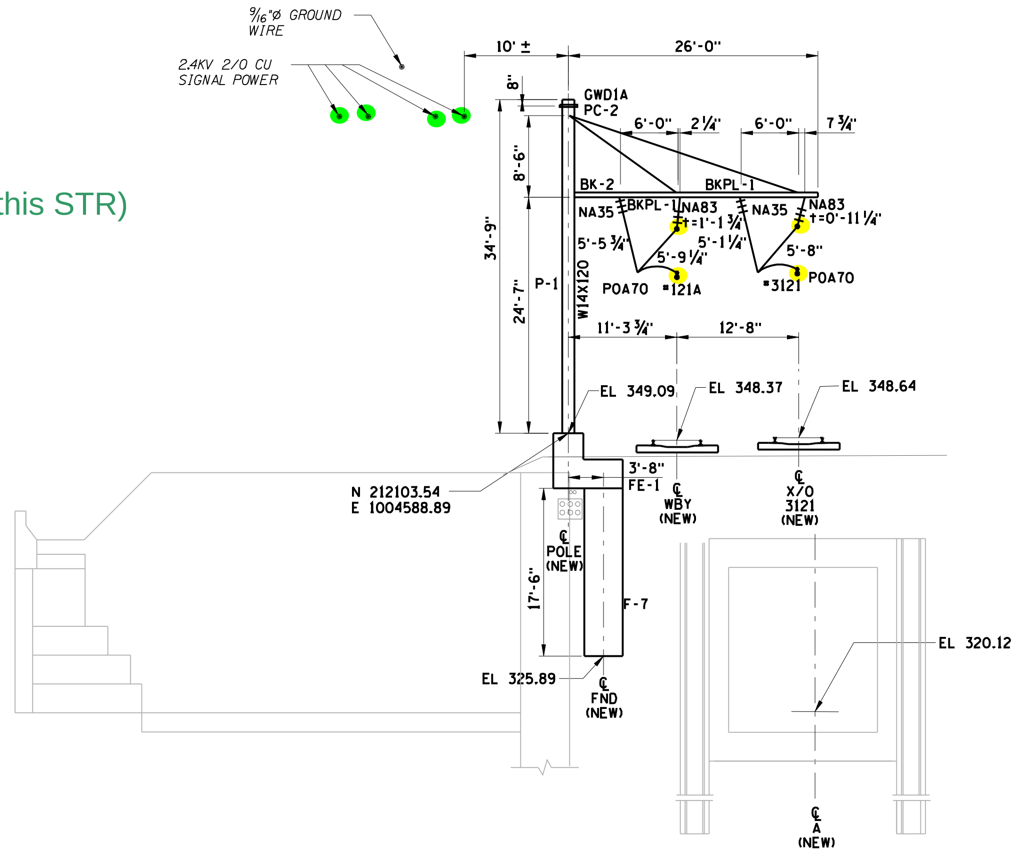
OCS (MW, AUX and CW)

HNTB

SAMPLE CANTILEVER+K-FRAME+CROSS CATENARY OCS STRUCTURE



PLAN



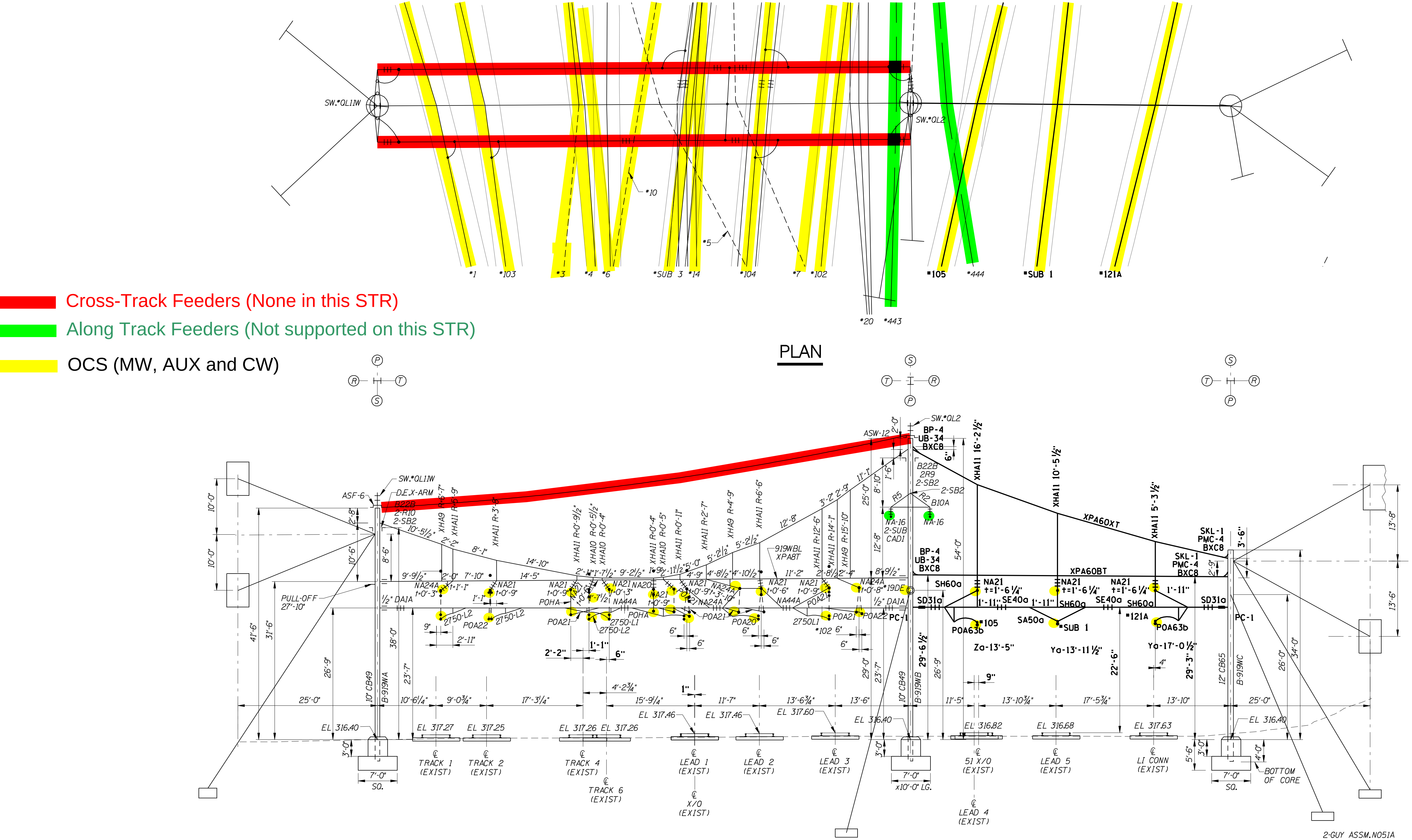
Cross-Track Feeders (None in this STR)

Along Track Feeders (Not supported on this STR)

OCS (MW, AUX and CW)

HNTB

SAMPLE CANTILEVER OCS STRUCTURE

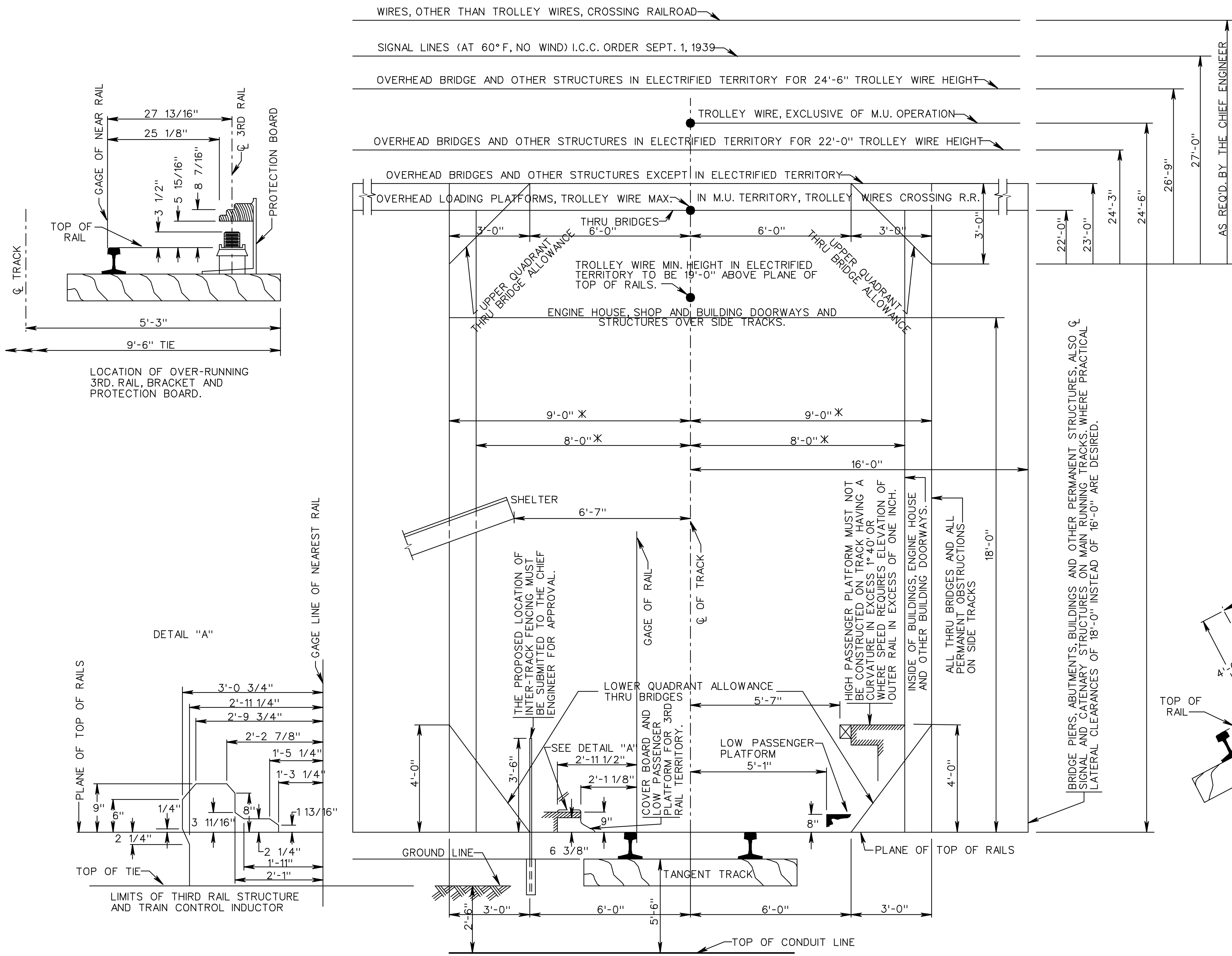


HNTB

SAMPLE CROSS CATENARY OCS STRUCTURE

APPENDIX A.5.C

AMTRAK AND LIRR CLEARANCE DIAGRAMS



NOTES:

CLEARANCE REQUIREMENTS SHOWN ON THIS PLAN APPLY ONLY TO NEW CONSTRUCTION OR RECONSTRUCTION. EXISTING STRUCTURES AND TRACKS MAY BE MAINTAINED AND EXTENDED AT PRESENT CLEARANCES. UNLESS OTHERWISE REQUIRED BY LOCAL OR STATE AUTHORITIES.

STRUCTURES MUST NOT BE LOCATED NEARER TO THE TRACK THAN THE MINIMUM CLEARANCE LIMITS SHOWN ON THIS PLAN AND THESE DISTANCES SHOULD BE EXCEEDED WHERE POSSIBLE. CONSIDERATION SHOULD BE GIVEN TO THE PROBABILITY OF INCREASED DISTANCE BETWEEN TRACK CENTER LINES. WIDENING ROADBED SHOULDERS AND WIDENING AND DEEPENING DITCHES, AND THE STRUCTURES SHOULD BE LOCATED ACCORDINGLY.

FOR STANDARD DISTANCES BETWEEN TRACK CENTER LINES AND THE SPACING OF TRACKS WHERE INTERTRACK CLEARANCE - LIMITING OBJECTS ARE LOCATED, SEE MW-1000 SPECIFICATIONS FOR INSPECTION, CONSTRUCTION AND MAINTENANCE OF TRACK

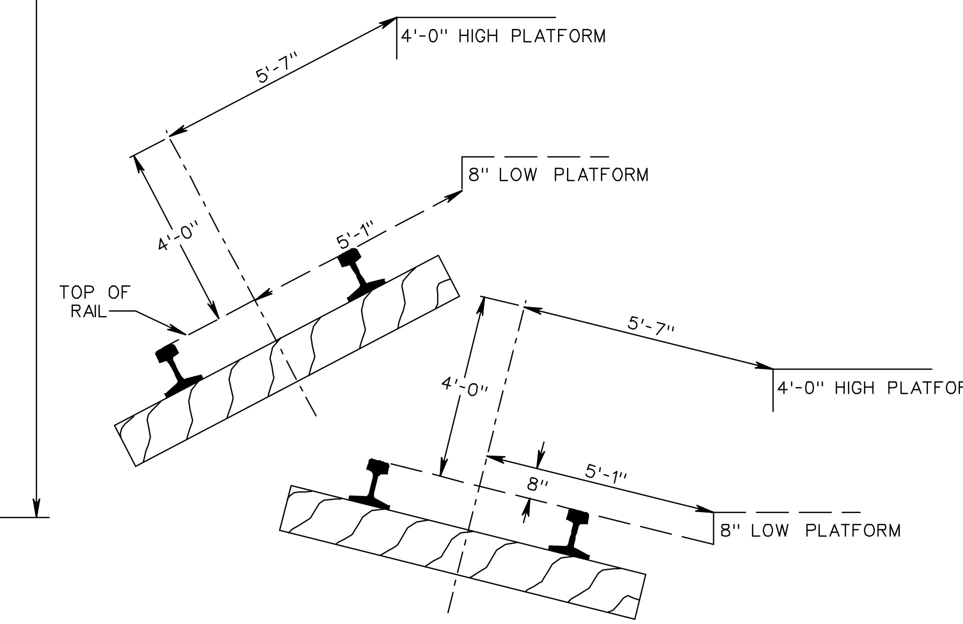
WHERE PHYSICAL CONDITIONS IMPOSE INSURMOUNTABLE RESTRICTIONS, NECESSITATING CLEARANCES CLOSER THAN THOSE SPECIFIED. THE MATTER MUST BE SUBMITTED TO THE CHIEF ENGINEER FOR ANY MODIFICATIONS, AND ALSO TO THE LOCAL OR STATE AUTHORITIES IF NECESSARY.

MINIMUM CLEARANCES SHOWN ON THIS PLAN ARE FOR TANGENT LEVEL TRACK.

FOR CURVED TRACK THE FOLLOWING PROVISIONS APPLY.

VERTICAL - MEASURED VERTICALLY ABOVE HIGH RAIL EXCEPT FOR PASSENGER AND FREIGHT PLATFORMS WHICH ARE MEASURED PERPENDICULAR TO THE PLANE OF TOP OF RAIL.

LATERAL - OUTSIDE AND INSIDE CLEARANCES SHALL BE MEASURED RADIALLY AND (EXCEPT FOR LOW PASSENGER PLATFORMS ON CURVES 13° OR LESS) HORIZONTALLY AND INCREASED BY 1 1/2 INCHES PER DEGREE OF CURVATURE OVER THAT SHOWN FOR TANGENT TRACK (EXCEPT LOW PASSENGER PLATFORMS ON CURVES 13° OR LESS). IN ADDITION, THE INSIDE CLEARANCE FOR SUPER ELEVATED TRACK SHALL BE FURTHER INCREASED BY 1 INCH FOR EACH 1 INCH OF SUPERELEVATION FOR EACH 5 FEET OF HEIGHT ABOVE TOP OF LOW RAIL.



VERTICAL MEASUREMENT ON CURVED TRACK

⁎ FOR STATE CLEARANCE REQUIREMENTS, SEE A.R.E.M.A. MANUAL, CHAPTER 28, SECTION 3.6, LEGAL CLEARANCE REQUIREMENTS BY STATES.

Amtrak®

OFFICE OF THE
CHIEF ENGINEER OF TRACK

Phila., PA Date: April 20, 2000 Approved: [signature]

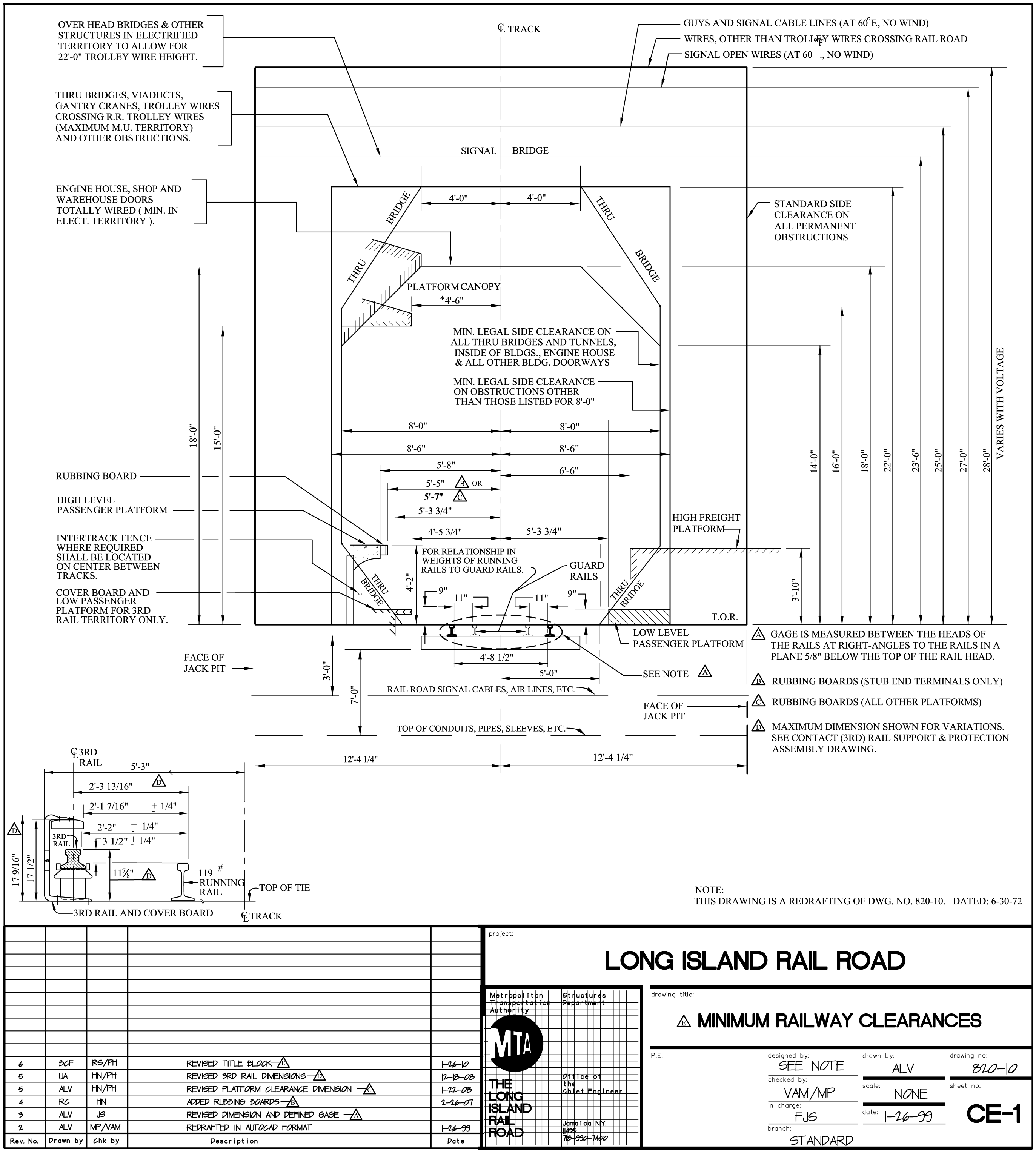
No.	Revisions	Date	By

STANDARD TRACK PLAN
MINIMUM ROADWAY CLEARANCES

Designed: Amtrak | Drawn: TDI-SLC | Checked: NJS | Date: 5-11-99

Dwg. No. AM70050G

Sheet No. 1 of 1



Long Island Rail Road
Minimum Railway Clearances Plan

NOTES:

THE MINIMUM CLEARANCE LIMITS PRESCRIBED BY THIS PLAN AND THESE DISTANCES SHOULD BE EXCEEDED WHERE POSSIBLE. STRUCTURES MUST NOT BE LOCATED NEARER TO TRACK THAN

MINIMUM CLEARANCES:

FOR TANGENT TRACK	SHALL BE SHOWN ON THIS PLAN.
FOR CURVED TRACK	ARE THE SAME AS SHOWN FOR TANGENT TRACK
ABOVE TOP OF RAIL	MEASURED VERTICALLY FROM TOP OF WHICH SHALL BE MEASURED FROM TOP OF NEAREST RAIL. OF HIGH RAIL. EXCEPT PASSENGER AND FREIGHT PLATFORMS. THE HEIGHT
SIDE CLEARANCE (MEASURED RADIALLY) — OUTSIDE:	ON THE OUTSIDE OF CURVED TRACK. SIDE CLEARANCES SHALL BE MEASURED HORIZONTALLY FROM THE GAGE OF NEAREST RAIL AND BE INCREASED BY 1 INCH PER DEGREE OF CURVATURE; OVER THAT SHOWN FOR TANGENT TRACK.
SIDE CLEARANCE (MEASURED RADIALLY) — INSIDE:	ON THE INSIDE OF CURVED TRACK SIDE CLEARANCES SHALL BE MEASURED HORIZONTALLY FROM THE GAGE OF NEAREST RAIL AND BE INCREASED BY 1 INCH PER DEGREE OF CURVATURE, OVER THAT SHOWN FOR TANGENT TRACK TO WHICH MUST ALSO BE ADDED TO THE AMOUNT OF SUPER ELEVATION OF THE HIGH RAIL ABOVE THE LOW RAIL.

CLEARANCE REQUIREMENTS SET FORTH ON THIS PLAN SHALL APPLY ONLY TO NEW CONSTRUCTION OR RECONSTRUCTION. STRUCTURES AND TRACKS CONSTRUCTED PRIOR TO APRIL 1, 1961. MAY BE MAINTAINED AND EXTENDED AT THE EXISTING CLEARANCE. OF THE RAIL ROAD LAW EFFECTIVE APRIL 1, 1961. THE FOLLOWING SIDE CLEARANCE ARE INCLUDED IN SECTION 51-A

MIN. C TO C DISTANCE FOR PARALLEL MAIN TRACKS	13'-6"	C TO C
MIN. C TO C DISTANCE YARD AND SIDE TRACKS	13'-6"	C TO C
ALL TRACKS PARALLEL TO MAIN OR PASSING TRACKS	15'-0"	C TO C
LADDER TRACKS TO ADJACENT TRACKS	18'-0"	C TO C
PARALLEL LADDER TRACKS	19'-0"	C TO C
PARALLEL TEAM TRACKS AND HOUSE TRACKS	13'-6"	C TO C

PLATFORM CANOPY CLEARANCE OF 4'-6" MAY BE USED ONLY IF RESTRICTIONS AGAINST RIDING ON THE SIDE OR TOP OF CARS AT THE LOCATION OF THE CANOPY ARE LISTED IN THE CURRENT TIME-TABLE UNDER SPECIAL INSTRUCTIONS.

Rev. No.	Drawn by	Chk by	Description	Date

project: LONG ISLAND RAIL ROAD

Metropolitan Transportation Authority — Structures Department

THE LONG ISLAND RAIL ROAD — Office of the Chief Engineer, Jamaica N.Y. 11435, 718-990-7400

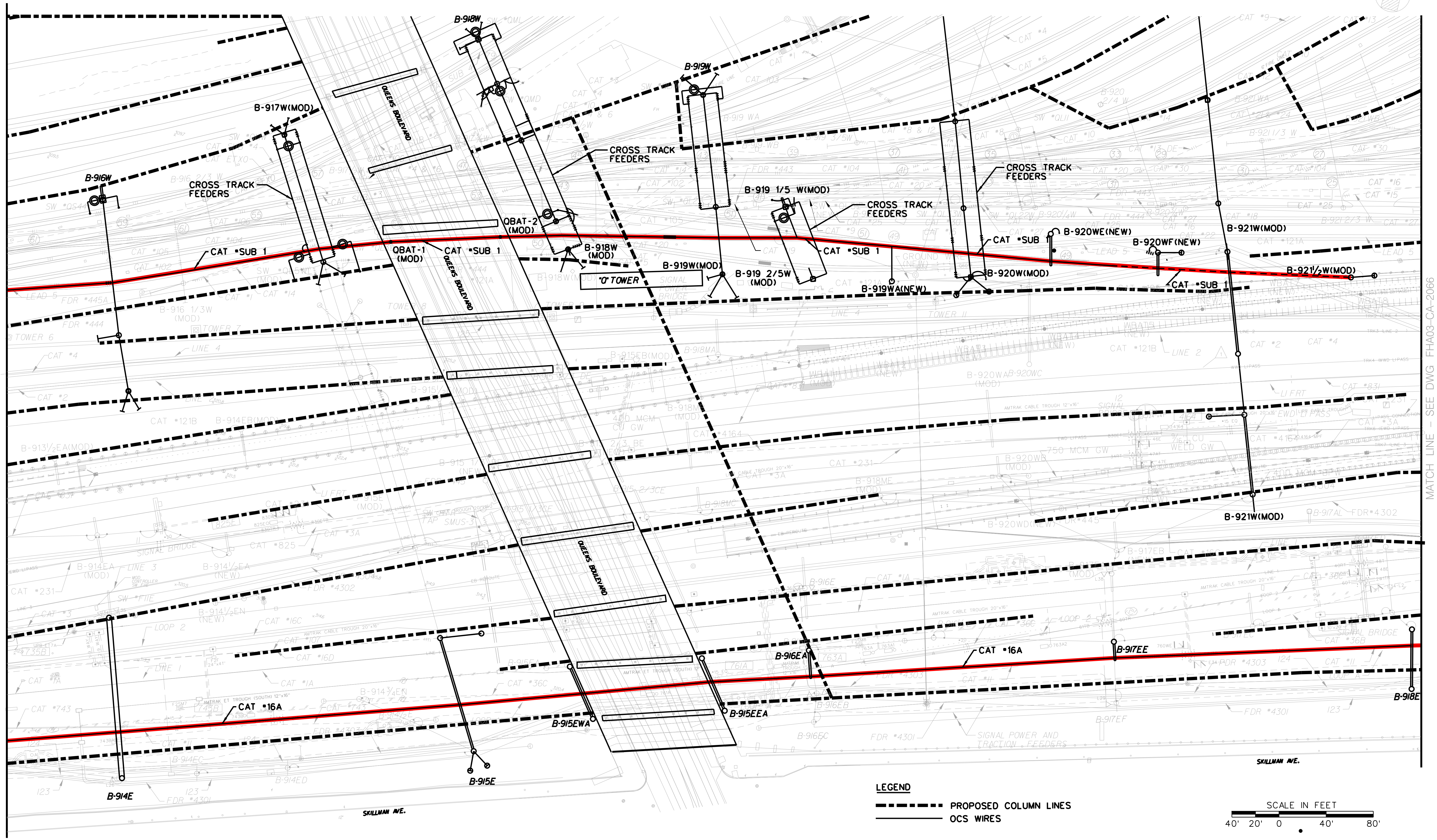
drawing title: MINIMUM RAILWAY CLEARANCES

P.E.

designed by: SEE NOTE	drawn by: ALV	drawing no: 820-10
checked by: VAM/MP	scale: NONE	sheet no: CE-1
in charge: FJS	date: 1-26-99	
branch: STANDARD		

APPENDIX A.5.D

PROPOSED AMTRAK OCS CLEARANCES



					DESIGNED BY: JMS
					DRAWN BY: JMS
					CHECKED BY:
					APPROVED BY:
DATE	DESIGNED BY	CHECKED BY	APPROVED BY	REV. NO.	

HNTB

350 5TH AVENUE, 57TH FLOOR
NEW YORK, NY 10118

NYCEDC

SUNNYSIDE YARD MASTERPLAN
LAYOUT PLAN – #SUB1 & #16A OCS WIRES

SCALE:

FILE NAME: OCS.QB.1

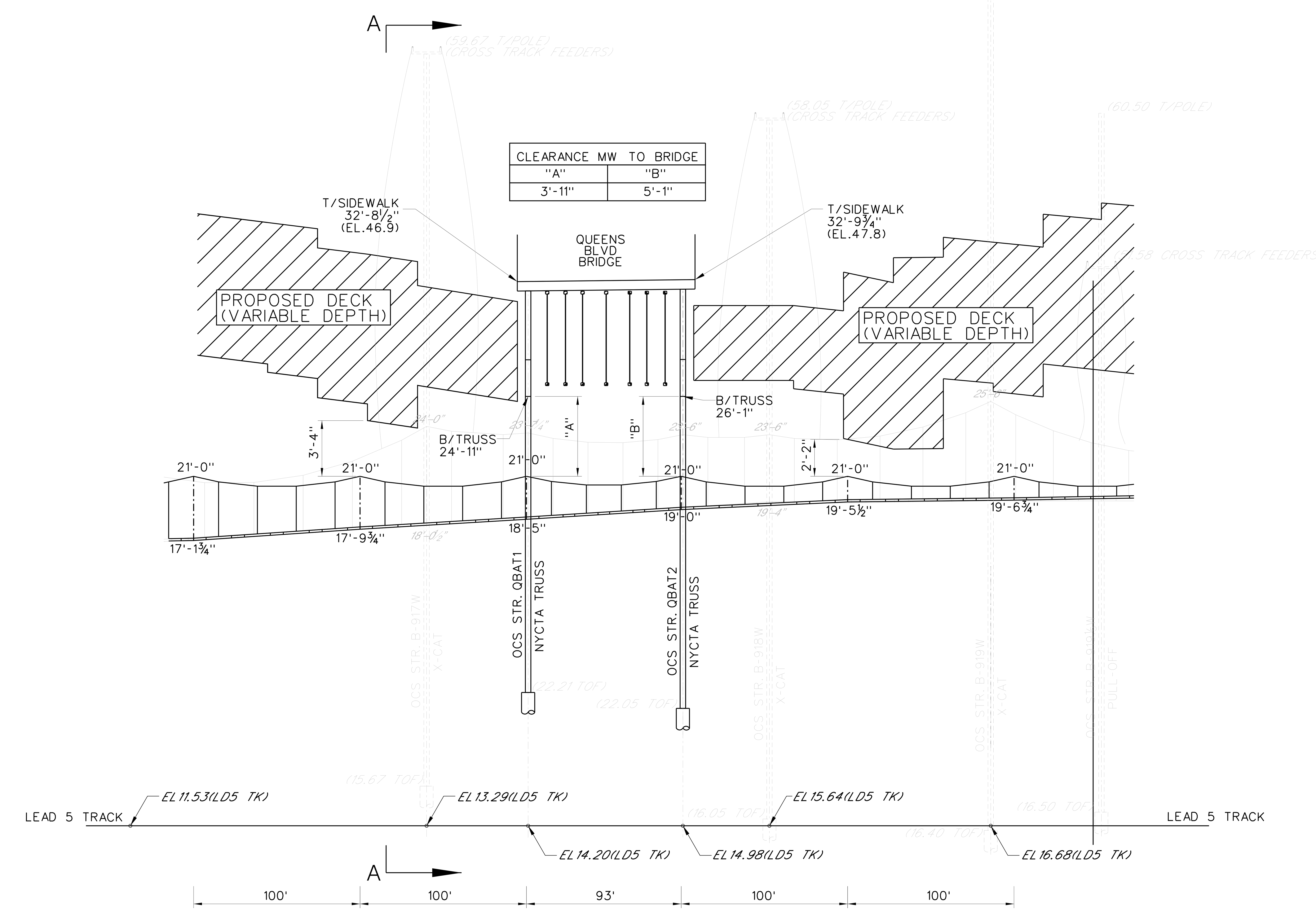
REV. NO.

CONTRACT NO. –

DATE DEC. 7, 2018

DRAWING NO.

SHEET 1 OF 6



PROPOSED CATENARY SUB#1 (LEAD 5 TRACK)

VERTICAL
SCALE IN FEET
4' 2' 0 4' 8'

HORIZONTAL
SCALE IN FEET
40' 20' 0 40' 80'

NOTES:
1. WIRE ELEVATIONS PROVIDED MEASURED FROM TOP OF RAIL.
2. BOLD LINEWORK AND TEXT INDICATES REPROFILED CATENARY RUN.
3. GRAY LINE INDICATES EXISTING CATENARY PROFILE AND HARDWARE.
4. THE CATENARY WIRE PROFILE IS SHOWN FOR A 60°F TEMPERATURE/TENSION PROFILE CONDITION.

NO.	DATE	DESIGNED BY	CHECKED BY	APPROVED BY	REV. NO.

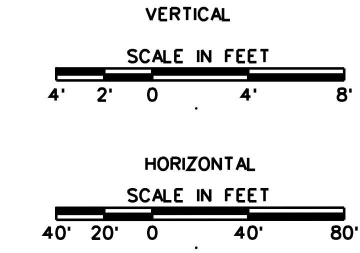
DESIGNED BY: JMS
DRAWN BY: JMS
CHECKED BY:
APPROVED BY:

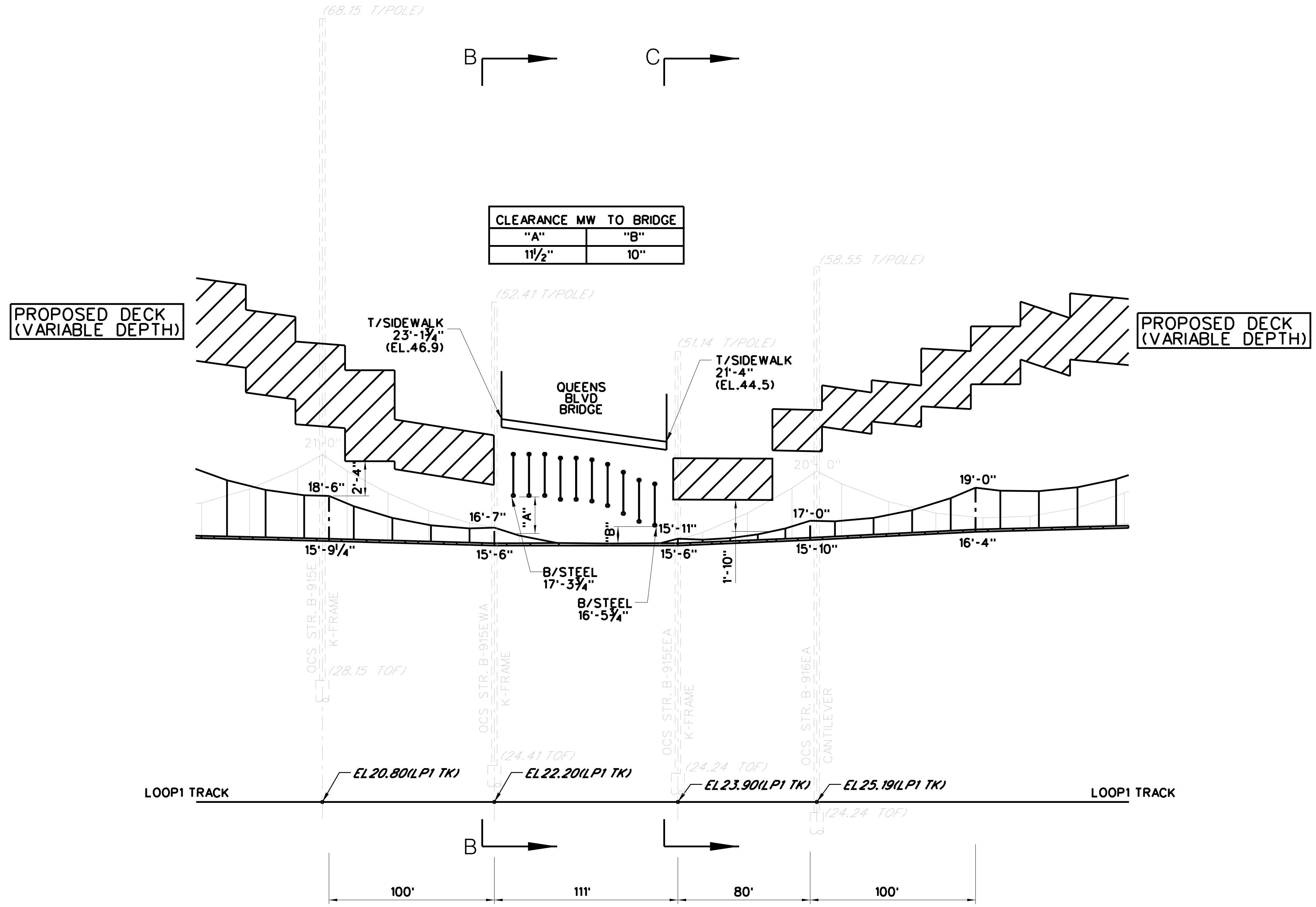
HNTB
350 5TH AVENUE, 57TH FLOOR
NEW YORK, NY 10118

NYCEDC
SUNNYSIDE YARD MASTERPLAN
SUB#1 PROPOSED OCS PROFILE (2 of 2)

SCALE:
FILE NAME: OCS.QB.2
REV. NO.

CONTRACT NO. –
DATE DEC. 7, 2018
DRAWING NO.





PROPOSED CATENARY 16A (LOOP 1 TRACK)

NOTES:
1. WIRE ELEVATIONS PROVIDED MEASURED FROM TOP OF RAIL.
2. BOLD LINEWORK AND TEXT INDICATES REPROFILED CATENARY RUN.
3. GRAY LINE INDICATES EXISTING CATENARY PROFILE AND HARDWARE.
4. THE CATENARY WIRE PROFILE IS SHOWN FOR A 60°F TEMPERATURE/TENSION PROFILE CONDITION.

NO.	DATE	DESIGNED BY	CHECKED BY	APPROVED BY	REV. NO.

DESIGNED BY: JMS
DRAWN BY: JMS
CHECKED BY:
APPROVED BY:

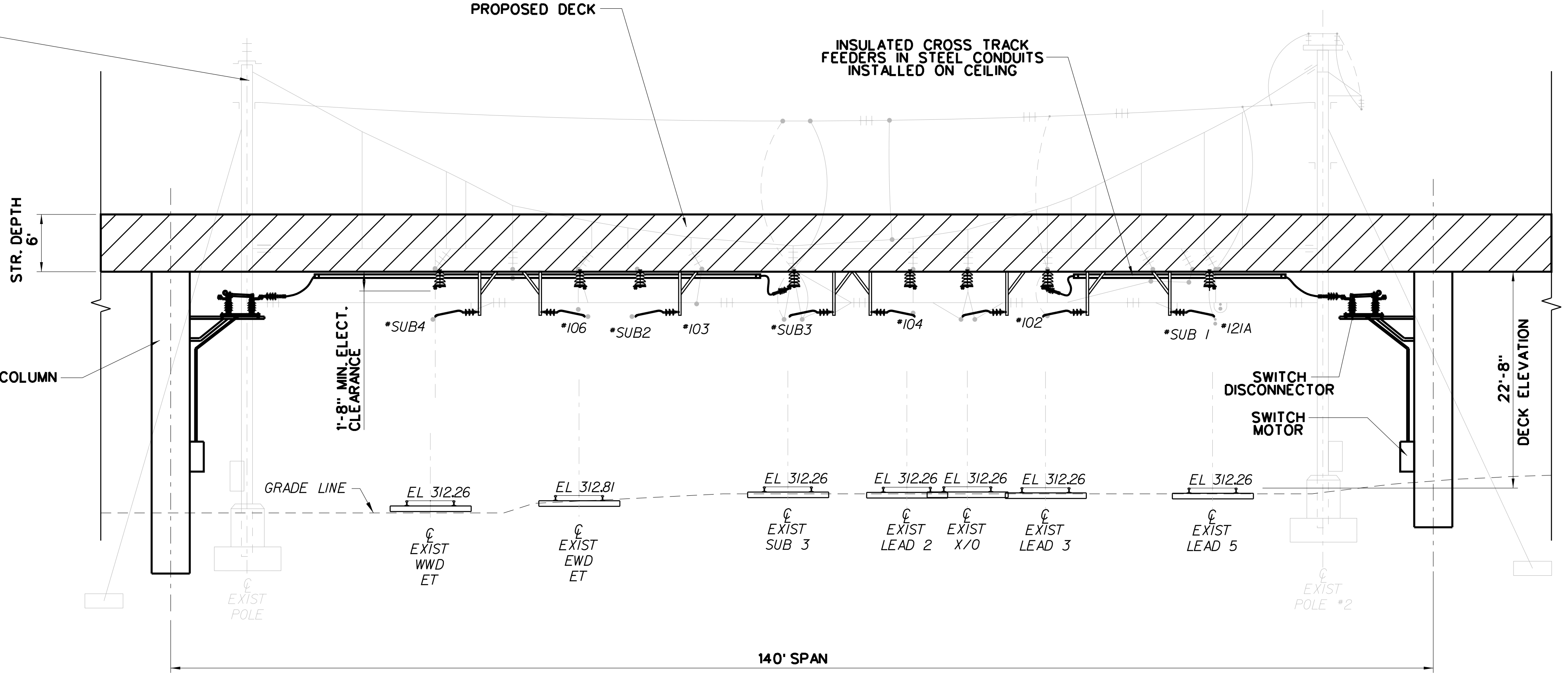
HNTB
350 5TH AVENUE, 57TH FLOOR
NEW YORK, NY 10118

NYCEDC

SUNNYSIDE YARD MASTERPLAN
SUB#1 PROPOSED OCS PROFILE (2 of 2)

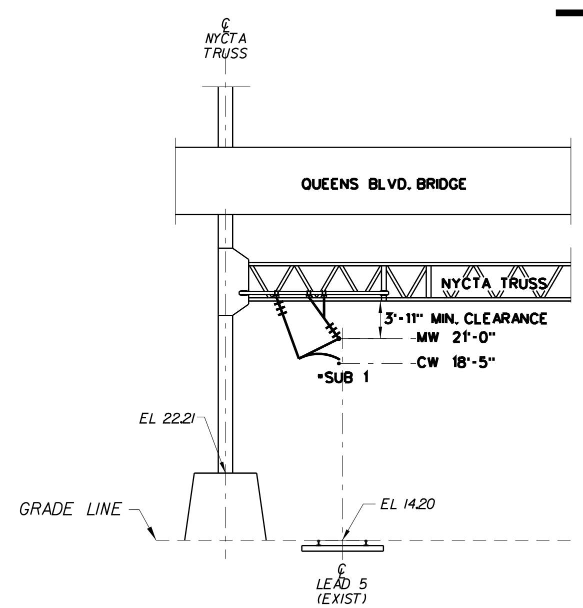
SCALE:
FILE NAME: OCS.QB.3
REV. NO.

CONTRACT NO. —
DATE DEC. 7, 2018
DRAWING NO.



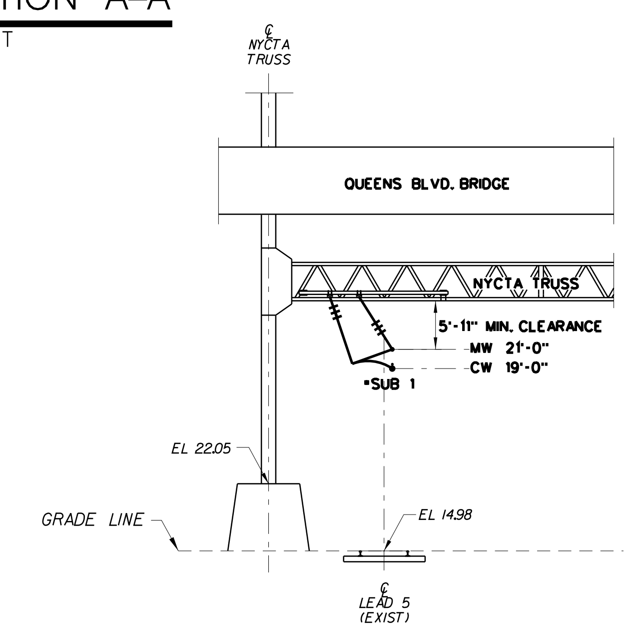
PROPOSED SECTION A–A

LOOKING EAST



PROPOSED STRUCTURE QBAT–1(MOD)

LOOKING EAST



STRUCTURE QBAT–2(MOD)

LOOKING EAST

SCALE IN FEET

10' 5' 0 10' 20'

NO.	DATE	DESIGNED BY	CHECKED BY	APPROVED BY	REV. NO.

DESIGNED BY: JMS

DRAWN BY: JMS

CHECKED BY:

APPROVED BY:

HNTB

350 5TH AVENUE, 57TH FLOOR
NEW YORK, NY 10118

NYCEDC

SUNNYSIDE YARD MASTERPLAN
SAMPLE PROPOSED SECTIONS FOR WIRE #SUB1

SCALE:

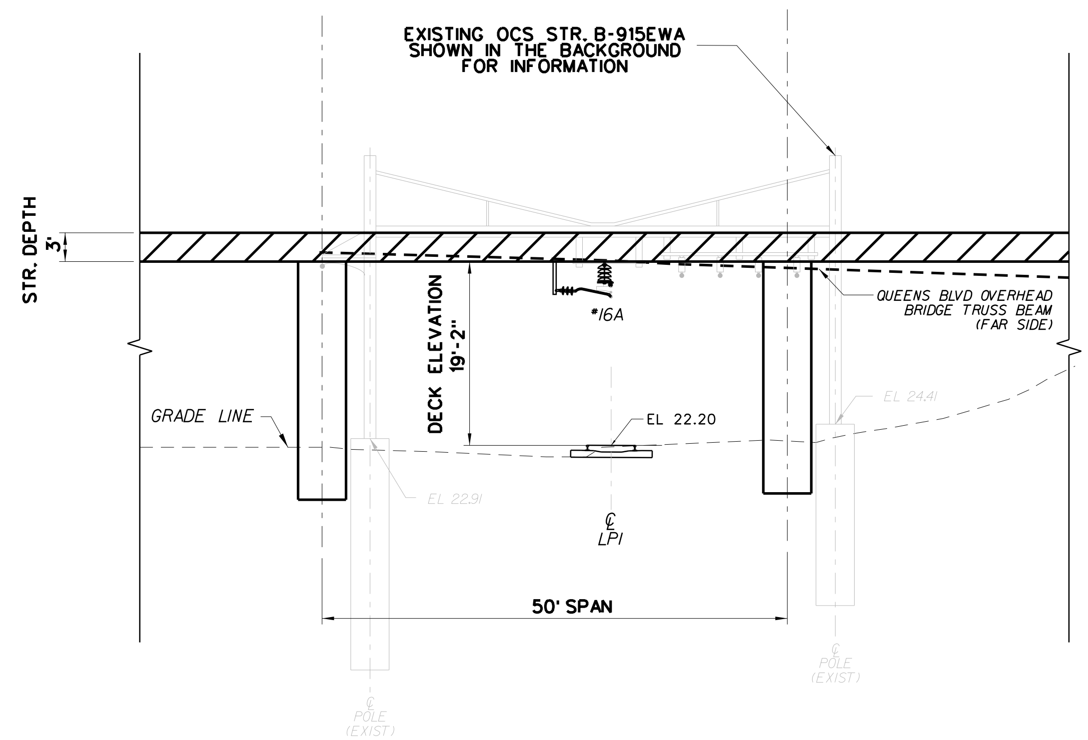
FILE NAME: OCS.QB.4

REV. NO.

CONTRACT NO. –

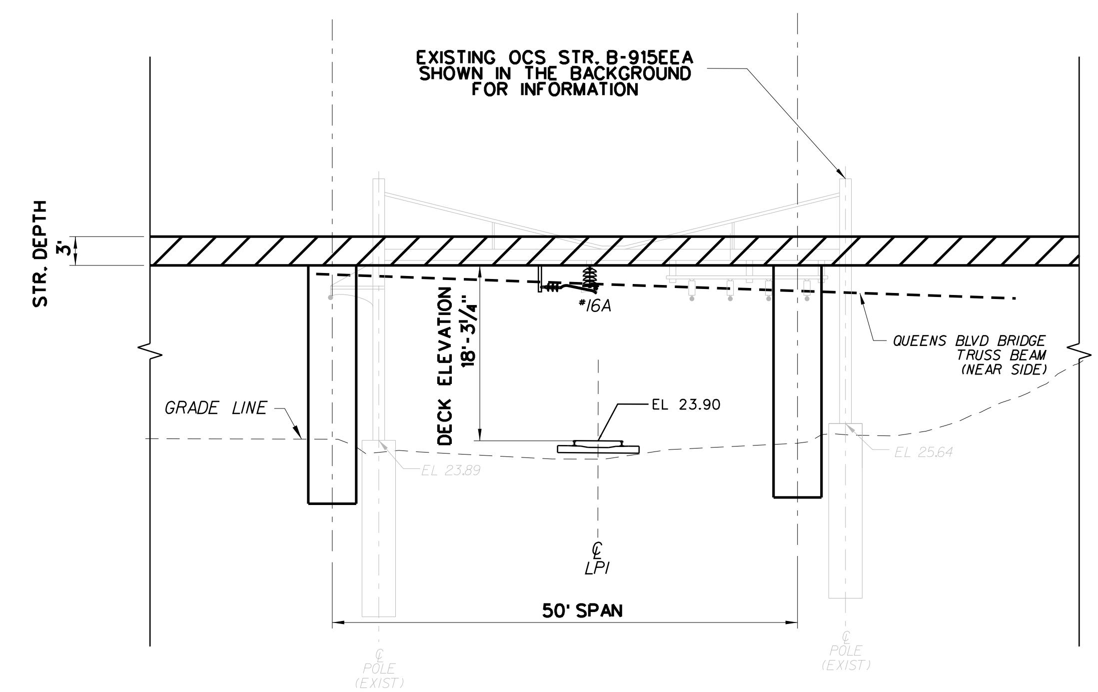
DATE DEC. 5, 2018

DRAWING NO.



PROPOSED SECTION B–B

LOOKING EAST



PROPOSED SECTION C–C

LOOKING EAST

SCALE IN FEET

10' 5' 0 10' 20'

NO.	DATE	DESIGNED BY	CHECKED BY	APPROVED BY	REV. NO.

DESIGNED BY: JMS
DRAWN BY: JMS
CHECKED BY:
APPROVED BY:

HNTB
350 5TH AVENUE, 57TH FLOOR
NEW YORK, NY 10118

NYCEDC

SUNNYSIDE YARD MASTERPLAN
SAMPLE PROPOSED SECTIONS FOR WIRE #16A

SCALE:
FILE NAME: OCS.QB.5
REV. NO.

CONTRACT NO. –
DATE DEC. 5, 2018
DRAWING NO.

Penn Station - 12kV Sectionalizing

NO.	DATE	DESIGNED BY	CHECKED BY	APPROVED BY	REV. NO.

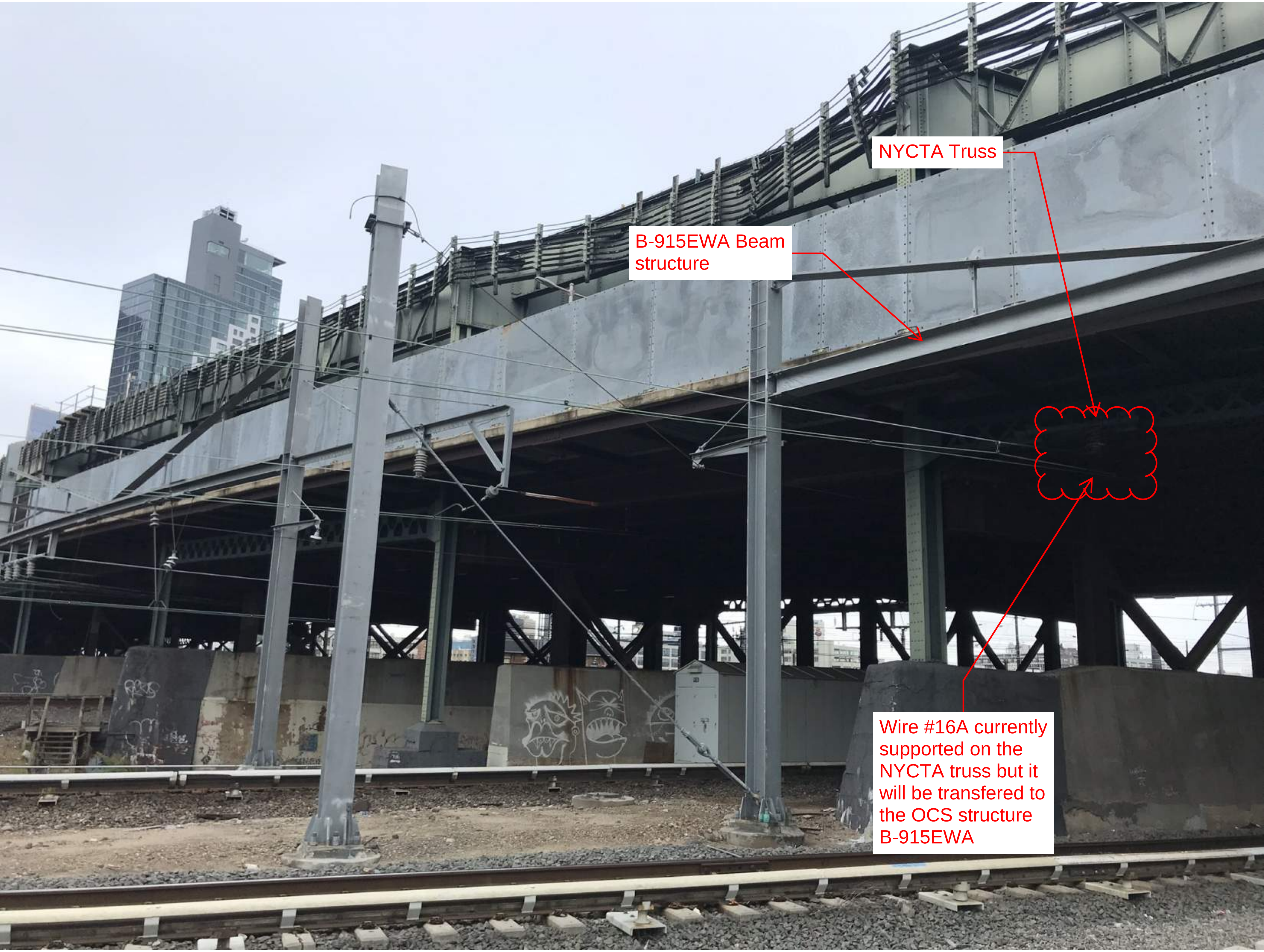
DESIGNED BY: JMS
DRAWN BY: JMS
CHECKED BY:
APPROVED BY:

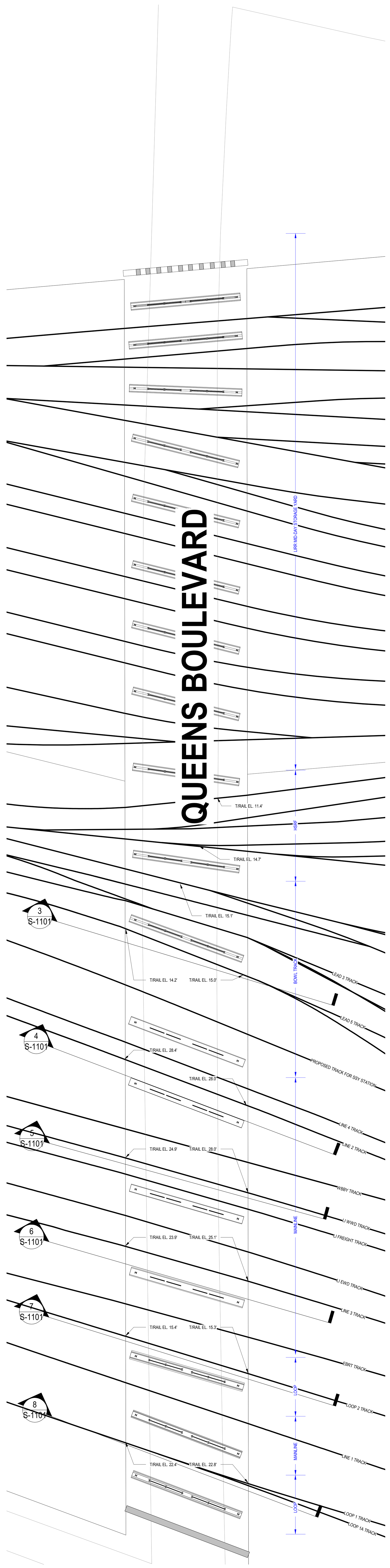
HNTB
350 5TH AVENUE, 57TH FLOOR
NEW YORK, NY 10118

NYCEDC
SUNNYSIDE YARD MASTERPLAN
SAMPLE PHOTO FOR FEEDERS INSTALLED ON CEILING

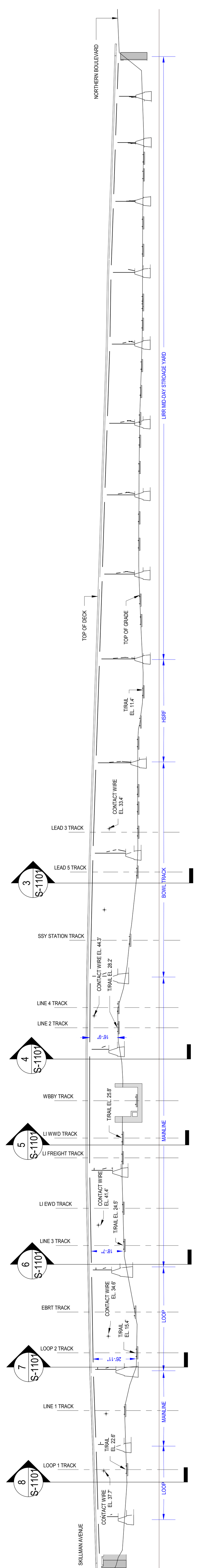
SCALE:
FILE NAME: OCS.QB.6
REV. NO.

CONTRACT NO. –
DATE DEC. 5, 2018
DRAWING NO.
SHEET 6 OF 6

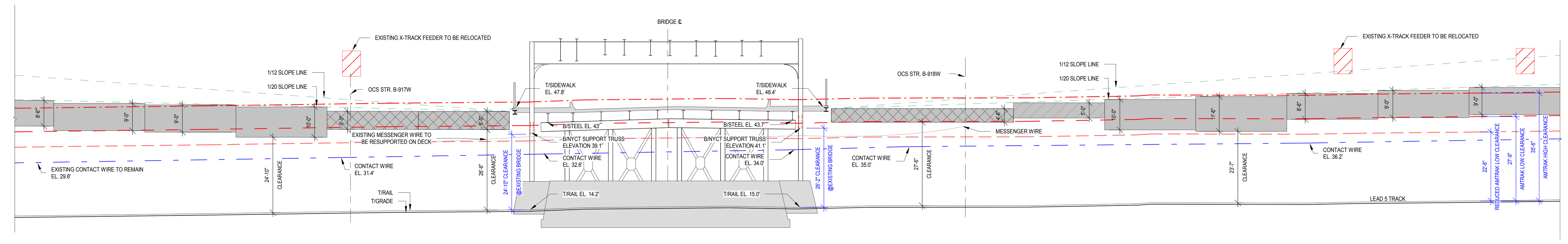

NYCTA Truss
B-915EWA Beam structure
Wire #16A currently supported on the NYCTA truss but it will be transfered to the OCS structure B-915EWA



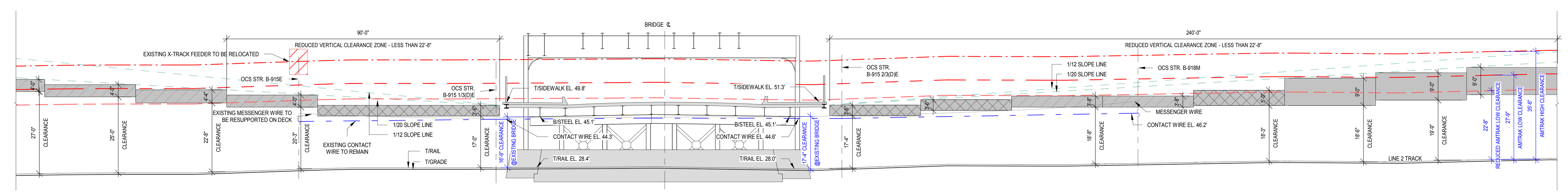
1 PARTIAL PLAN - QUEENS BOULEVARD BRIDGE
SCALE: 1" = 40'-0"



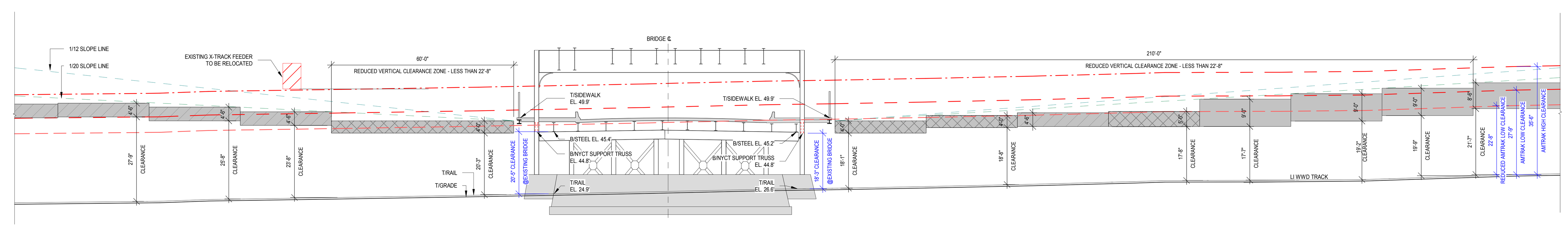
2 ELEVATION OF QUEENS BOULEVARD BRIDGE
SCALE: 1" = 40'-0"



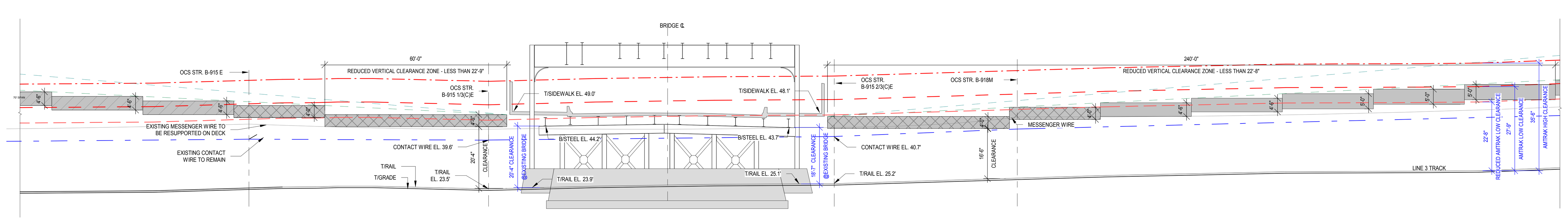
3 SECTION AT QUEENS BOULEVARD BRIDGE - BOWL - LEAD 5 TRACK
SCALE: 3/64" = 1'-0"



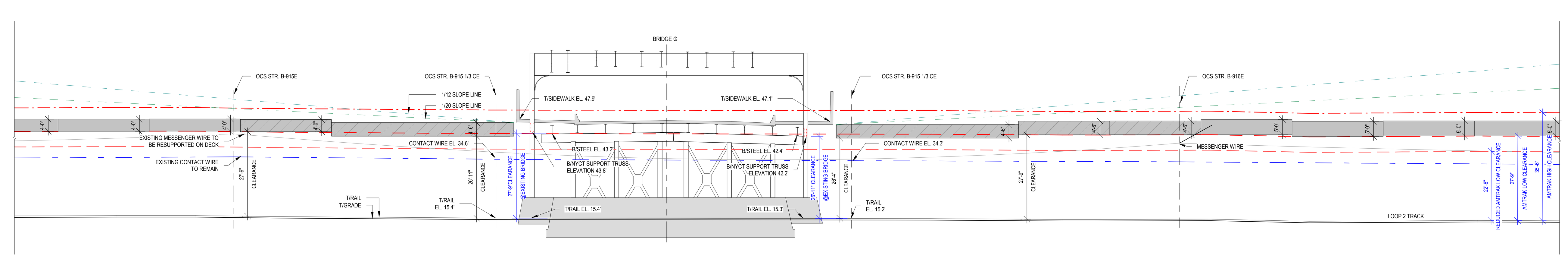
4 SECTION AT QUEENS BOULEVARD BRIDGE - MAINLINE - LINE 2 TRACK
SCALE: 3/64" = 1'-0"



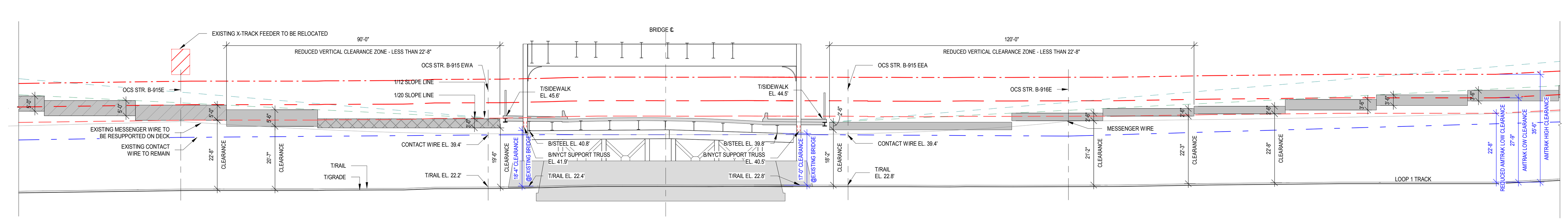
5 SECTION AT QUEENS BOULEVARD BRIDGE - MAINLINE - LI WWD TRACK
SCALE: 3/64" = 1'-0"



6 SECTION AT QUEENS BOULEVARD BRIDGE - MAINLINE - LINE 3 TRACK
SCALE: 3/64" = 1'-0"



7 SECTION AT QUEENS BOULEVARD BRIDGE - LOOP - LOOP 2 TRACK
SCALE: 3/64" = 1'-0"



8 SECTION AT QUEENS BOULEVARD BRIDGE - LOOP - LOOP 1 TRACK
SCALE: 3/64" = 1'-0"

LEGEND

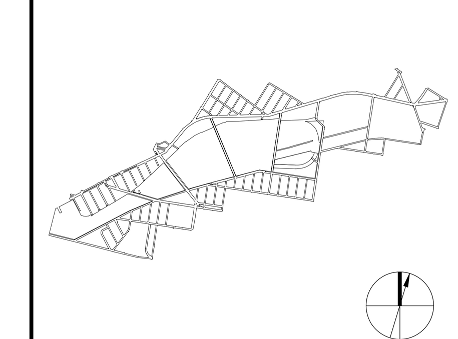
- TYPICAL LOADING
- TYPICAL LOADING + CLOSE SPACING
- REDUCED LOADING + CLOSE SPACING
- REDUCED AMTRAK LOW CLEARANCE @22'-8"
- AMTRAK LOW CLEARANCE @27'-9"
- AMTRAK HIGH CLEARANCE @35'-6"

NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date

Key Plan



Discipline: STRUCTURE

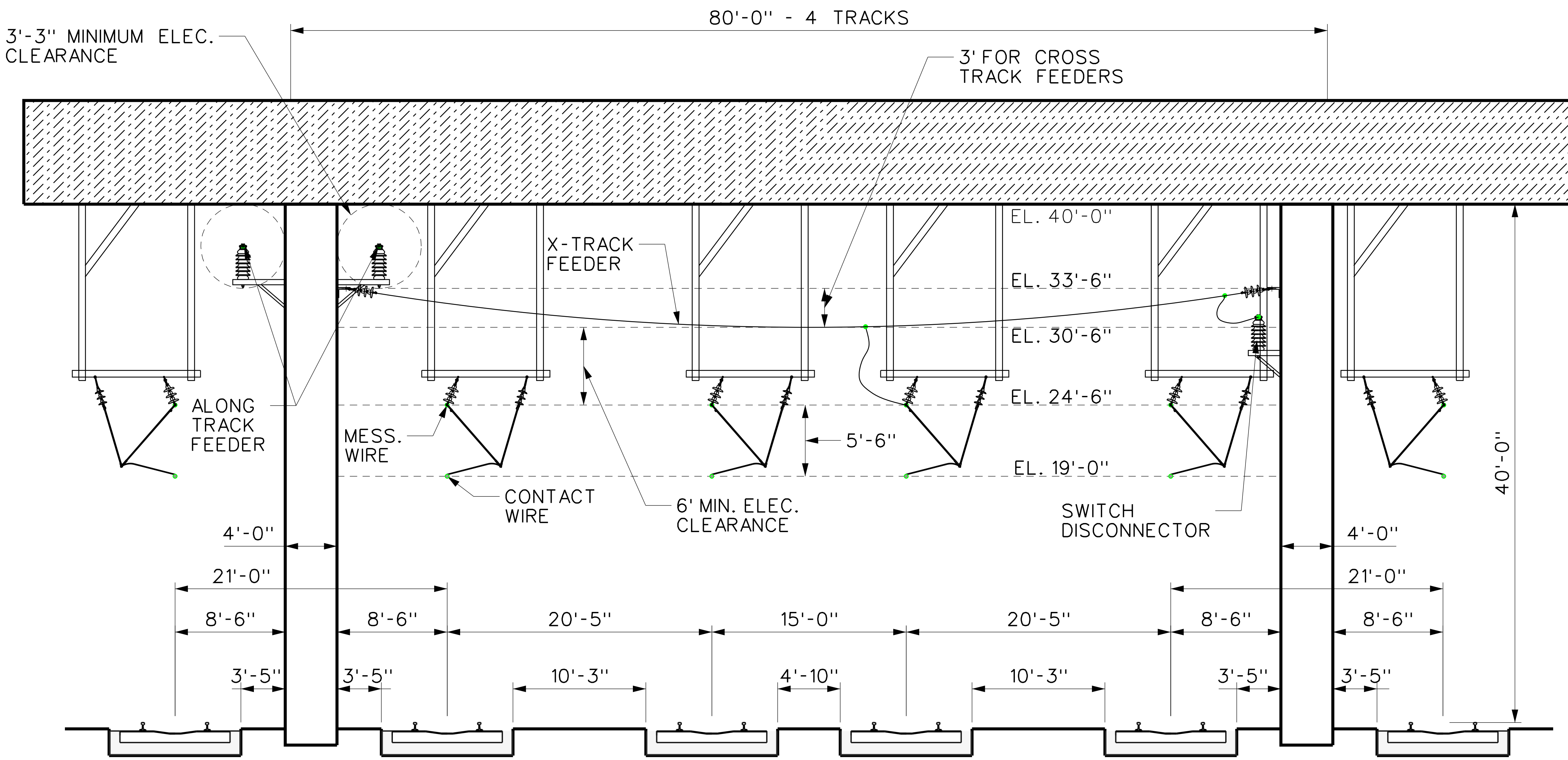
Title

QUEENS BOULEVARD BRIDGE AMTRAK STUDY

Thornton Tomasetti

Designed by	CCG
Drawn by	HK / GS
Checked by	JB
Date	11/30/18
Drawing Number	S-1101.00

SKETCH A



NOTES:

1. For Minimum Roadway Clearances refer to AMTRAK ET-200 Drawing.
2. For electrical clearances shown for cross track feeders, the Gibbs & Hill Principals of Design was used.
3. SAP assemblies are shown, but other Amtrak approved assemblies may be used.

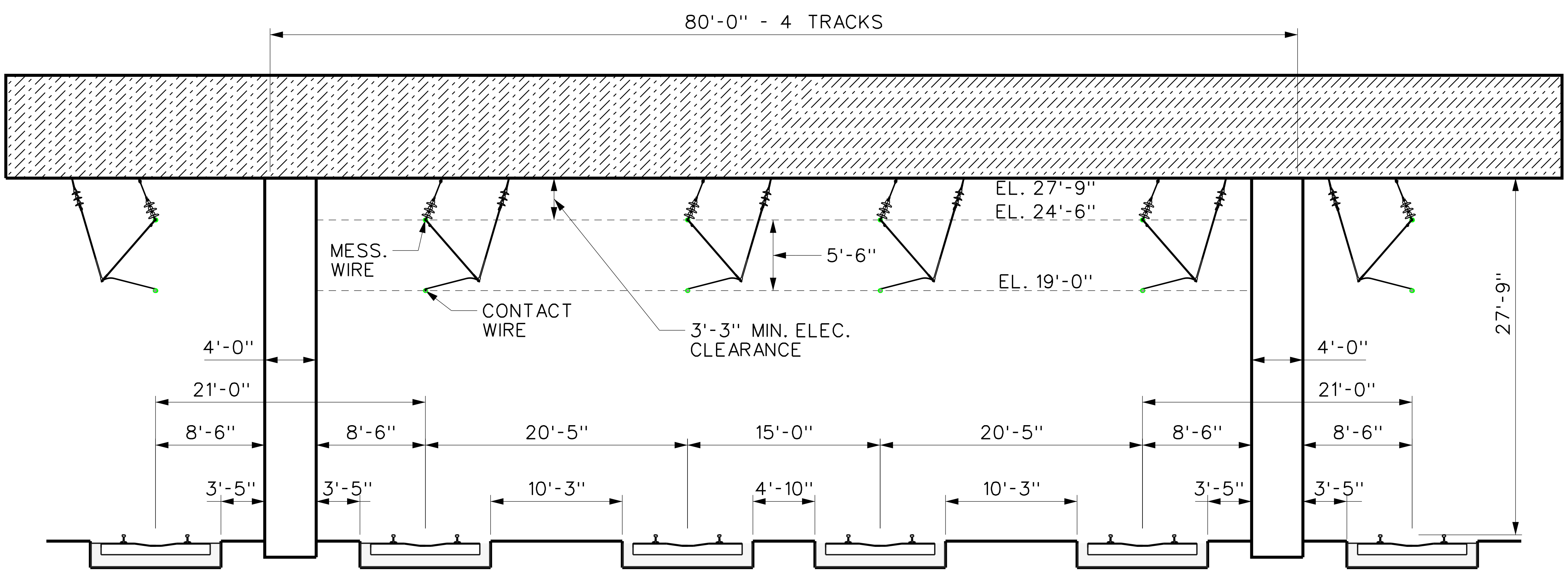
STANDARD AMTRAK OCS CLEARANCES WITH ALONG AND CROSS TRACK FEEDERS

HNTB

SSY - TYPICAL SECTIONS (1 of 4)

DATE: 08/13/2018

SKETCH B

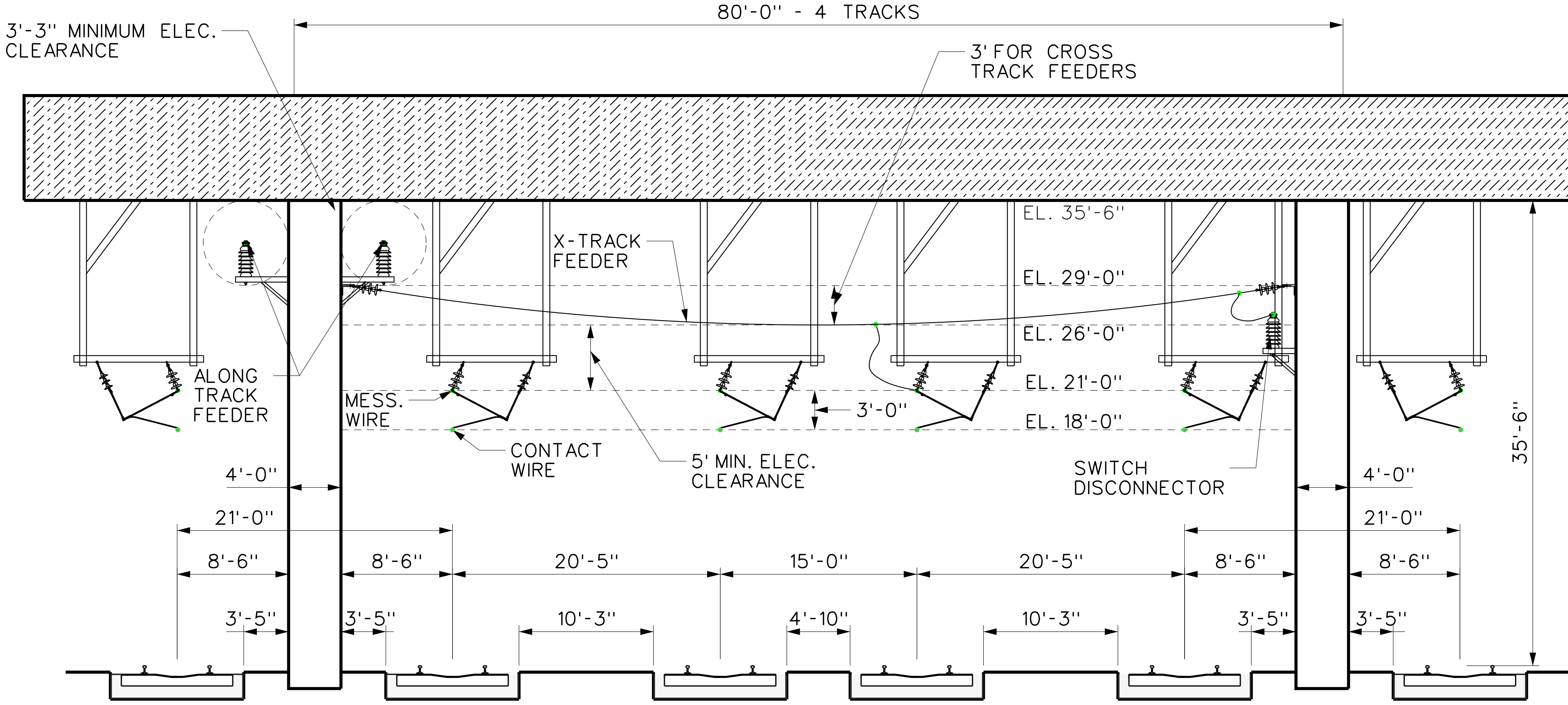


NOTES:

1. For Minimum Roadway Clearances refer to AMTRAK ET-200 Drawing.
2. For electrical clearances shown for cross track feeders, the Gibbs & Hill Principals of Design was used.
3. SAP assemblies are shown, but other Amtrak approved assemblies may be used.

STANDARD AMTRAK OCS CLEARANCES WITHOUT ALONG AND CROSS TRACK FEEDERS

SKETCH C



NOTES:

1. For Minimum Roadway Clearances refer to AMTRAK ET-200 Drawing.
2. For electrical clearances shown for cross track feeders, the Gibbs & Hill Principals of Design was used.
3. SAP assemblies are shown, but other Amtrak approved assemblies may be used.

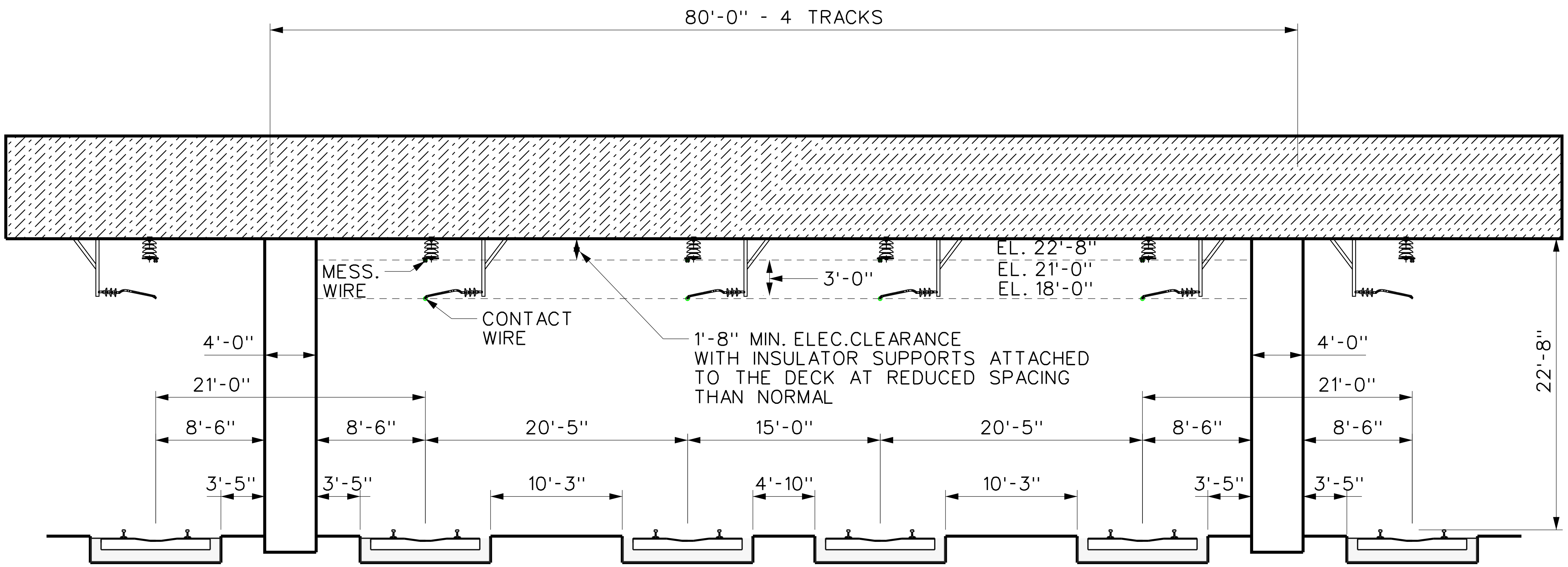
REDUCED AMTRAK OCS CLEARANCES WITH ALONG AND CROSS TRACK FEEDERS

HNTB

SSY - TYPICAL SECTIONS (3 of 4)

DATE: 08/13/2018

SKETCH D



NOTES:

1. For Minimum Roadway Clearances refer to AMTRAK ET-200 Drawing.
2. For electrical clearances shown for cross track feeders, the Gibbs & Hill Principals of Design was used.
3. SAP assemblies are shown, but other Amtrak approved assemblies may be used.

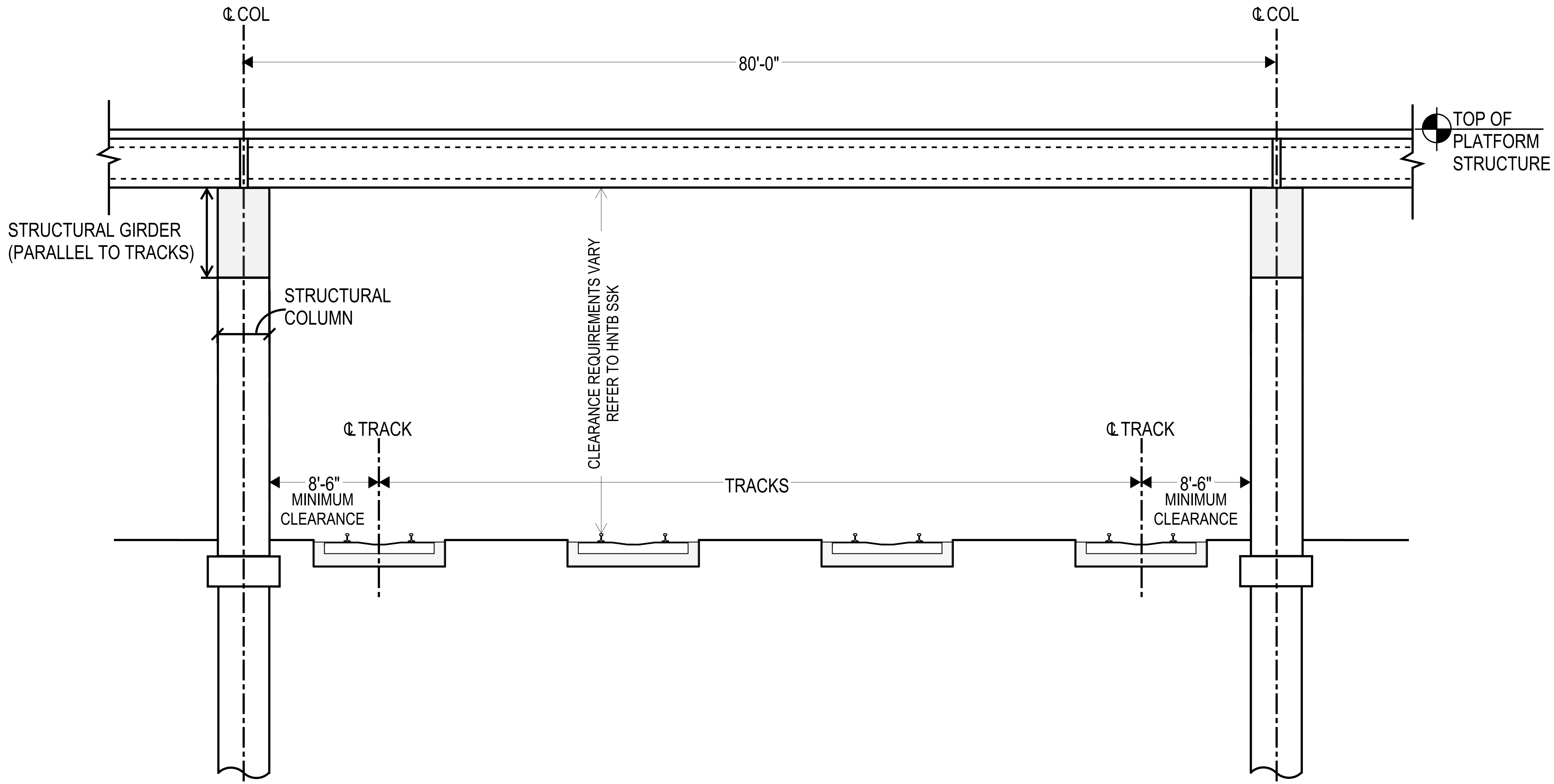
REDUCED AMTRAK OCS CLEARANCES WITHOUT ALONG AND CROSS TRACK FEEDERS

HNTB

SSY - TYPICAL SECTIONS (4 of 4)

DATE: 08/13/2018

SKETCH E



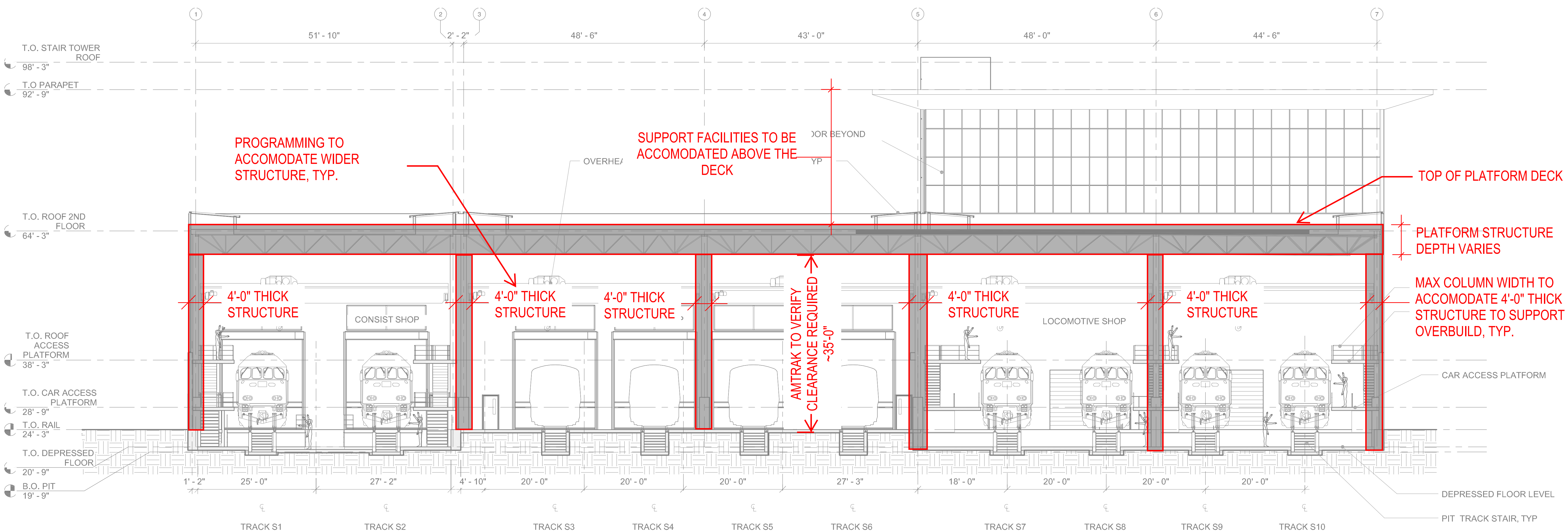
Thornton Tomasetti

PROJECT: SUNNYSIDE YARDS MASTER PLAN
REFERENCE:
BY: CCG
DATE: 08/13/18

SUBJECT: AMTRAK ASSUMPTIONS - TYPICAL STRUCTURAL SECTION

SSK-008A

SKETCH F



CONVENTIONAL SHOP - TRANSVERSE SECTION **(EXAMPLE SECTION)**

SCALE: 1" = 10'-0"

MASTERPLAN ASSMUPTIONS:

1A. PROGRAMMING IN THE BUILDINGS OF THE AMTRAK MASTERPLAN WILL ACCOMODATE A 4'-0" WIDE STRUCTURE AT COLUMN GRIDS BETWEEN TRACKS TO SUPPORT OVERBUILD COLUMNS

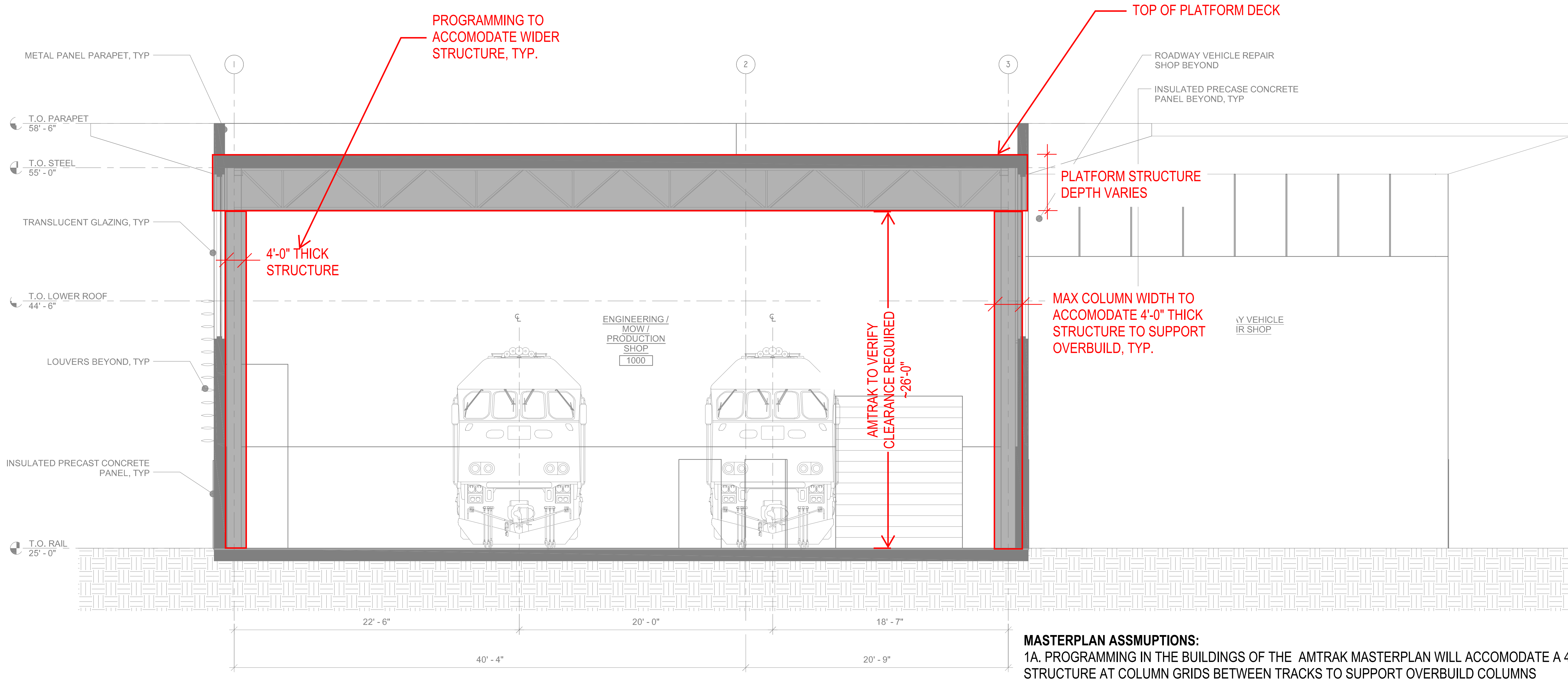
1B. COLUMNS WITHIN BUILDINGS OF THE AMTRAK MASTERPLAN WILL BE DESIGNED TO ACCOMODATE OVERBUILD LOADS

2. PLATFORM STRUCTURE WILL ACCOMODATE VERTICAL CLEARANCE REQUIREMENTS AND SERVE AS THE ROOF OF THE BUILDINGS. THE BUILDINGS WILL BE FITTED OUT AFTER THE PLATFORM IS CONSTRUCTED.

3. FOR MULTI-STORY BUILDINGS IN THE MASTER PLAN, THE SECOND FLOOR CONTAINING ANY SUPPORT FACILITIES WILL BE COORDINATED TO BE PLACED ABOVE THE DECK

Thornton Tomasetti	PROJECT: SUNNYSIDE YARDS MASTER PLAN REFERENCE: AMTRAK MASTER PLAN - CR_A1-400 BY: CCG DATE: 08/13/18	SUBJECT: AMTRAK ASSUMPTIONS - SECTION AT CONVENTIONAL SHOP	SSK-008B

SKETCH G



1 ENGINEERING / MOW / PRODUCTION SHOP - TRANSVERSE SECTION **(EXAMPLE SECTION)**
SCALE: 1/4" = 1'-0"

MASTERPLAN ASSMUPTIONS:

1A. PROGRAMMING IN THE BUILDINGS OF THE AMTRAK MASTERPLAN WILL ACCOMODATE A 4'-0" WIDE STRUCTURE AT COLUMN GRIDS BETWEEN TRACKS TO SUPPORT OVERBUILD COLUMNS

1B. COLUMNS WITHIN BUILDINGS OF THE AMTRAK MASTERPLAN WILL BE DESIGNED TO ACCOMODATE OVERBUILD LOADS

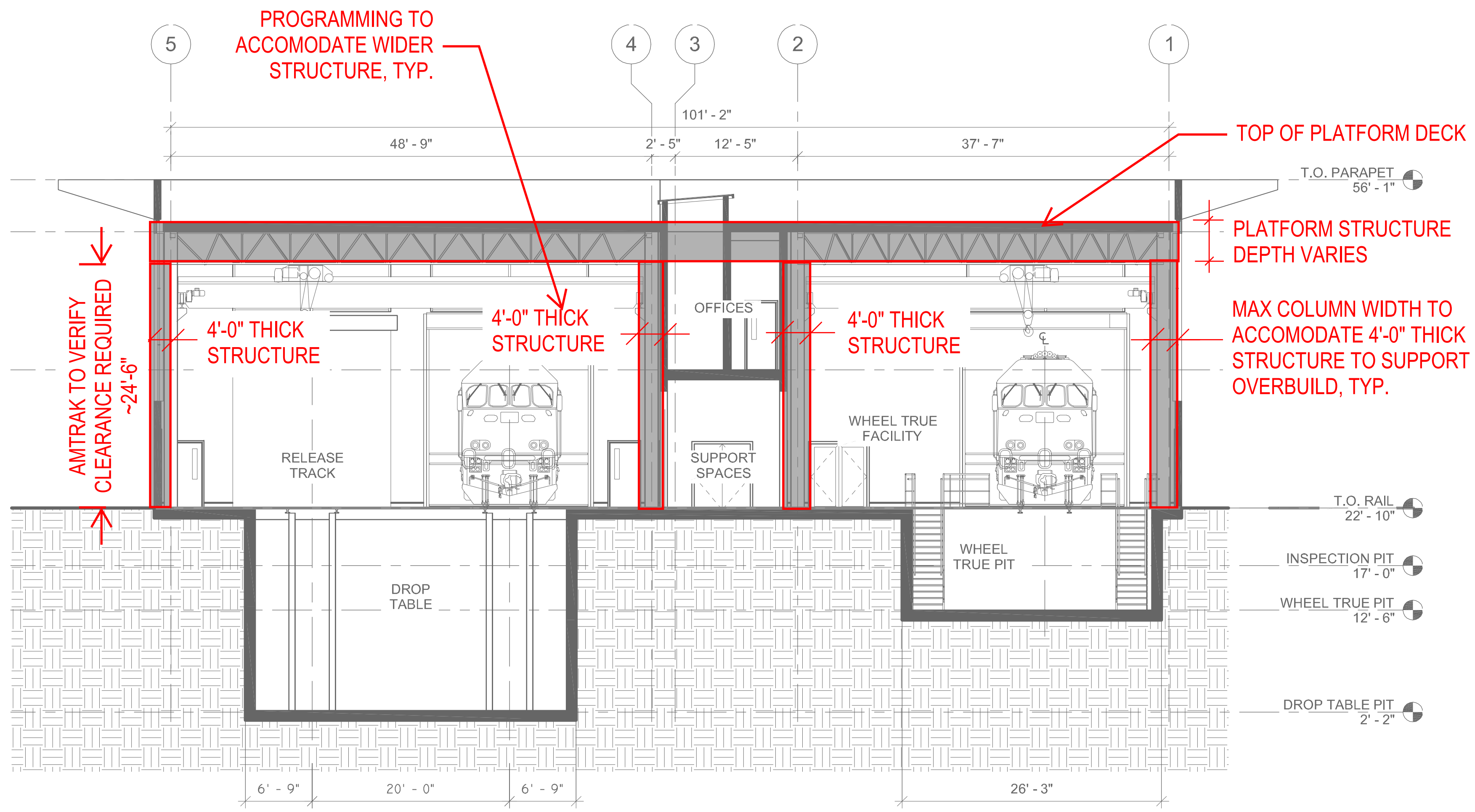
2. PLATFORM STRUCTURE WILL ACCOMODATE VERTICAL CLEARANCE REQUIREMENTS AND SERVE AS THE ROOF OF THE BUILDINGS. THE BUILDINGS WILL BE FITTED OUT AFTER THE PLATFORM IS CONSTRUCTED.

3. FOR MULTI-STORY BUILDINGS IN THE MASTER PLAN, THE SECOND FLOOR CONTAINING ANY SUPPORT FACILITIES WILL BE COORDINATED TO BE PLACED ABOVE THE DECK

Thornton Tomasetti	PROJECT: SUNNYSIDE YARDS MASTER PLAN REFERENCE: AMTRAK MASTER PLAN - MW_A1-400 BY: CCG DATE: 08/13/18	SUBJECT: AMTRAK ASSUMPTIONS - SECTION AT MOW

SSK-008C

SKETCH H



1 WHEEL TRUE FACILITY & DROP TABLE - TRANSVERSE SECTION **(EXAMPLE SECTION)**
SCALE: 1/8" = 1'-0"

MASTERPLAN ASSMUPTIONS:

1A. PROGRAMMING IN THE BUILDINGS OF THE AMTRAK MASTERPLAN WILL ACCOMODATE A 4'-0" WIDE STRUCTURE AT COLUMN GRIDS BETWEEN TRACKS TO SUPPORT OVERBUILD COLUMNS

1B. COLUMNS WITHIN BUILDINGS OF THE AMTRAK MASTERPLAN WILL BE DESIGNED TO ACCOMODATE OVERBUILD LOADS

2. PLATFORM STRUCTURE WILL ACCOMODATE VERTICAL CLEARANCE REQUIREMENTS AND SERVE AS THE ROOF OF THE BUILDINGS. THE BUILDINGS WILL BE FITTED OUT AFTER THE PLATFORM IS CONSTRUCTED.

3. FOR MULTI-STORY BUILDINGS IN THE MASTER PLAN, THE SECOND FLOOR CONTAINING ANY SUPPORT FACILITIES WILL BE COORDINATED TO BE PLACED ABOVE THE DECK

Thornton Tomasetti	PROJECT: SUNNYSIDE YARDS MASTER PLAN REFERENCE: AMTRAK MASTER PLAN - WT_A1-400 BY: CCG DATE: 08/13/18	SUBJECT: AMTRAK ASSUMPTIONS - SECTION AT WHEEL TRUER FACILITY	SSK-008D

APPENDIX A.5.E

TYPICAL YARD OCS AND SIGNAL STRUCTURE PHOTOS

Zone 1 – Lighting Poles (under construction):

Zone 1 – Pedestrian Bridge (under construction):

Zone 2 – X Catenary:

Zone 2 – X Catenary + High Speed Shop:

Zone 3 – X Catenary Structure (1):

Zone 3 – X Catenary Structure (2):

Zone 7 – Aerial Utility Crossing:

Zone 7 – OCS Truss + Signal Power Monopole + Signal Bridge:

Zone 7 – OCS X Catenary + G02 Substation:

Zone 7 – Signal Power Monopole:

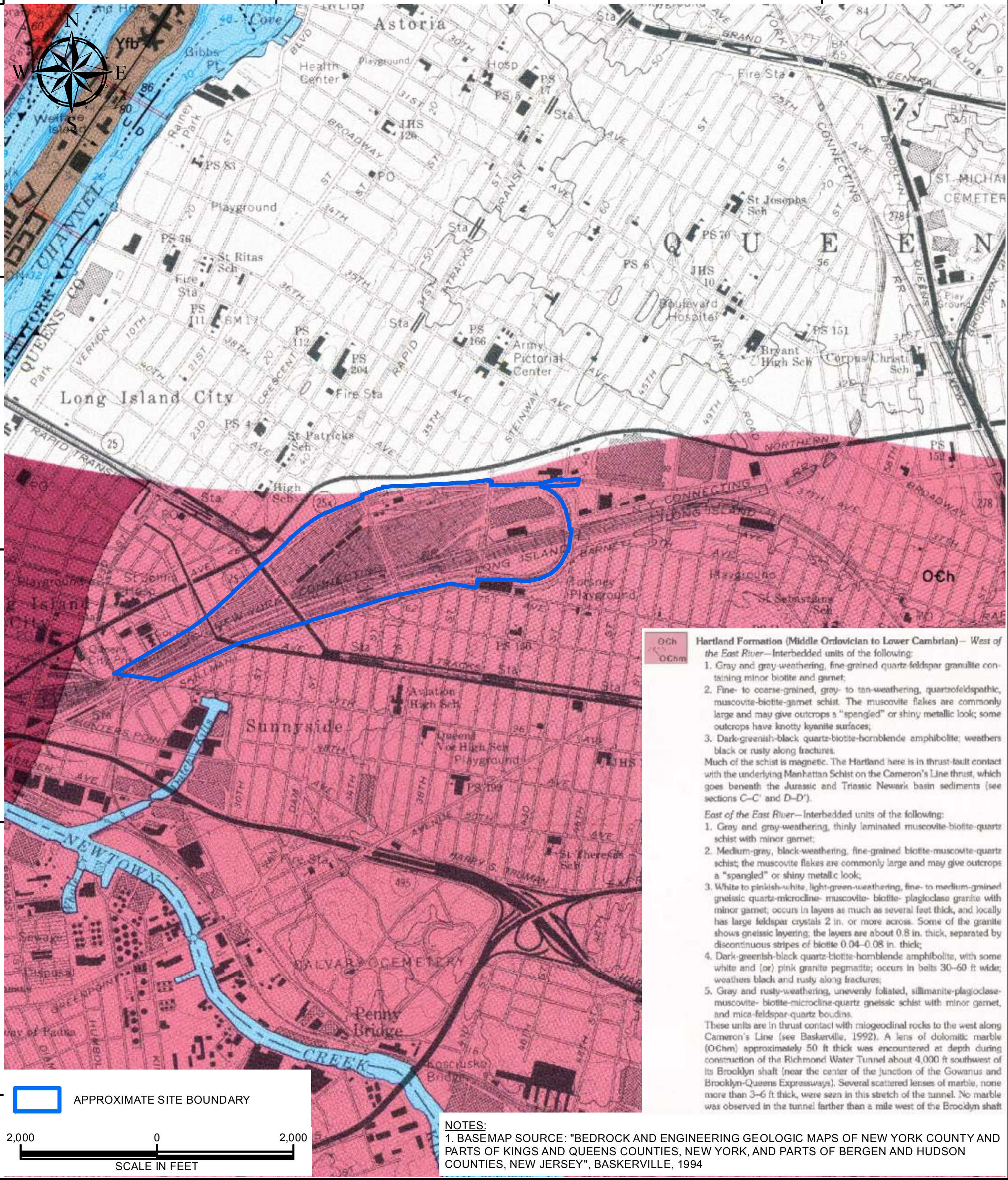
Zone 7 – Sub #44:

Zone 8 – OCS K-Frames:

Zone 8 – Signal Bridge:

APPENDIX A.5.F

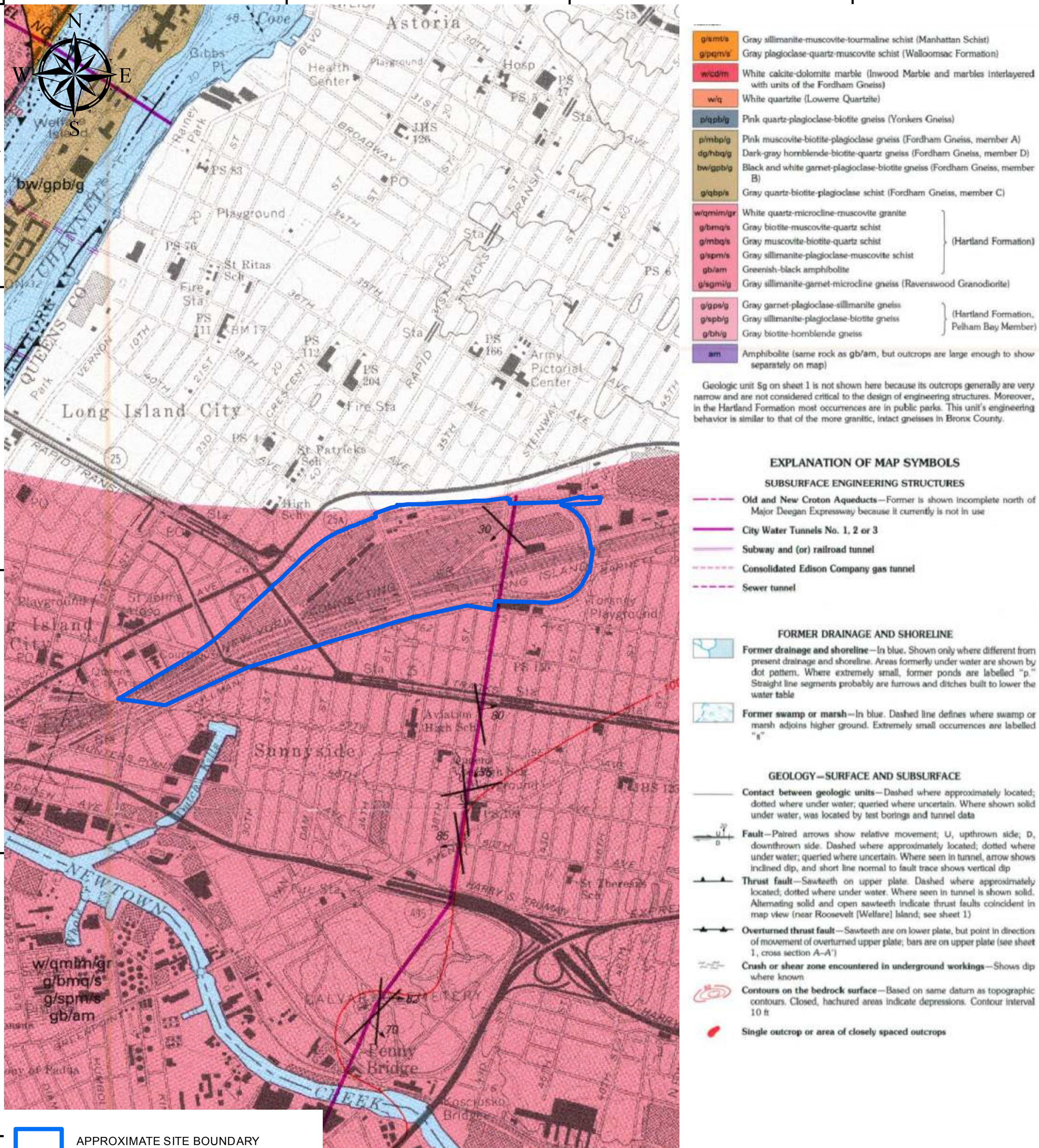
GEOLOGIC MAPS



NOTES:
1. BASEMAP SOURCE: "BEDROCK AND ENGINEERING GEOLOGIC MAPS OF NEW YORK COUNTY AND PARTS OF KINGS AND QUEENS COUNTIES, NEW YORK, AND PARTS OF BERGEN AND HUDSON COUNTIES, NEW JERSEY", BASKERVILLE, 1994

LANGAN 21 Penn Plaza, 360 West 31st Street, 8th Floor New York, NY 10001-2727 T: 212.479.5400 F: 212.479.5444 www.langan.com Langan Engineering & Environmental Services, Inc. Langan Engineering, Environmental, Surveying, Landscape Architecture, and Geology, D.P.C. Langan International LLC Collectively known as Langan	Project SUNNYSIDE YARD QUEENS NEW YORK	Figure Title BEDROCK GEOLOGIC MAP	Project No. 170522401 Date 09/10/2018 Scale 1"=2,000' Drawn By MG Submission Date 09/10/2018	Figure 1 Sheet 1 of 5

Path: \\langan.com\data\NYC\data4\170522401\Project Data\ArcGIS\MXD\Geotech_Figures\Figure 4 - Bedrock Geologic Map.mxd Date: 09/11/18 User: mgeorgalas Time: 12:50:47 PM



NOTES:
1. BASEMAP SOURCE: "BEDROCK AND ENGINEERING GEOLOGIC MAPS OF NEW YORK COUNTY AND PARTS OF KINGS AND QUEENS COUNTIES, NEW YORK, AND PARTS OF BERGEN AND HUDSON COUNTIES, NEW JERSEY", BASKERVILLE, 1994

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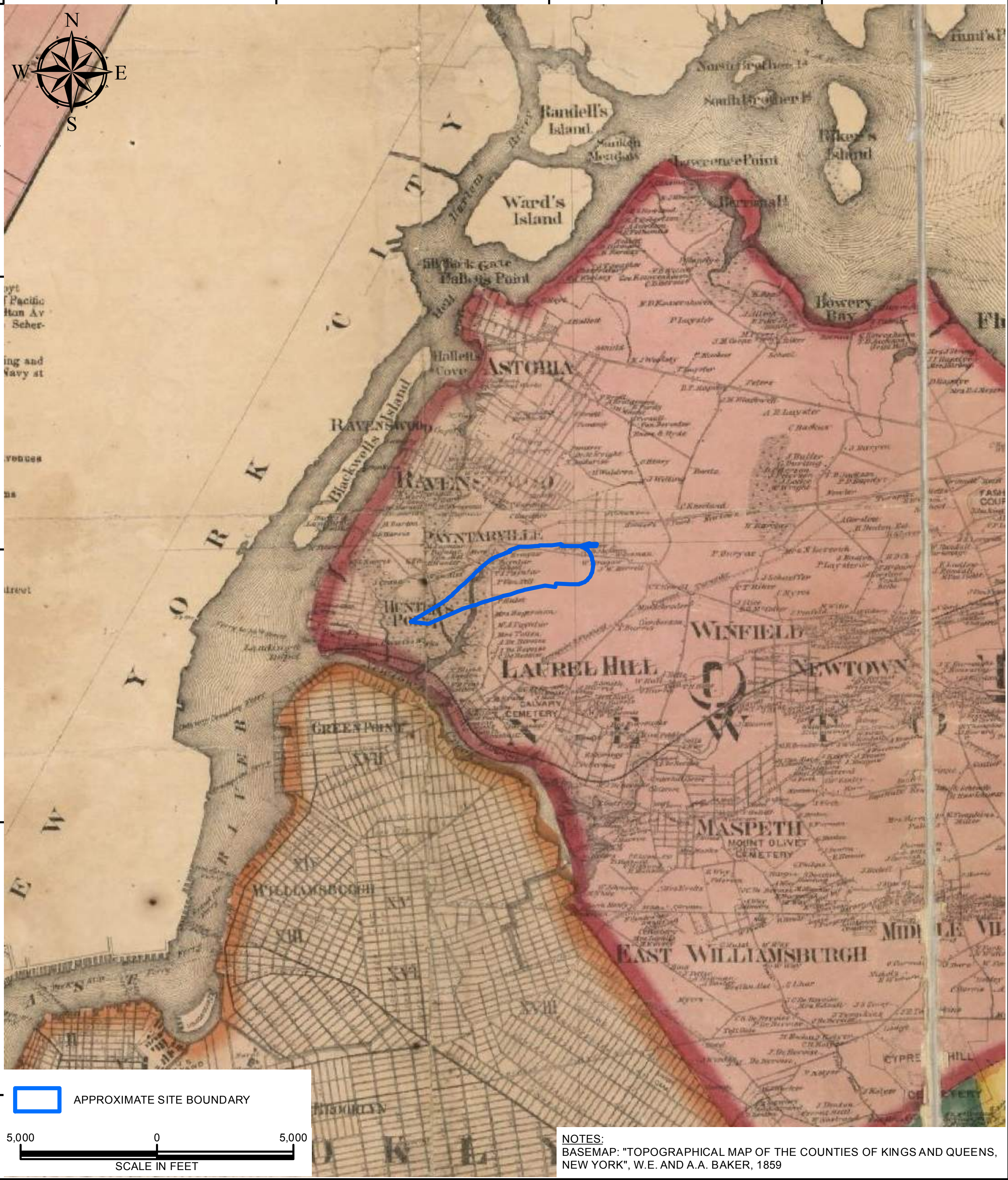
Project	Figure Title	Project No. 170522401	Figure
SUNNYSIDE YARD	ENGINEERING GEOLOGIC MAP	Date 09/10/2018	2
QUEENS NEW YORK		Scale 1"=2,000'	
		Drawn By MG	
		Submission Date 09/10/2018	Sheet 2 of 5



NOTES:
BASEMAP: "TOPOGRAPHICAL MAP OF THE COUNTIES OF KINGS AND QUEENS, NEW YORK", W.E. AND A.A. BAKER, 1859

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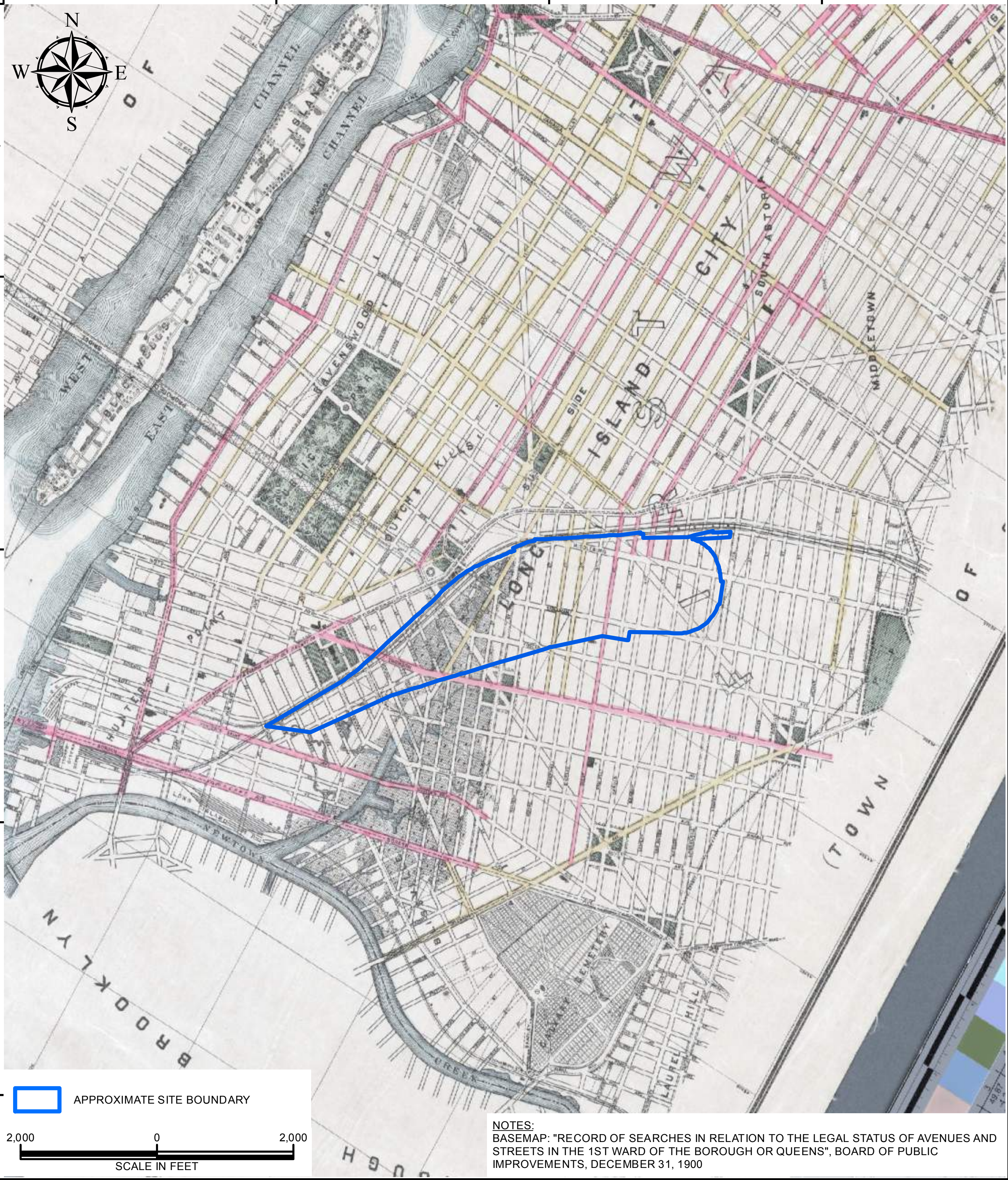
Project	Figure Title	Project No.	Figure
SUNNYSIDE YARD	1859 HISTORICAL MAP	170522401	3
QUEENS NEW YORK		Date: 09/10/2018	
		Scale: 1"=5,000'	
		Drawn By: MG	
		Submission Date: 09/10/2018	Sheet 3 of 5

Path: \\langan.com\data\NYC\data4\170522401\Project Data\ArcGIS\MXD\Geotech_Figures\Figure 5 - Historical Map 1859.mxd Date: 09/11/18 User: mgeorgalas Time: 12:54:17 PM



NOTES:
BASEMAP: "RECORD OF SEARCHES IN RELATION TO THE LEGAL STATUS OF AVENUES AND STREETS IN THE 1ST WARD OF THE BOROUGH OR QUEENS", BOARD OF PUBLIC IMPROVEMENTS, DECEMBER 31, 1900

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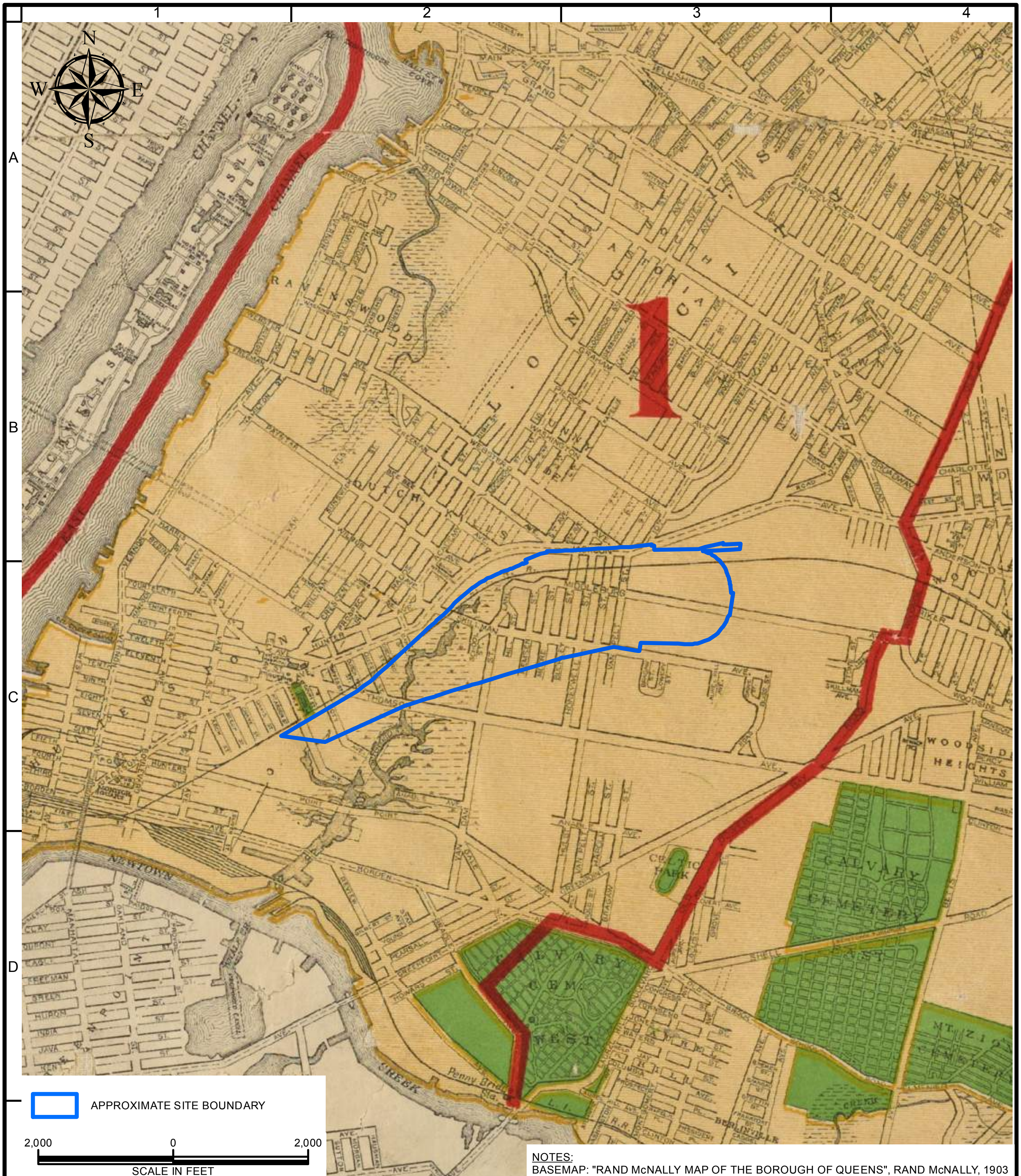
Project	Figure Title	Project No.	Figure
SUNNYSIDE YARD	1900 HISTORICAL MAP	170522401	4
		Date: 09/10/2018	
		Scale: 1"=2,000'	
		Drawn By: MG	
QUEENS / NEW YORK		Submission Date: 09/10/2018	Sheet 4 of 5

Path: \\langan.com\data\NYC\data4\170522401\Project Data\ArcGIS\MXD\Geotech_Figures\Figure 1 - Historical Map.mxd Date: 09/11/18 User: mgeorgalas Time: 12:53:11 PM



NOTES:
BASEMAP: "RAND McNALLY MAP OF THE BOROUGH OF QUEENS", RAND McNALLY, 1903

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Project	Figure Title	Project No.	Figure
SUNNYSIDE YARD QUEENS NEW YORK	1903 HISTORICAL MAP	170522401	5
		Date: 09/10/2018	
		Scale: 1"=2,000'	
		Drawn By: MG	
		Submission Date: 09/10/2018	Sheet 5 of 5

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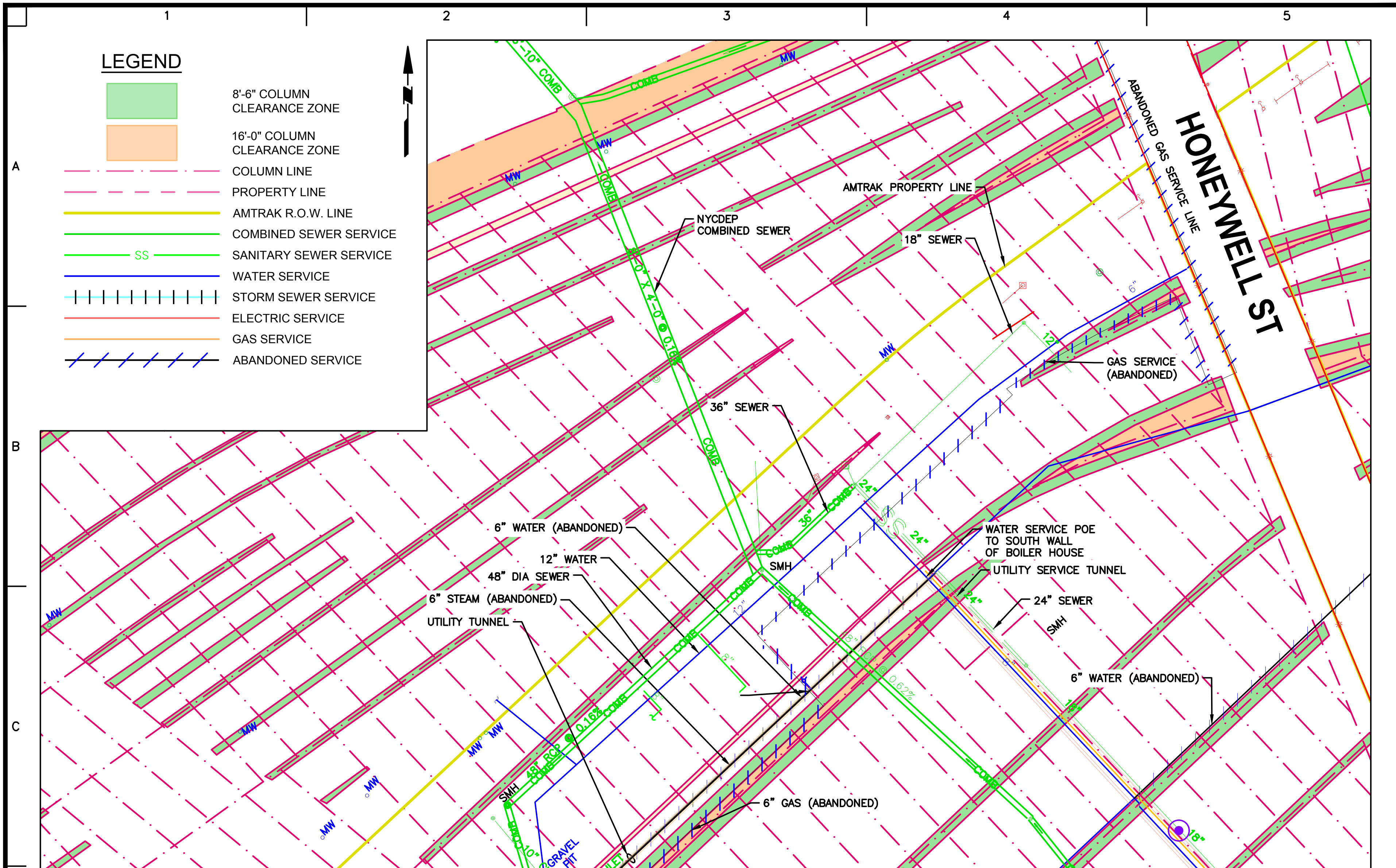
APPENDIX A.5.G

UTILITY-COLUMN LOCATION CONFLICTS



WARNING: IT IS A VIOLATION OF THE NYS EDUCATION LAW ARTICLE 145 FOR ANY PERSON, UNLESS HE IS ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER, TO ALTER THIS ITEM IN ANY WAY.

100 0 50 100
SCALE IN FEET

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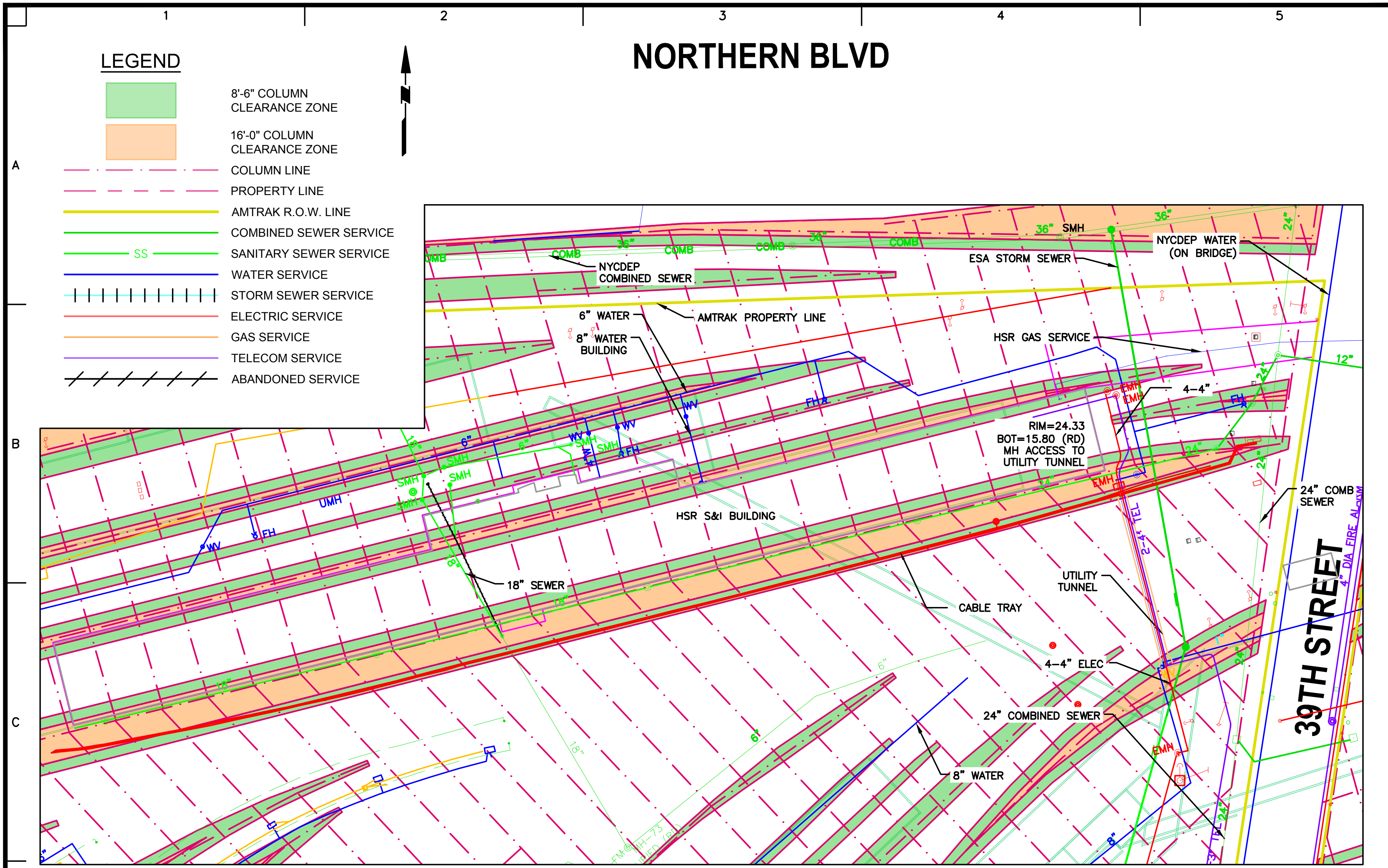
Project	Drawing Title	Project No. 170522401	Drawing No.
SUNNYSIDE YARD MASTER PLAN QUEENS SUNNYSIDE NEW YORK	TASK 3D COLUMN LINES AND EXISTING UTILITIES ZONE 1: EXISTING COMBINED SEWER	Date 09/13/2018 Drawn By RND Checked By LKB	FIGURE 1 Sheet 1 of 1

Filename: \\langan.com\data\NYC\data4\170522401\Project Data\CAD\01\SheetFiles\Civil\Existing Utility Column Conflicts\Figure 1 (Existing Combined Sewer).dwg Date: 9/13/2018 Time: 20:29 User: rdolin Style Table: Langan.stb Layout: ANSIA-BL



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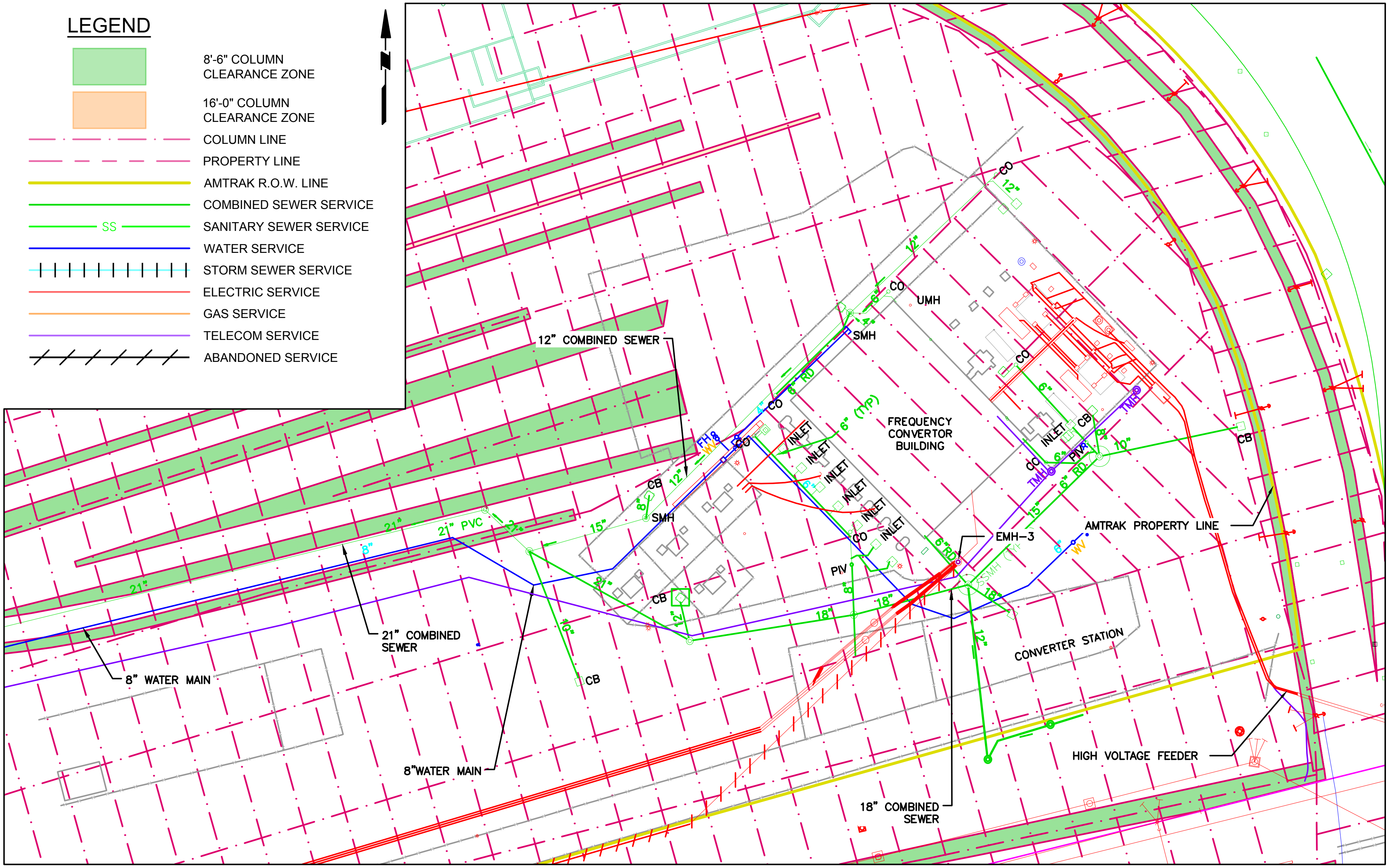
Project
SUNNYSIDE YARD MASTER PLAN
QUEENS SUNNYSIDE NEW YORK

Drawing Title
TASK 3D COLUMN LINES AND EXISTING UTILITIES
ZONE 2: HSRF AND SURROUNDINGS

Project No.	170522401
Date	09/13/2018
Drawn By	RND
Checked By	LKB

Drawing No.
FIGURE 2
Sheet 1 of 1

Filename: \\langan.com\data\NYC\data4\170522401\Project Data\CAD\01\SheetFiles\Civil\Existing Utility Column Conflicts\Figure 4 (HSRF + Surroundings).dwg Date: 9/13/2018 Time: 20:26 User: rdolin Style Table: Langan.stb Layout: ANSIA-BL



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100 0 50 100
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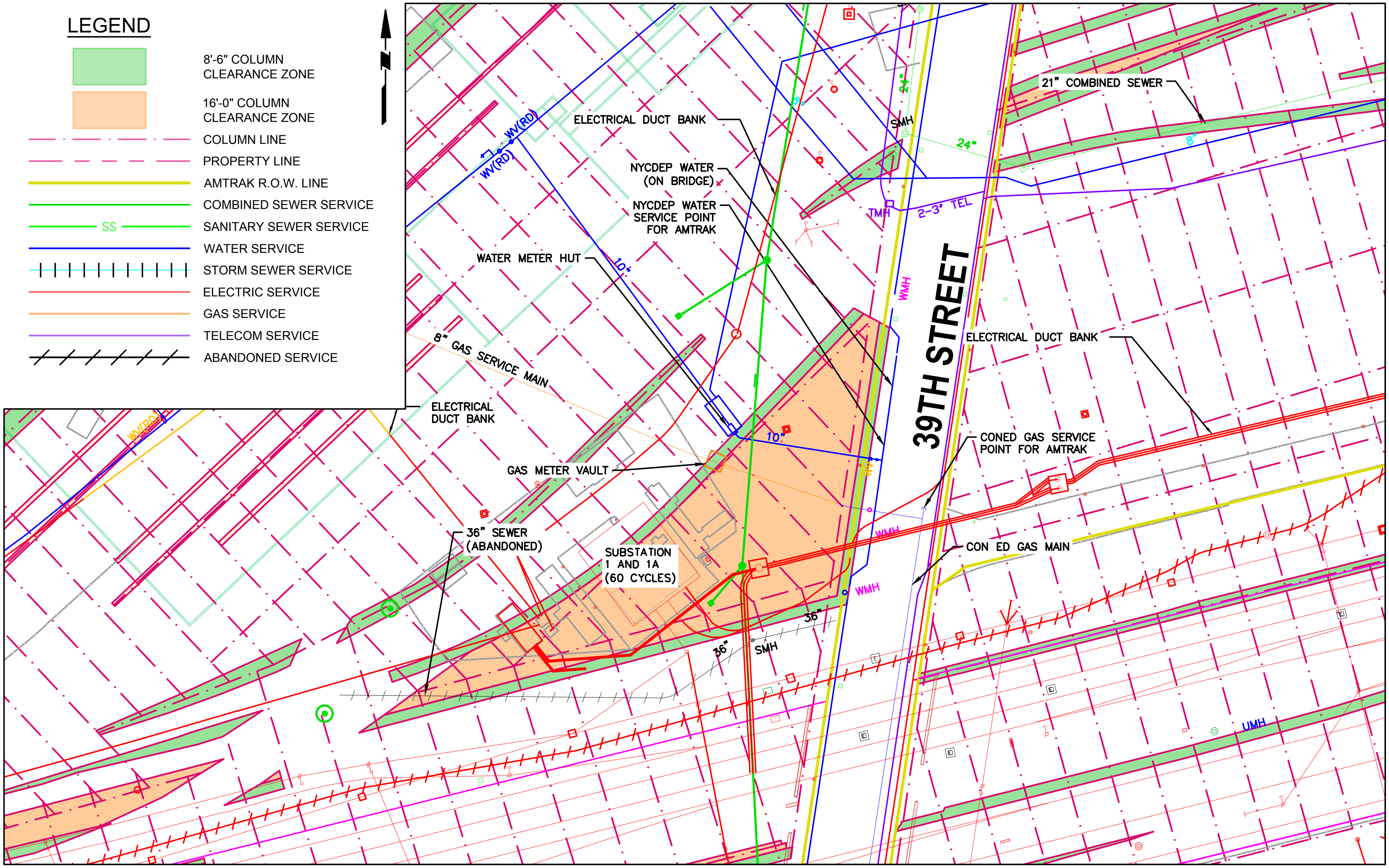
Project	Drawing Title	Project No. 170522401	Drawing No.
SUNNYSIDE YARD MASTER PLAN	TASK 3D COLUMN LINES AND EXISTING UTILITIES	Date 09/13/2018	FIGURE 3
QUEENS SUNNYSIDE NEW YORK	ZONE 6: FREQUENCY CONVERTOR BUILDING	Drawn By RND	
		Checked By LKB	Sheet 1 of 1

Filename: \\langan.com\data\NYC\data4\170522401\Project Data\CAD\01\SheetFiles\Civil\Existing Utility Column Conflicts\Figure 3 (Frequency Convertor Building).dwg Date: 9/13/2018 Time: 20:27 User: rdolin Style Table: Langan.stb Layout: ANSIA-BL



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100 0 50 100
SCALE IN FEET

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Project
SUNNYSIDE YARD MASTER PLAN
SUNNYSIDE
QUEENS NEW YORK

Drawing Title
TASK 3D
COLUMN LINES AND EXISTING UTILITIES
ZONE 6: ELECTRICAL SUBSTATION

Project No. 170522401
Date 09/13/2018
Drawn By RND
Checked By LKB

Drawing No.
FIGURE 4
Sheet 1 of 1

Filename: \\langan.com\data\NYC\data4\170522401\Project Data\CAD\01\SheetFiles\Civil\Existing Utility Column Conflicts\Figure 2 (Electrical Substation).dwg Date: 9/13/2018 Time: 20:33 User: rdolin Style Table: Langan.stb Layout: ANSIA-BL

APPENDIX A.5.H

COLUMN CLEARANCE ZONES

SUNNYSIDE YARDS - MASTER PLAN

NYCEDC

QUEENS, NEW YORK

STRUCTURAL DRAWINGS

09/14/2018

STRUCTURAL DRAWING LIST

SHEET LIST

	Sheet Number	SHEET NAME
**	S-010	PRECAST AND STEEL STRUCTURAL MATRIX
**	S-100	OVERALL SITE PLAN - EXISTING AND PROPOSED STRUCTURES
**	S-100A	OVERALL SITE PLAN - EXISTING AND PROPOSED STRUCTURES - SECTOR A
**	S-100B	OVERALL SITE PLAN - EXISTING AND PROPOSED STRUCTURES - SECTOR B
**	S-100C	OVERALL SITE PLAN - EXISTING AND PROPOSED STRUCTURES - SECTOR C
**	S-100D	OVERALL SITE PLAN - EXISTING AND PROPOSED STRUCTURES - SECTOR D
**	S-100E	OVERALL SITE PLAN - EXISTING AND PROPOSED STRUCTURES - SECTOR E
	S-110	OVERALL SITE PLAN - COLUMNS & HORIZONTAL CLEARANCES
	S-110A	OVERALL SITE PLAN - COLUMNS & HORIZONTAL CLEARANCES - SECTOR A
	S-110B	OVERALL SITE PLAN - COLUMNS & HORIZONTAL CLEARANCES - SECTOR B
	S-110C	OVERALL SITE PLAN - COLUMNS & HORIZONTAL CLEARANCES - SECTOR C
	S-110D	OVERALL SITE PLAN - COLUMNS & HORIZONTAL CLEARANCES - SECTOR D
	S-110E	OVERALL SITE PLAN - COLUMNS & HORIZONTAL CLEARANCES - SECTOR E
	S-120	STRUCTURAL SPANS LENGTH
	S-120A	STRUCTURAL SPAN LENGTH - SECTOR A
	S-120B	STRUCTURAL SPANS LENGTH - SECTOR B
	S-120C	STRUCTURAL SPANS LENGTH - SECTOR C
	S-120D	STRUCTURAL SPANS LENGTH - SECTOR D
	S-120E	STRUCTURAL SPANS LENGTH - SECTOR E
	S-130	TOP OF STRUCTURE STEEL - HIGH CLEARANCE
	S-130A	TOP OF STRUCTURE STEEL - HIGH CLEARANCE - SECTOR A
	S-130B	TOP OF STRUCTURE STEEL - HIGH CLEARANCE - SECTOR B
	S-130C	TOP OF STRUCTURE STEEL - HIGH CLEARANCE - SECTOR C
	S-130D	TOP OF STRUCTURE STEEL - HIGH CLEARANCE - SECTOR D
	S-130E	TOP OF STRUCTURE STEEL - HIGH CLEARANCE - SECTOR E
	S-140	TOP OF STRUCTURE STEEL - LOW CLEARANCE
	S-140A	TOP OF STRUCTURE STEEL - LOW CLEARANCE - SECTOR A
	S-140B	TOP OF STRUCTURE STEEL - LOW CLEARANCE - SECTOR B
	S-140C	TOP OF STRUCTURE STEEL - LOW CLEARANCE - SECTOR C
	S-140D	TOP OF STRUCTURE STEEL - LOW CLEARANCE - SECTOR D
	S-140E	TOP OF STRUCTURE STEEL - LOW CLEARANCE - SECTOR E
	S-150	TOP OF STRUCTURE CONCRETE - HIGH CLEARANCE
	S-150A	TOP OF STRUCTURE CONCRETE - HIGH CLEARANCE - SECTOR A
	S-150B	TOP OF STRUCTURE CONCRETE - HIGH CLEARANCE - SECTOR B
	S-150C	TOP OF STRUCTURE CONCRETE - HIGH CLEARANCE - SECTOR C
	S-150D	TOP OF STRUCTURE CONCRETE - HIGH CLEARANCE - SECTOR D
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	S-160	TOP OF STRUCTURE CONCRETE - LOW CLEARANCE
	S-160A	TOP OF STRUCTURE CONCRETE - LOW CLEARANCE - SECTOR A
	S-160B	TOP OF STRUCTURE CONCRETE - LOW CLEARANCE - SECTOR B
	S-160C	TOP OF STRUCTURE CONCRETE - LOW CLEARANCE - SECTOR C
	S-160D	TOP OF STRUCTURE CONCRETE - LOW CLEARANCE - SECTOR D
	S-160E	TOP OF STRUCTURE CONCRETE - LOW CLEARANCE - SECTOR E
	S-170	BOTTOM OF STRUCTURE - HIGH CLEARANCE
	S-170A	BOTTOM OF STRUCTURE - HIGH CLEARANCE - SECTOR A
	S-170B	BOTTOM OF STRUCTURE - HIGH CLEARANCE - SECTOR B
	S-170C	BOTTOM OF STRUCTURE - HIGH CLEARANCE - SECTOR C
	S-170D	BOTTOM OF STRUCTURE - HIGH CLEARANCE - SECTOR D
	S-170E	BOTTOM OF STRUCTURE - HIGH CLEARANCE - SECTOR E
	S-180	BOTTOM OF STRUCTURE - LOW CLEARANCE
	S-180A	BOTTOM OF STRUCTURE - LOW CLEARANCE - SECTOR A
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	S-180C	BOTTOM OF STRUCTURE - LOW CLEARANCE - SECTOR C
	S-180D	BOTTOM OF STRUCTURE - LOW CLEARANCE - SECTOR D
	S-180E	BOTTOM OF STRUCTURE - LOW CLEARANCE - SECTOR E
*	S-190	FRAMING PLAN
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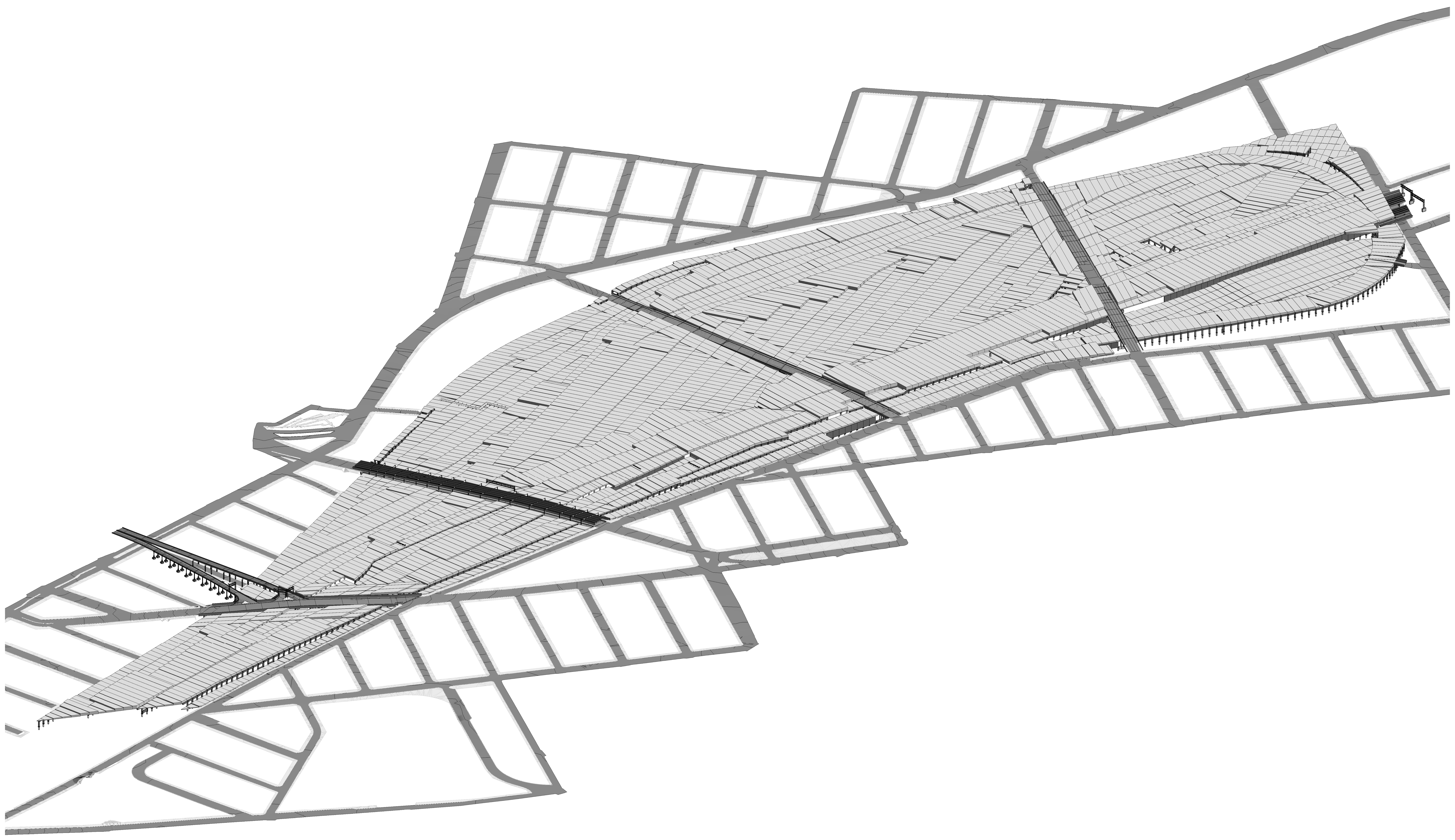
*	S-190B	FRAMING PLAN - SECTOR B
*	S-190C	FRAMING PLAN - SECTOR C
*	S-190D	FRAMING PLAN - SECTOR D
*	S-190E	FRAMING PLAN - SECTOR E
**	S-300	CROSS SECTION - BETWEEN 49TH AVENUE AND THOMSON AVENUE
**	S-301	CROSS SECTION - BETWEEN THOMSON AVENUE AND QUEENS BOULEVARD
**	S-302	CROSS SECTION - BETWEEN QUEENS BOULEVARD AND HONEYWELL STREET
**	S-303	CROSS SECTION - BETWEEN QUEENS BOULEVARD AND HONEYWELL STREET
**	S-304	CROSS SECTION - BETWEEN HONEYWELL STREET AND 39TH STREET
**	S-305	CROSS SECTION - BETWEEN HONEYWELL STREET AND 39TH STREET
**	S-310	BRIDGE SECTIONS - THOMSON AVENUE AND QUEENS BOULEVARD
**	S-311	BRIDGE SECTIONS - HONEYWELL STREET AND 39TH STREET

* NEW SHEETS

** NO UPDATES TO PREVIOUS ISSUANCE

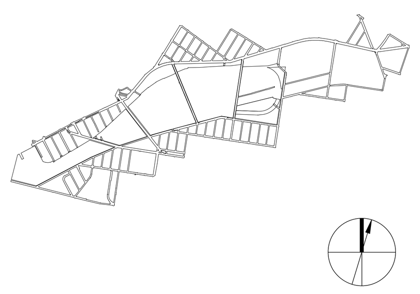


NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date
2	DRAWINGS UPDATE	12/21/2018
1	DRAWINGS UPDATE	11/20/2018

Key Plan



Discipline:

STRUCTURE

Title

COVER SHEET & DRAWINGS LIST

Thornton Tomasetti

Designed by	CCG
Drawn by	AP
Checked by	JB
Date	09/14/2018
Drawing Number	S-001.00

LEGEND

HORIZONTAL CLEARANCE

- 8'-6" ABSOLUTE CLEARANCE LINE
  3' CLEARANCE CUT AND COVER TUNNELS
  10' CLEARANCE ESA TUNNELS
- 16'-0" FOULING LINE

TRACKS

- EXISTING TRACK
- PROPOSED TRACK
- CROSS TRACK FEEDER

TRACK ZONES

- TRACK ZONE 1
- TRACK ZONE 2
- TRACK ZONE 3
- TRACK ZONE 4
- TRACK ZONE 5
- TRACK ZONE 6
- TRACK ZONE 7
- TRACK ZONE 8

STRUCTURE

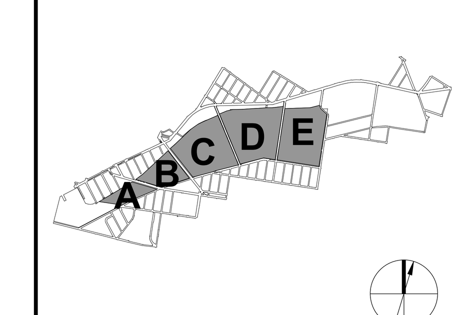
- COLUMN LINES
- TRUSSES PARALLEL TO TRACKS
- TRUSSES PERPENDICULAR TO TRACKS
- MEGATRUSS
- MEGACOLUMN
- EXISTING BUILDINGS
- PROPOSED BUILDINGS

NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date
2	DRAWINGS UPDATE	12/21/2018
1	DRAWINGS UPDATE	11/20/2018

Key Plan



Discipline:

STRUCTURE

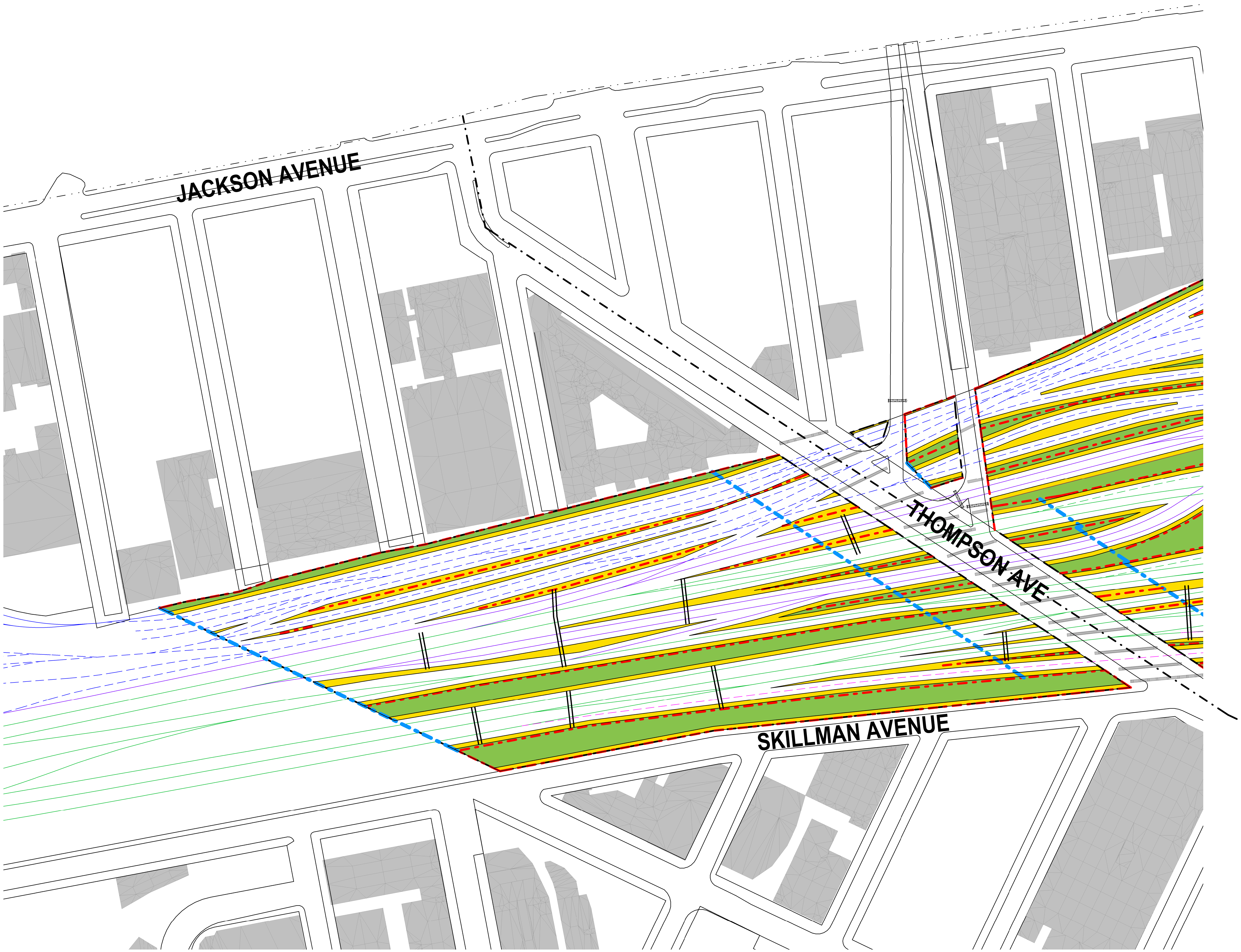
Title

OVERALL SITE PLAN - COLUMNS & HORIZONTAL CLEARANCES

Thornton Tomasetti

Designed by CC
Drawn by AP
Checked by JB
Date 09/14/2018
Drawing Number S-110.00

Appendix H



LEGEND

HORIZONTAL CLEARANCE

- 8'-6" ABSOLUTE CLEARANCE LINE
  3' CLEARANCE CUT AND COVER TUNNELS
  10' CLEARANCE ESA TUNNELS
- 16'-0" FOULING LINE

TRACKS

- EXISTING TRACK
- PROPOSED TRACK
- CROSS TRACK FEEDER

TRACK ZONES

- TRACK ZONE 1
- TRACK ZONE 2
- TRACK ZONE 3
- TRACK ZONE 4
- TRACK ZONE 5
- TRACK ZONE 6
- TRACK ZONE 7
- TRACK ZONE 8

STRUCTURE

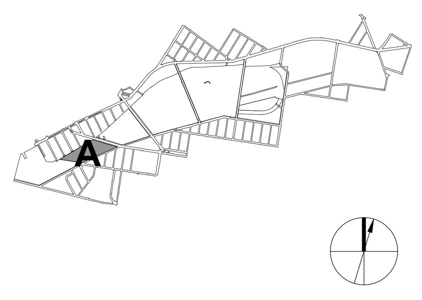
- COLUMN LINES
- TRUSSES PARALLEL TO TRACKS
- TRUSSES PERPENDICULAR TO TRACKS
- MEGATRUSS
- MEGACOLUMN
- EXISTING BUILDINGS
- PROPOSED BUILDINGS

NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date
2	DRAWINGS UPDATE	12/21/2018
1	DRAWINGS UPDATE	11/20/2018

Key Plan



Discipline:

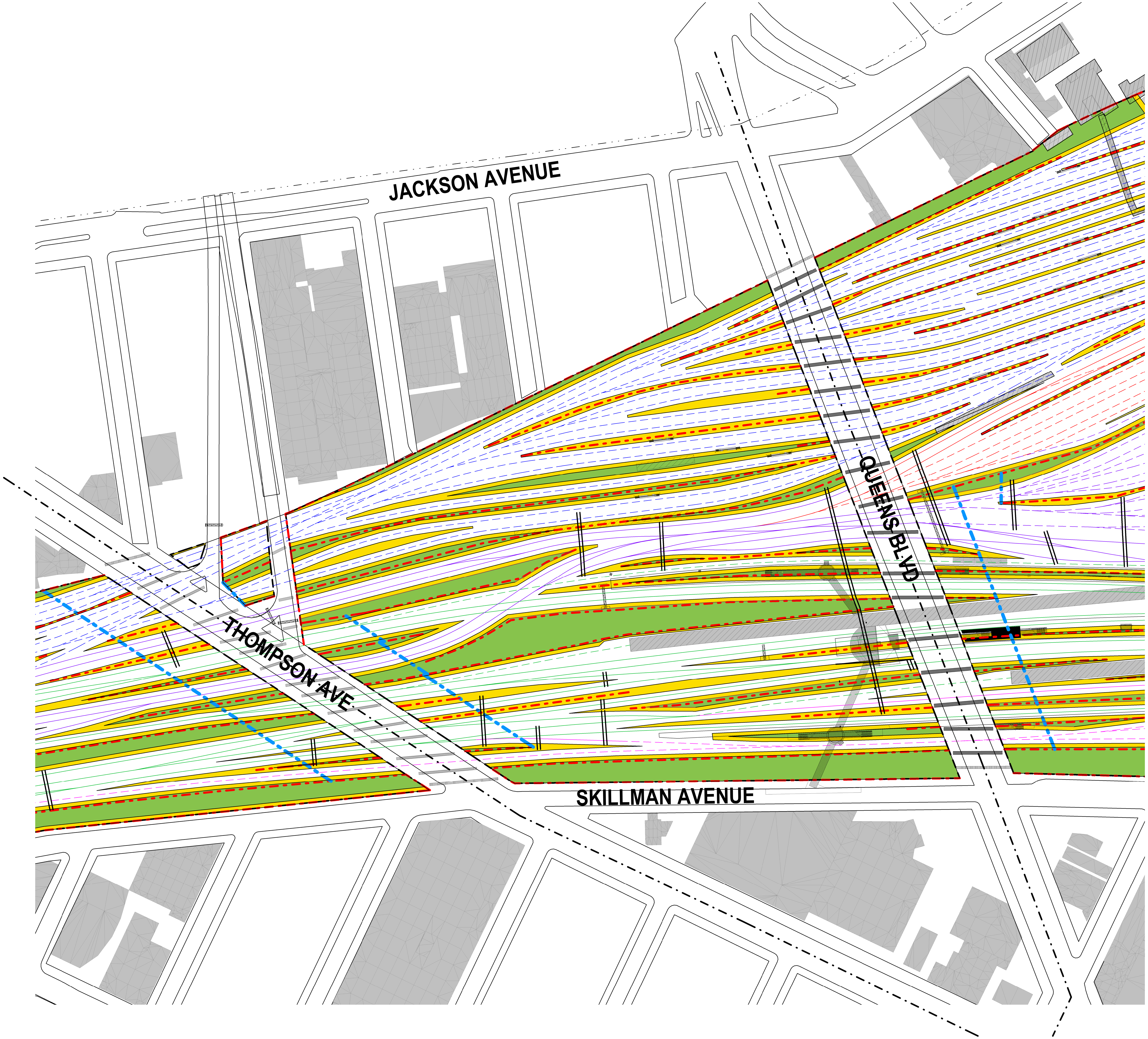
STRUCTURE

Title

OVERALL SITE PLAN - COLUMNS & HORIZONTAL CLEARANCES - SECTOR A

Thornton Tomasetti

Designed by	CC
Drawn by	AP
Checked by	JB
Date	09/14/2018
Drawing Number	S-110A.00



LEGEND

HORIZONTAL CLEARANCE

- 8'-6" ABSOLUTE CLEARANCE LINE / 3' CLEARANCE CUT AND COVER TUNNELS / 10' CLEARANCE ESA TUNNELS
- 16'-0" FOULING LINE

TRACKS

- EXISTING TRACK
- PROPOSED TRACK
- CROSS TRACK FEEDER

TRACK ZONES

- TRACK ZONE 1
- TRACK ZONE 2
- TRACK ZONE 3
- TRACK ZONE 4
- TRACK ZONE 5
- TRACK ZONE 6
- TRACK ZONE 7
- TRACK ZONE 8

STRUCTURE

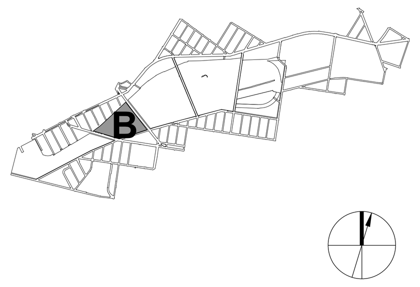
- COLUMN LINES
- TRUSSES PARALLEL TO TRACKS
- TRUSSES PERPENDICULAR TO TRACKS
- MEGATRUSS
- MEGACOLUMN
- EXISTING BUILDINGS
- PROPOSED BUILDINGS

NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date
2	DRAWINGS UPDATE	12/21/2018
1	DRAWINGS UPDATE	11/20/2018

Key Plan



Discipline:

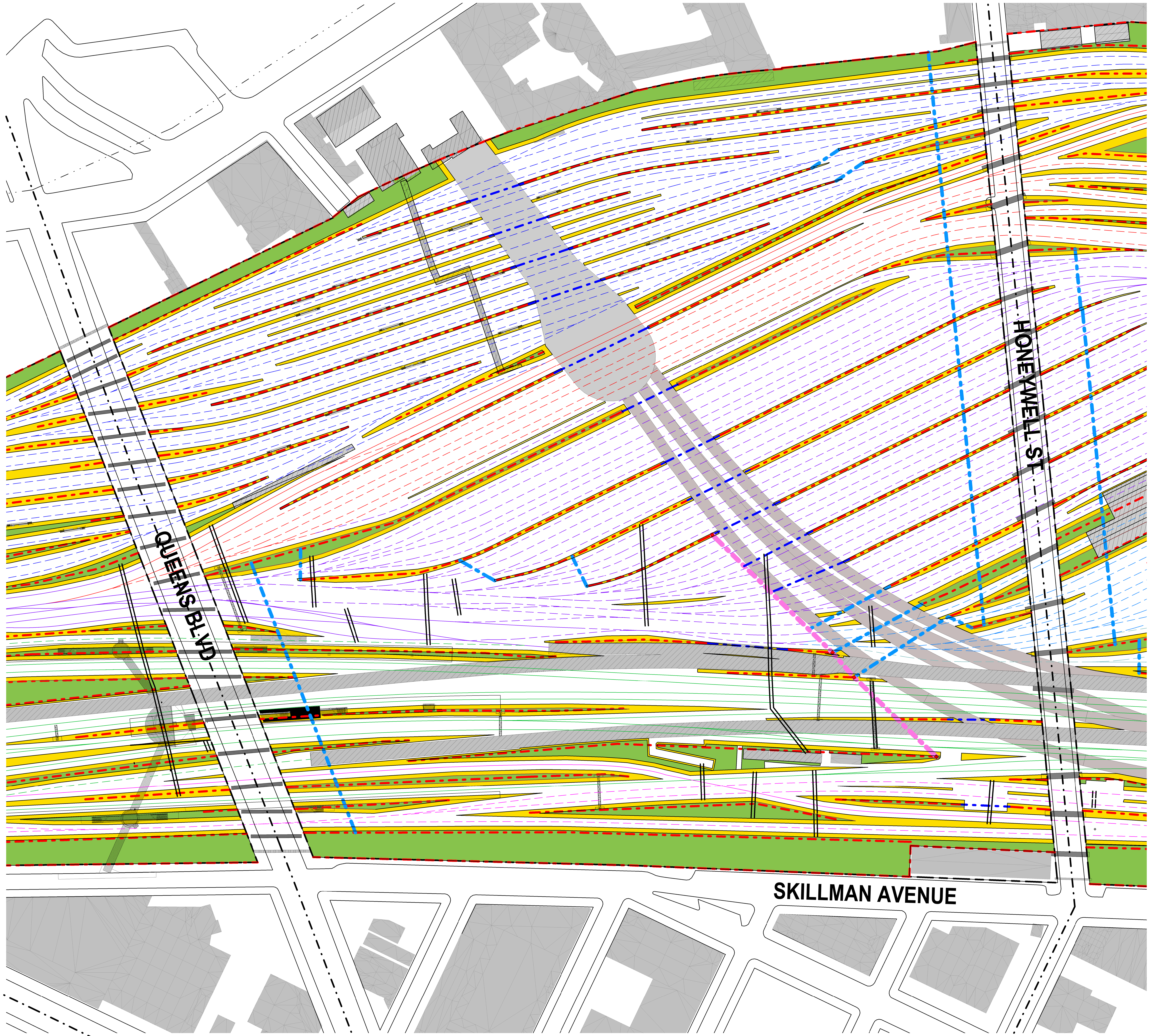
STRUCTURE

Title

OVERALL SITE PLAN - COLUMNS & HORIZONTAL CLEARANCES - SECTOR B

Thornton Tomasetti

Designed by	CC
Drawn by	AP
Checked by	JB
Date	09/14/2018
Drawing Number	S-110B.00



LEGEND

HORIZONTAL CLEARANCE

- 8'-6" ABSOLUTE CLEARANCE LINE 3' CLEARANCE CUT AND COVER TUNNELS 10' CLEARANCE ESA TUNNELS
- 16'-0" FOULING LINE

TRACKS

- EXISTING TRACK
- PROPOSED TRACK
- CROSS TRACK FEEDER

TRACK ZONES

- TRACK ZONE 1
- TRACK ZONE 2
- TRACK ZONE 3
- TRACK ZONE 4
- TRACK ZONE 5
- TRACK ZONE 6
- TRACK ZONE 7
- TRACK ZONE 8

STRUCTURE

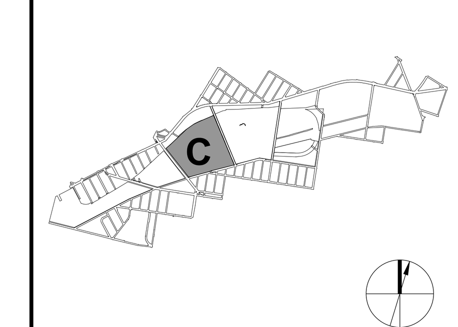
- COLUMN LINES
- TRUSSES PARALLEL TO TRACKS
- TRUSSES PERPENDICULAR TO TRACKS
- MEGATRUSS
- MEGACOLUMN
- EXISTING BUILDINGS
- PROPOSED BUILDINGS

NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date
2	DRAWINGS UPDATE	12/21/2018
1	DRAWINGS UPDATE	11/20/2018

Key Plan



Discipline:

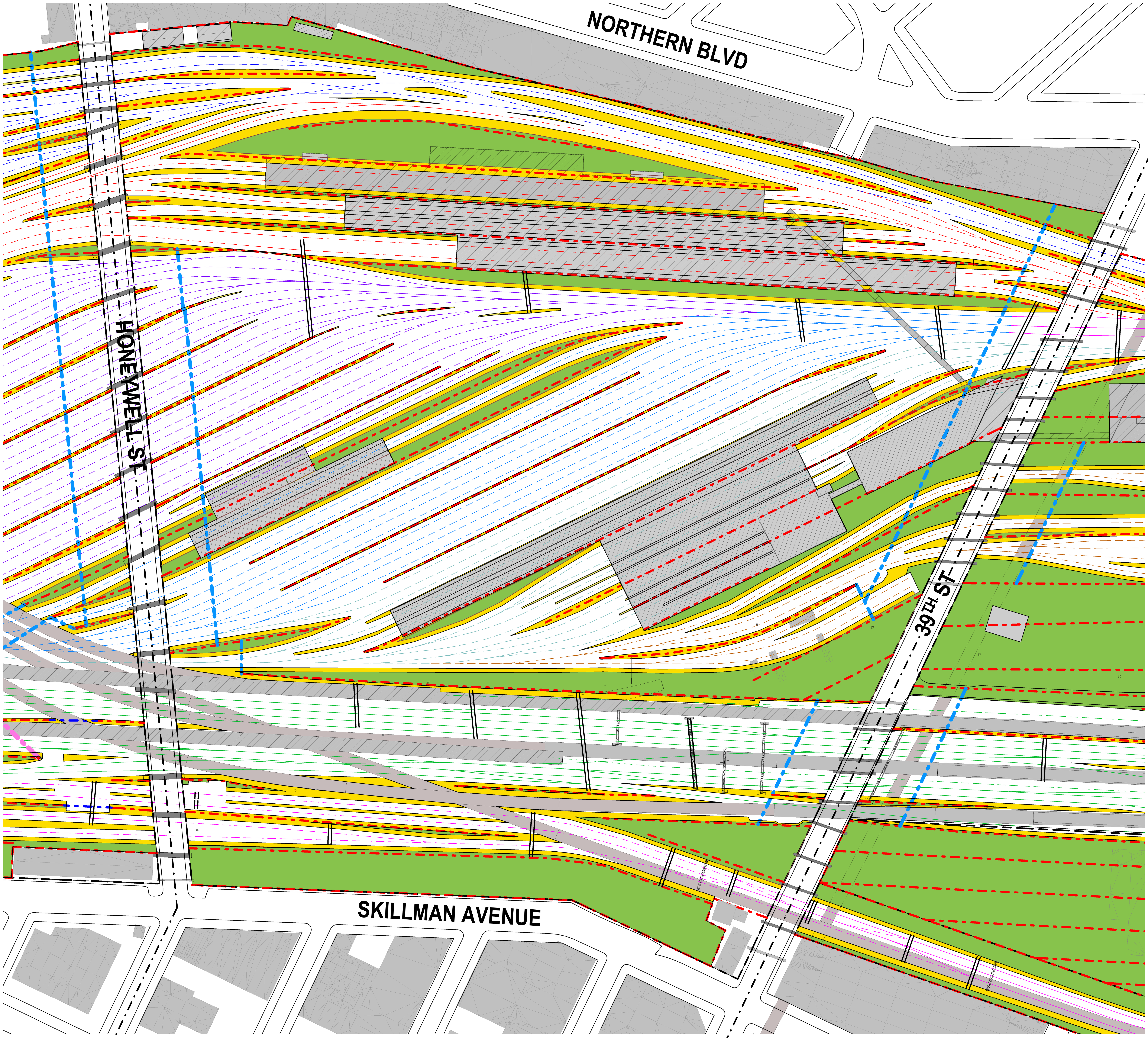
STRUCTURE

Title

OVERALL SITE PLAN - COLUMNS & HORIZONTAL CLEARANCES - SECTOR C

Thornton Tomasetti

Designed by	CC
Drawn by	AP
Checked by	JB
Date	09/14/2018
Drawing Number	S-110C.00



LEGEND

HORIZONTAL CLEARANCE

- 8'-6" ABSOLUTE CLEARANCE LINE 3' CLEARANCE CUT AND COVER TUNNELS 10' CLEARANCE ESA TUNNELS
- 16'-0" FOULING LINE

TRACKS

- EXISTING TRACK
- PROPOSED TRACK
- CROSS TRACK FEEDER

TRACK ZONES

- TRACK ZONE 1
- TRACK ZONE 2
- TRACK ZONE 3
- TRACK ZONE 4
- TRACK ZONE 5
- TRACK ZONE 6
- TRACK ZONE 7
- TRACK ZONE 8

STRUCTURE

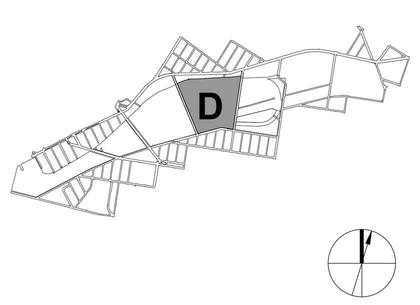
- COLUMN LINES
- TRUSSES PARALLEL TO TRACKS
- TRUSSES PERPENDICULAR TO TRACKS
- MEGATRUSS
- MEGACOLUMN
- EXISTING BUILDINGS
- PROPOSED BUILDINGS

NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date
2	DRAWINGS UPDATE	12/21/2018
1	DRAWINGS UPDATE	11/20/2018

Key Plan



Discipline:

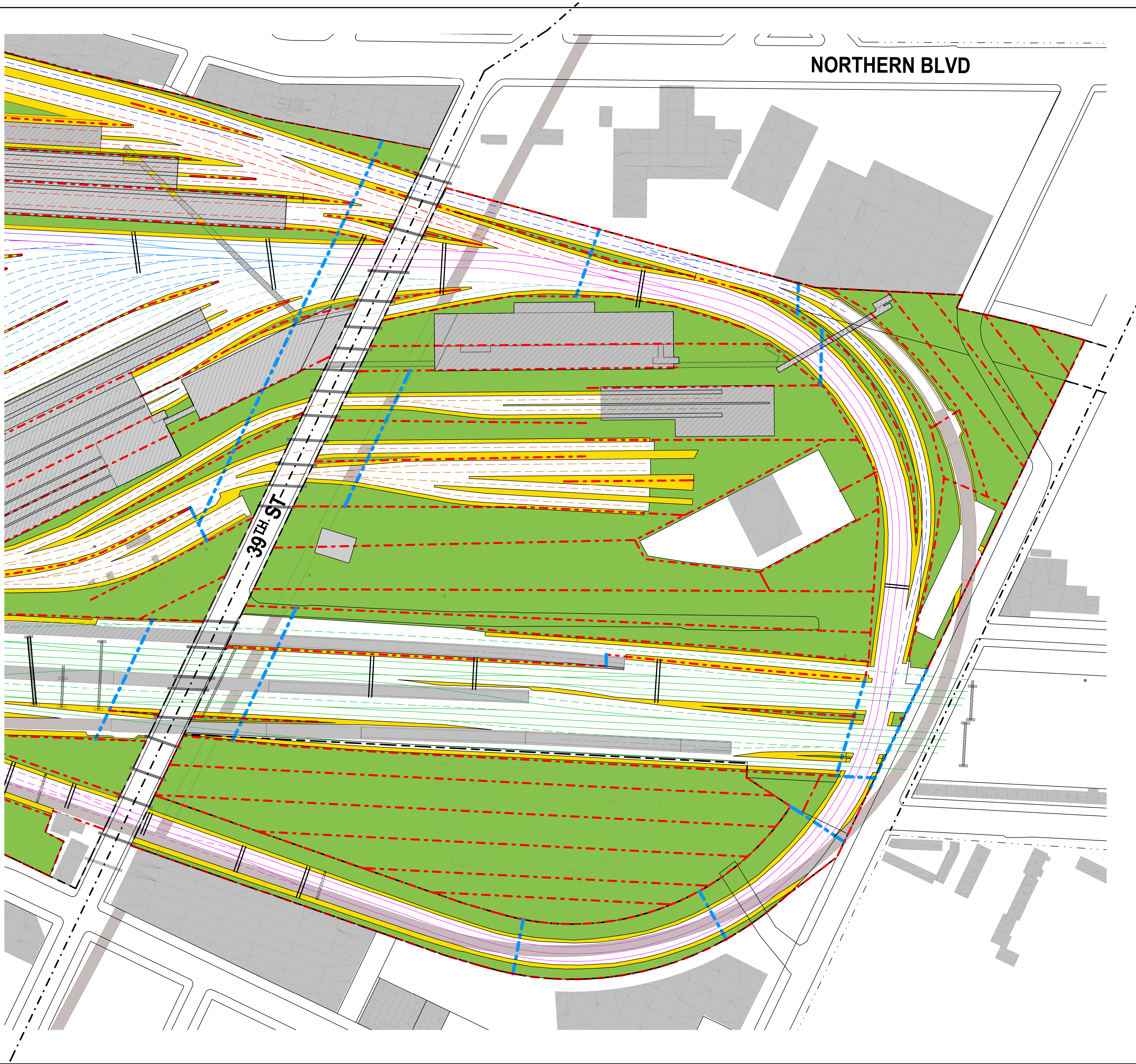
STRUCTURE

Title

OVERALL SITE PLAN - COLUMNS & HORIZONTAL CLEARANCES - SECTOR D

Thornton Tomasetti

Designed by	CC
Drawn by	AP
Checked by	JB
Date	09/14/2018
Drawing Number	S-110D.00



LEGEND

HORIZONTAL CLEARANCE

- 8'-6" ABSOLUTE CLEARANCE LINE 3' CLEARANCE CUT AND COVER TUNNELS 10' CLEARANCE ESA TUNNELS
- 16'-0" FOULING LINE

TRACKS

- EXISTING TRACK
- PROPOSED TRACK
- CROSS TRACK FEEDER

TRACK ZONES

- TRACK ZONE 1
- TRACK ZONE 2
- TRACK ZONE 3
- TRACK ZONE 4
- TRACK ZONE 5
- TRACK ZONE 6
- TRACK ZONE 7
- TRACK ZONE 8

STRUCTURE

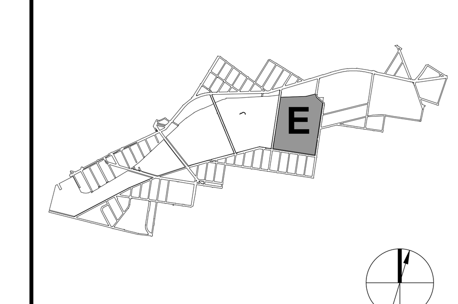
- COLUMN LINES
- TRUSSES PARALLEL TO TRACKS
- TRUSSES PERPENDICULAR TO TRACKS
- MEGATRUSS
- MEGACOLUMN
- EXISTING BUILDINGS
- PROPOSED BUILDINGS

NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date
2	DRAWINGS UPDATE	12/21/2018
1	DRAWINGS UPDATE	11/20/2018

Key Plan



Discipline:
STRUCTURE

Title

OVERALL SITE PLAN - COLUMNS & HORIZONTAL CLEARANCES - SECTOR E

Thornton Tomasetti

Designed by CC
Drawn by AP
Checked by JB
Date 09/14/2018
Drawing Number S-110E.00

APPENDIX A.5.I

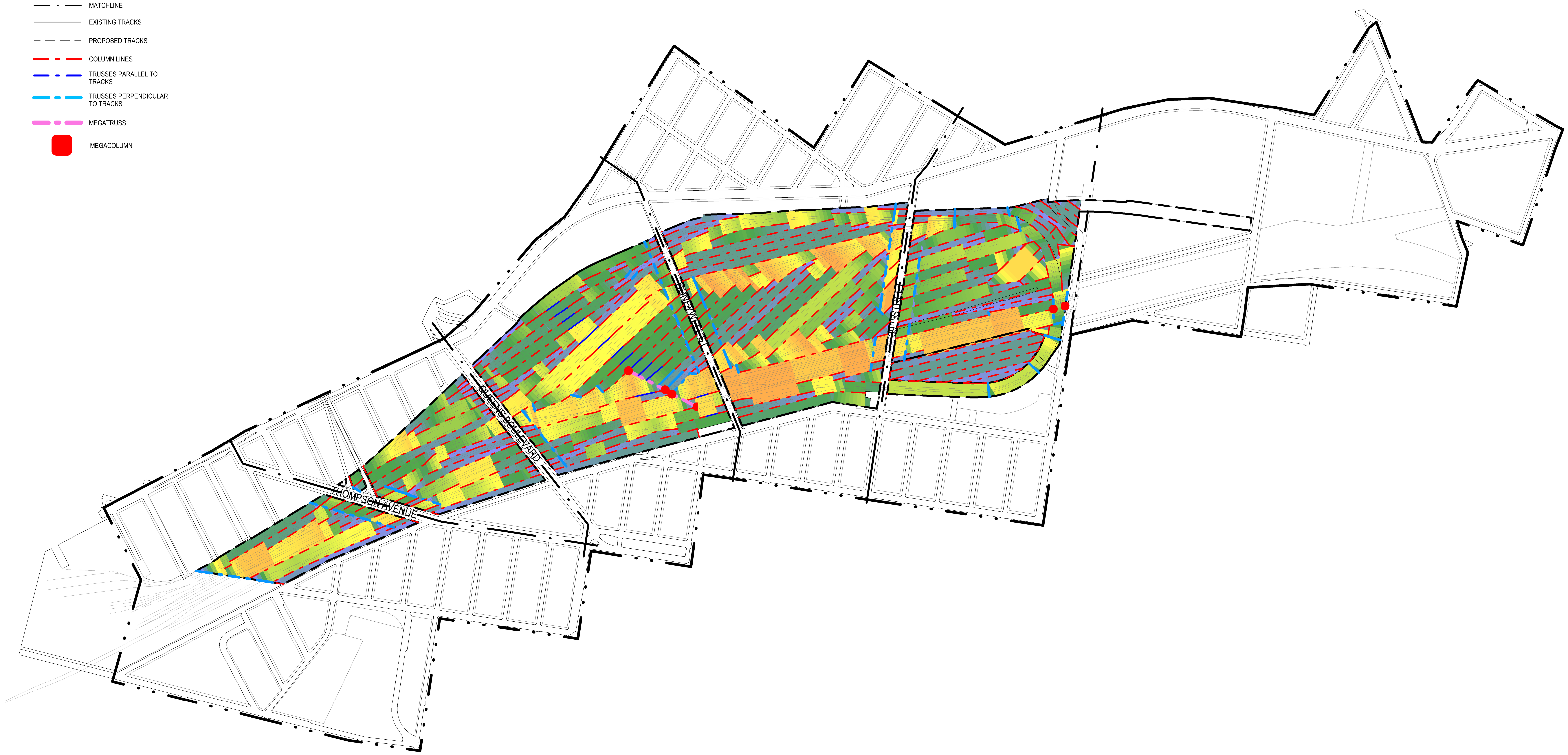
HEAT MAPS

LEGEND

Span size in feet
>200
200
180
160
140
120
100
80
60
40
30
<30

SPAN SIZE IN FEET

- PROJECT BOUNDARY
- SITE BOUNDARY
- MATCHLINE
- EXISTING TRACKS
- PROPOSED TRACKS
- COLUMN LINES
- TRUSSES PARALLEL TO TRACKS
- TRUSSES PERPENDICULAR TO TRACKS
- MEGATRUSS
- MEGACOLUMN

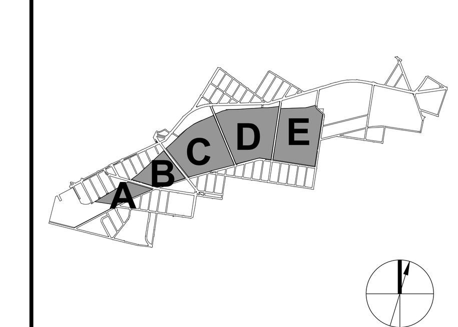


NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date
2	DRAWINGS UPDATE	12/21/2018
1	DRAWINGS UPDATE	11/20/2018

Key Plan



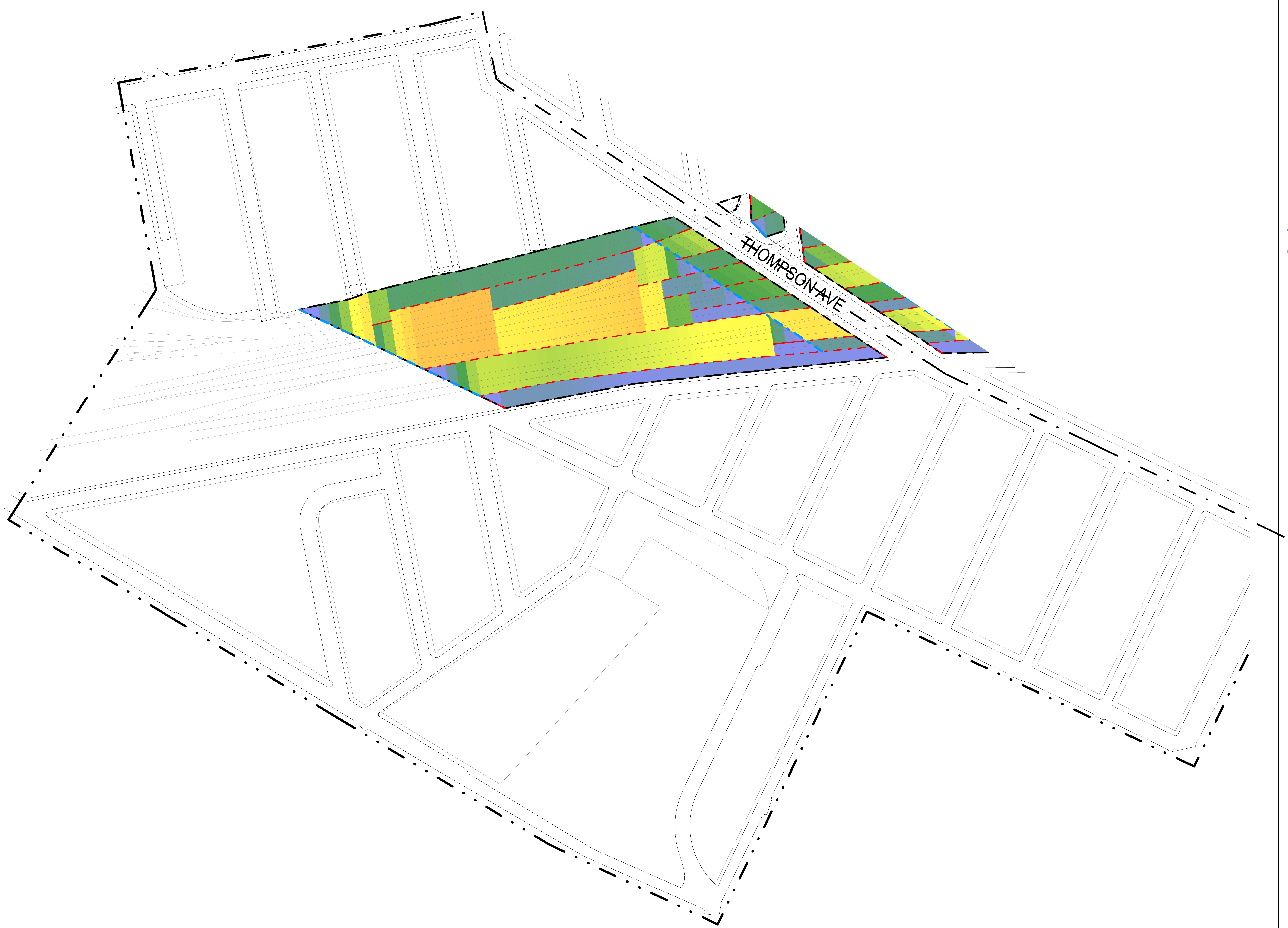
Discipline: **STRUCTURE**

Title

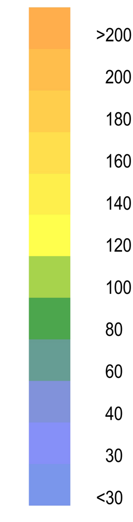
STRUCTURAL SPANS LENGTH

Thornton Tomasetti

Designed by	CC
Drawn by	AP
Checked by	JB
Date	09/14/2018
Drawing Number	S-120.00



LEGEND

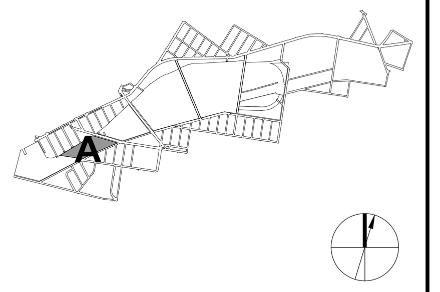


NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date
2	DRAWINGS UPDATE	12/21/2018
1	DRAWINGS UPDATE	11/20/2018

Key Plan



Discipline:

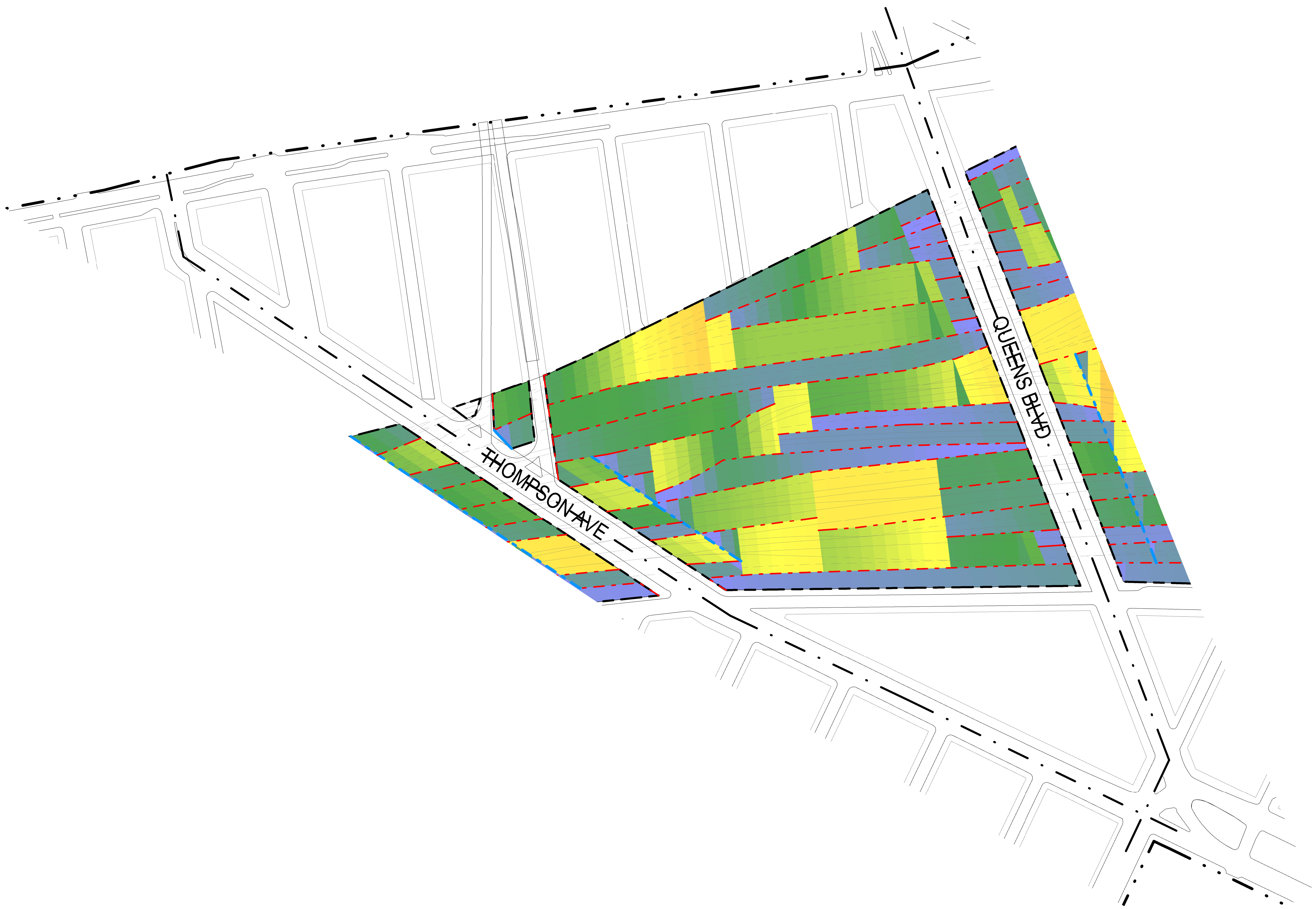
STRUCTURE

Title

STRUCTURAL SPAN LENGTH - SECTOR A

Thornton Tomasetti

Designed by	CC
Drawn by	AP
Checked by	JB
Date	09/14/2018
Drawing Number	S-120A.00



LEGEND

>200
200
180
160
140
120
100
80
60
40
30
<30

SPAN SIZE IN FEET

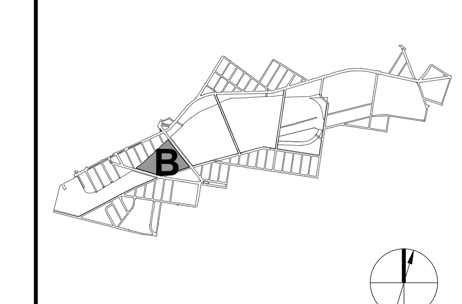
PROJECT BOUNDARY
SITE BOUNDARY
MATCHLINE
EXISTING TRACKS
PROPOSED TRACKS
COLUMN LINES
TRUSSES PARALLEL TO TRACKS
TRUSSES PERPENDICULAR TO TRACKS
MEGATRUSS
MEGACOLUMN

NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date
2	DRAWINGS UPDATE	12/21/2018
1	DRAWINGS UPDATE	11/20/2018

Key Plan



Discipline:
STRUCTURE

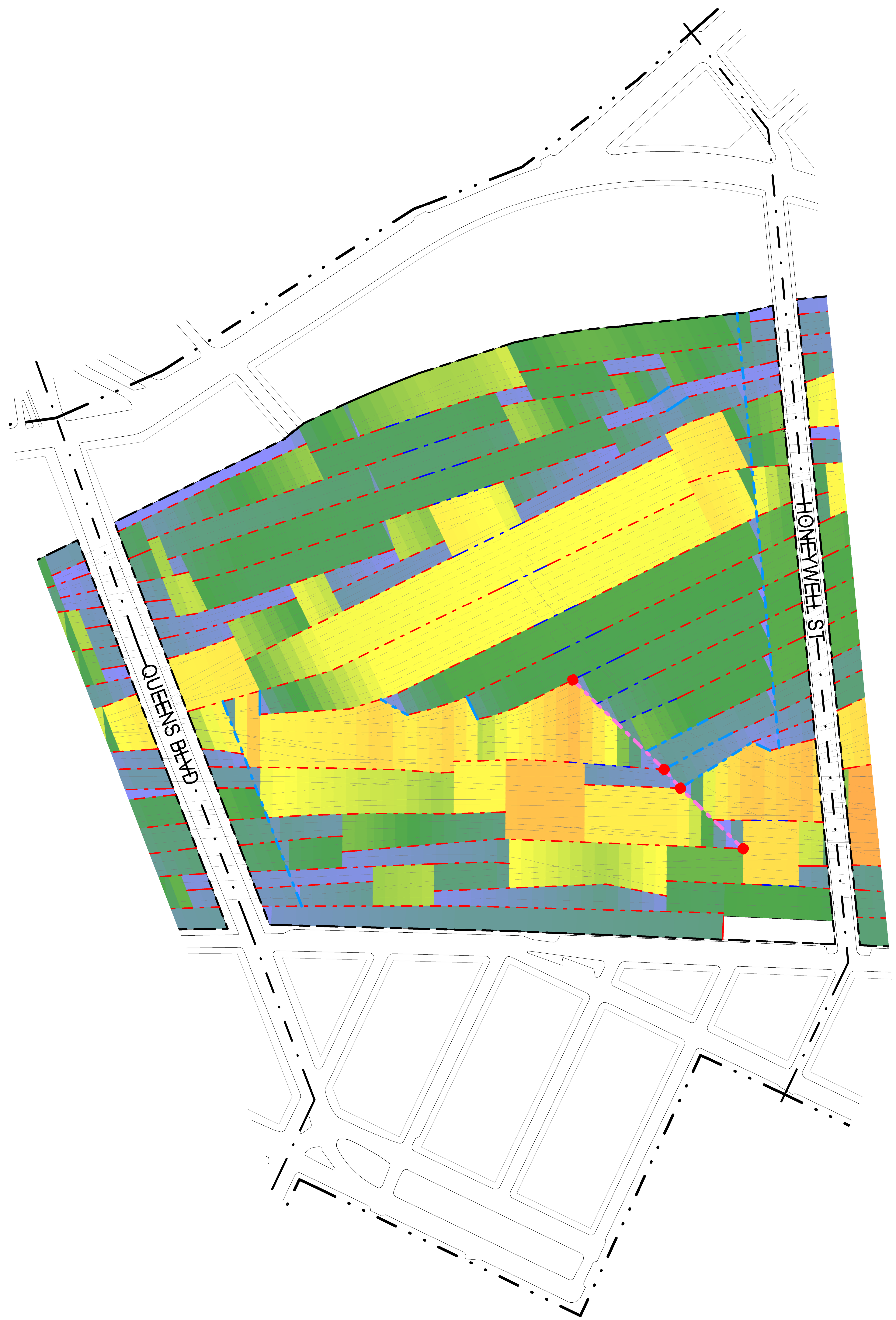
Title

STRUCTURAL SPANS LENGTH - SECTOR B

Thornton Tomasetti

Designed by CC
Drawn by AP
Checked by JB
Date 09/14/2018
Drawing Number S-120B.00

Appendix I



LEGEND

>200	
200	
180	
160	
140	
120	
100	
80	
60	
40	
30	
<30	

SPAN SIZE IN FEET

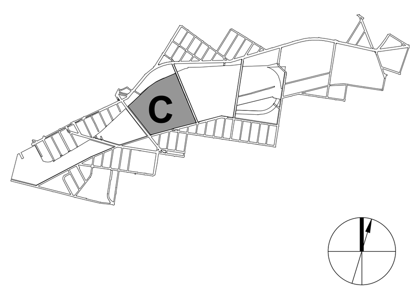
- PROJECT BOUNDARY
- SITE BOUNDARY
- MATCHLINE
- EXISTING TRACKS
- PROPOSED TRACKS
- COLUMN LINES
- TRUSSES PARALLEL TO TRACKS
- TRUSSES PERPENDICULAR TO TRACKS
- MEGATRUSS
- MEGACOLUMN

NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date
2	DRAWINGS UPDATE	12/21/2018
1	DRAWINGS UPDATE	11/20/2018

Key Plan



Discipline:

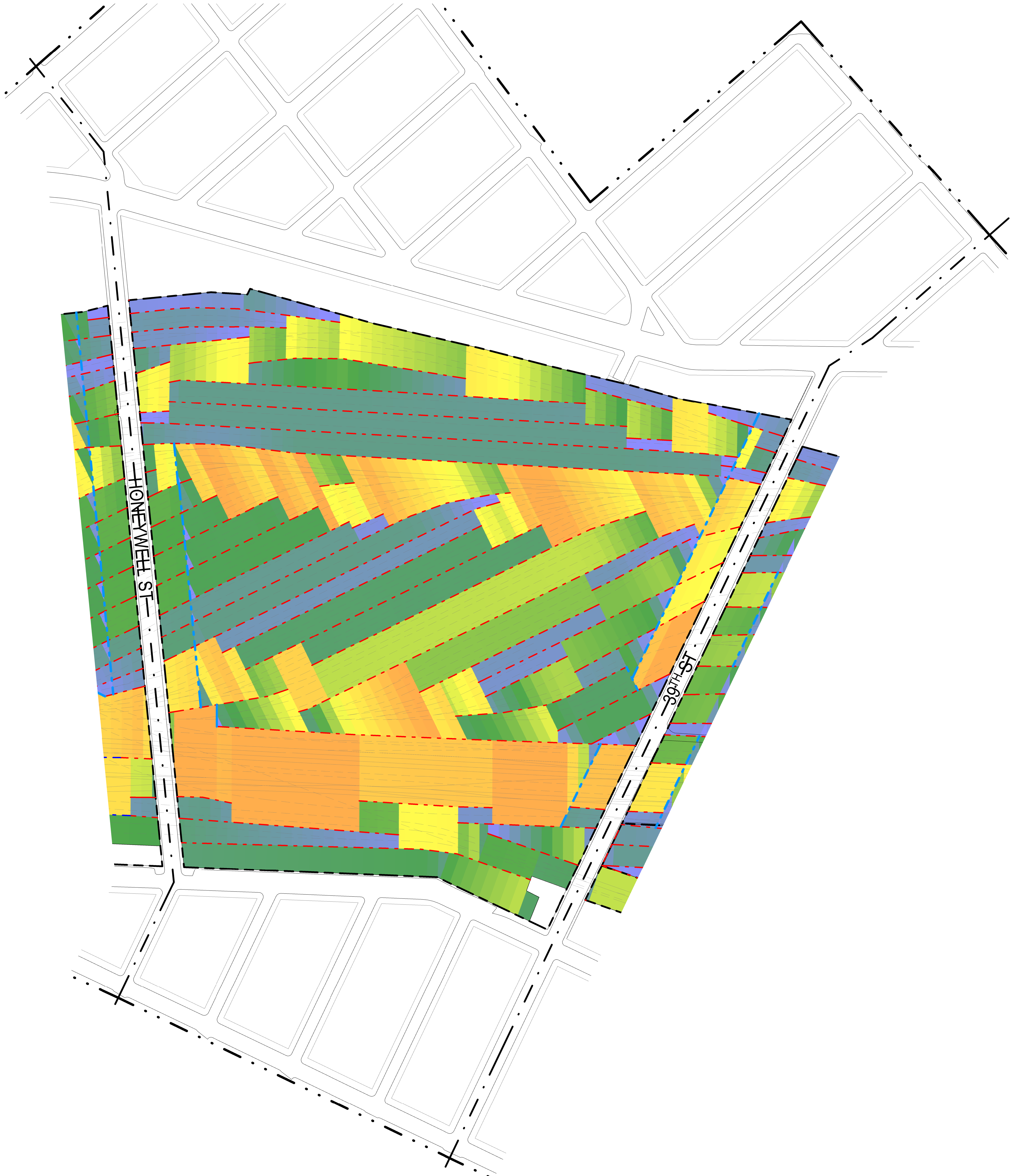
STRUCTURE

Title

STRUCTURAL SPANS LENGTH - SECTOR C

Thornton Tomasetti

Designed by	CC
Drawn by	AP
Checked by	JB
Date	09/14/2018
Drawing Number	S-120C.00



LEGEND

Span size in feet
>200
200
180
160
140
120
100
80
60
40
30
<30

SPAN SIZE IN FEET

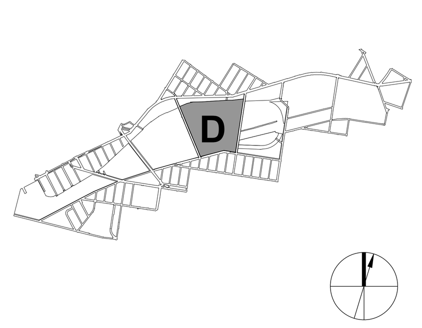
- PROJECT BOUNDARY
- SITE BOUNDARY
- MATCHLINE
- EXISTING TRACKS
- PROPOSED TRACKS
- COLUMN LINES
- TRUSSES PARALLEL TO TRACKS
- TRUSSES PERPENDICULAR TO TRACKS
- MEGATRUSS
- MEGACOLUMN

NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date
2	DRAWINGS UPDATE	12/21/2018
1	DRAWINGS UPDATE	11/20/2018

Key Plan



Discipline:

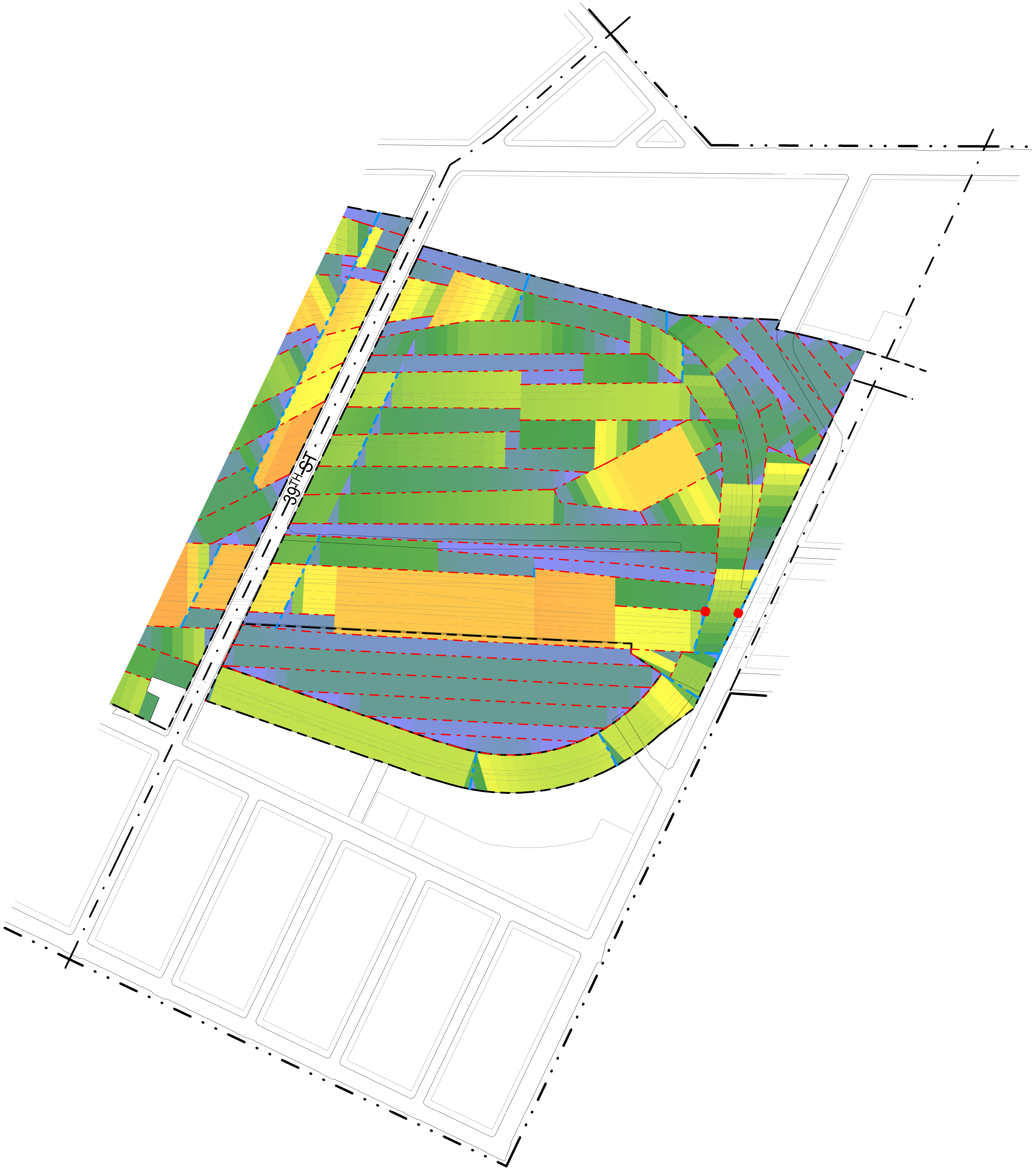
STRUCTURE

Title

STRUCTURAL SPANS LENGTH - SECTOR D

Thornton Tomasetti

Designed by	CC
Drawn by	AP
Checked by	JB
Date	09/14/2018
Drawing Number	S-120D.00



LEGEND

>200	
200	
180	
160	
140	
120	
100	
80	
60	
40	
30	
<30	

SPAN SIZE IN FEET

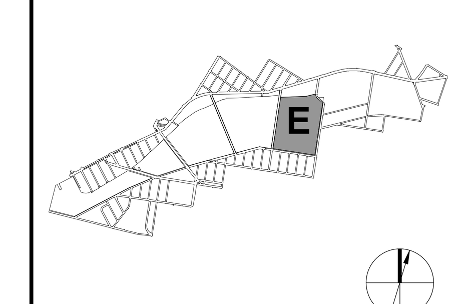
- PROJECT BOUNDARY
- SITE BOUNDARY
- MATCHLINE
- EXISTING TRACKS
- PROPOSED TRACKS
- COLUMN LINES
- TRUSSES PARALLEL TO TRACKS
- TRUSSES PERPENDICULAR TO TRACKS
- MEGATRUSS
- MEGACOLUMN

NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date
2	DRAWINGS UPDATE	12/21/2018
1	DRAWINGS UPDATE	11/20/2018

Key Plan



Discipline:

STRUCTURE

Title

STRUCTURAL SPANS LENGTH - SECTOR E

Thornton Tomasetti

Designed by CC

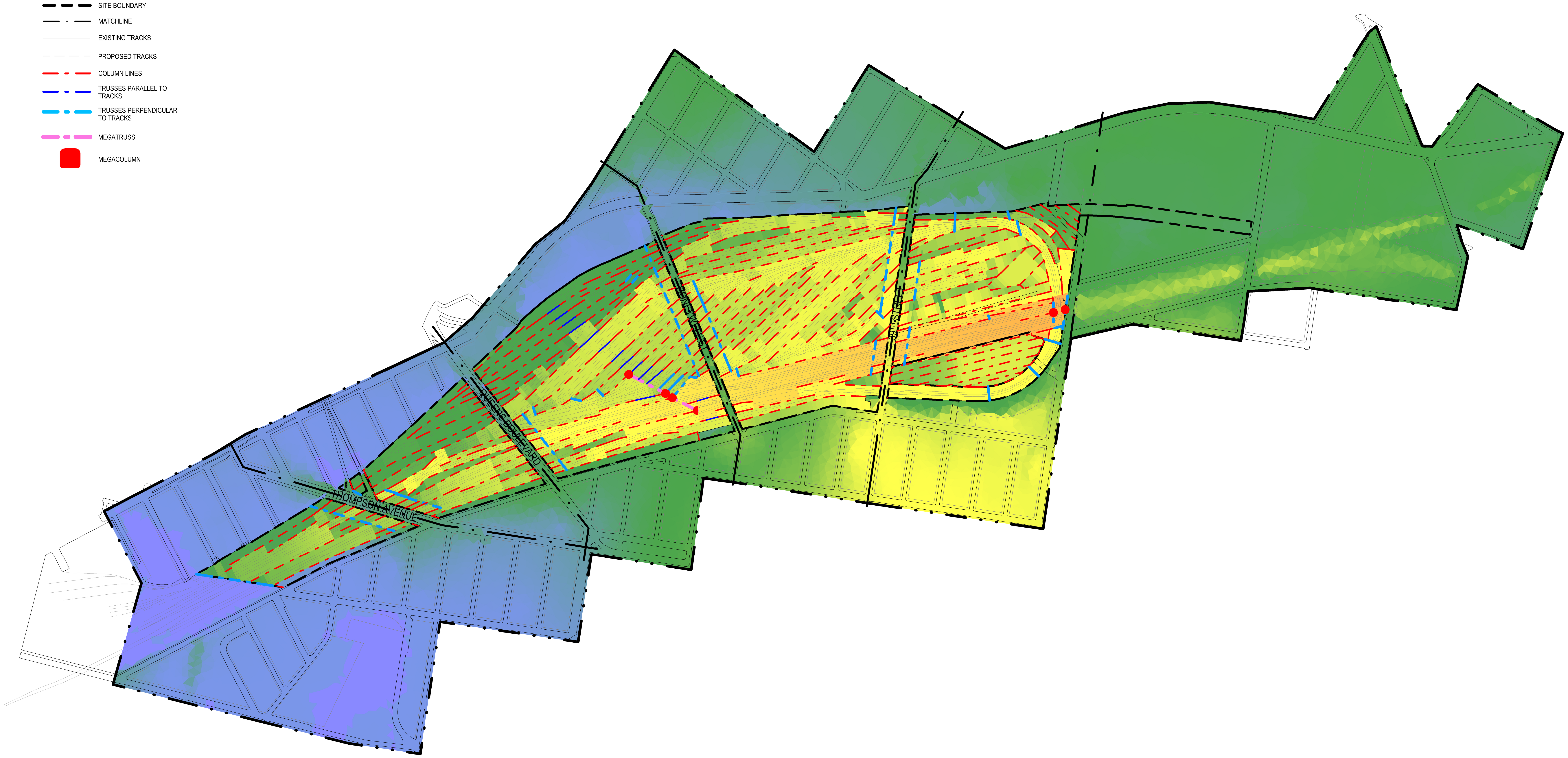
Drawn by AP

Checked by JB

Date 09/14/2018

Drawing Number

S-120E.00



LEGEND

120
109
98
87
76
65
54
43
32
21
10

ELEVATIONS IN FEET ACCORDING TO THE NAVD88 VERTICAL DATUM

22' CLEARANCE FOR ZONE 1

35'-6" CLEARANCE FOR ZONES 2-8

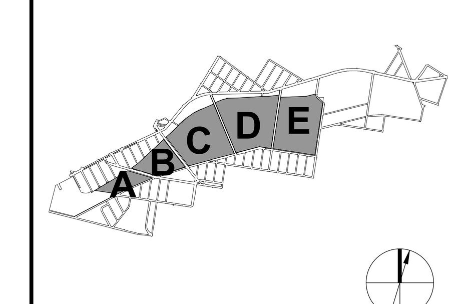
PROJECT BOUNDARY
SITE BOUNDARY
MATCHLINE
EXISTING TRACKS
PROPOSED TRACKS
COLUMN LINES
TRUSSES PARALLEL TO TRACKS
TRUSSES PERPENDICULAR TO TRACKS
MEGATRUSS
MEGACOLUMN

NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date
2	DRAWINGS UPDATE	12/21/2018
1	DRAWINGS UPDATE	11/20/2018

Key Plan



Discipline:

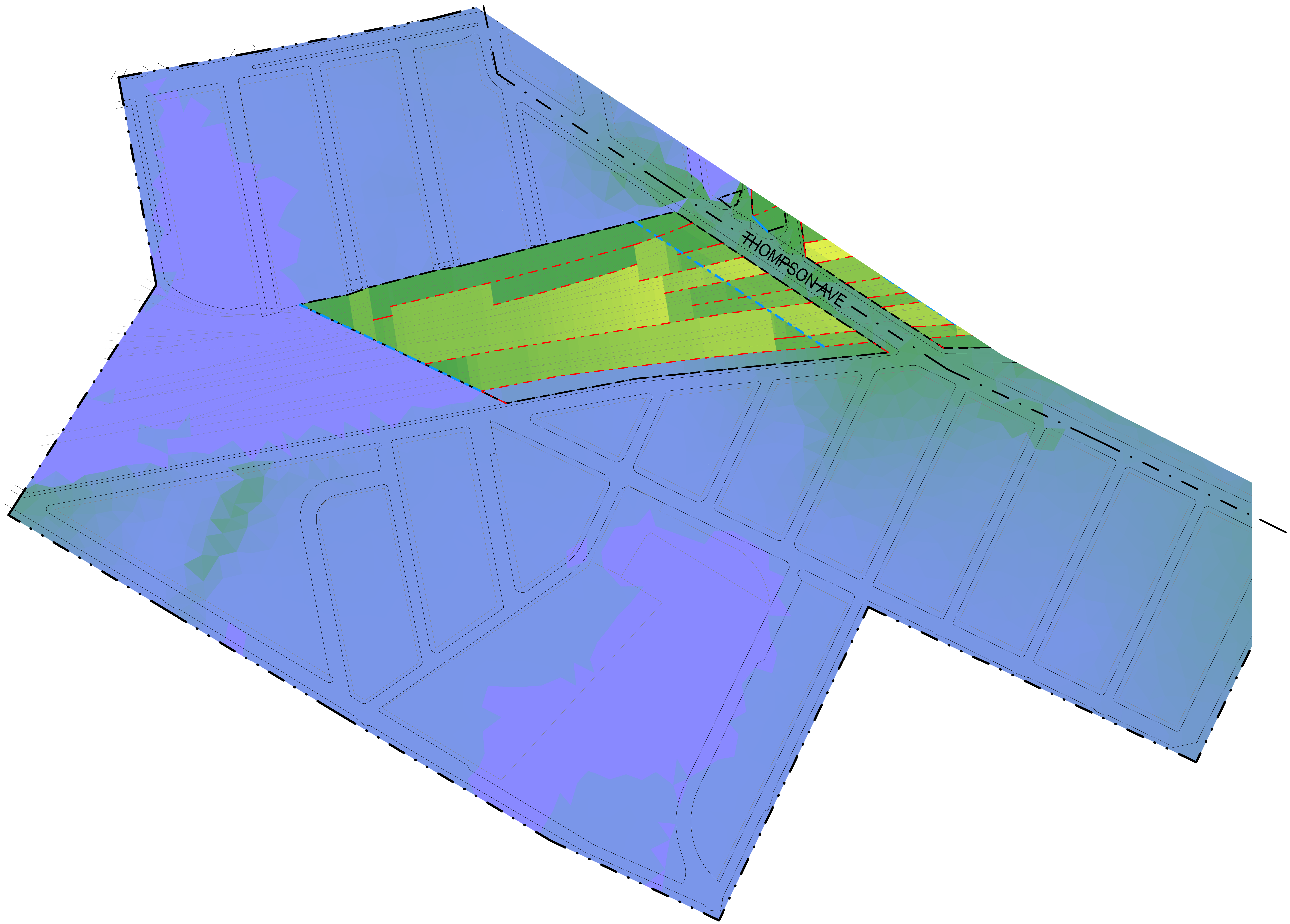
STRUCTURE

Title

TOP OF STRUCTURE STEEL - HIGH CLEARANCE

Thornton Tomasetti

Designed by CC
Drawn by AP
Checked by JB
Date 09/14/2018
Drawing Number S-130.00



LEGEND

Elevation
120
109
98
87
76
65
54
43
32
21
10

ELEVATIONS IN FEET ACCORDING TO THE NAVD88 VERTICAL DATUM

22' CLEARANCE FOR ZONE 1

35'-6" CLEARANCE FOR ZONES 2-8

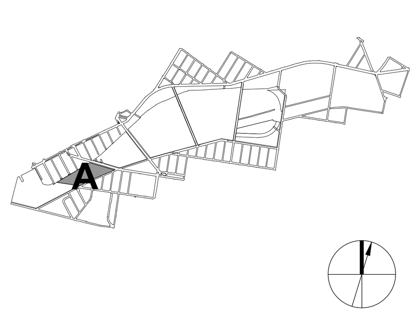
- PROJECT BOUNDARY
- SITE BOUNDARY
- MATCHLINE
- EXISTING TRACKS
- PROPOSED TRACKS
- COLUMN LINES
- TRUSSES PARALLEL TO TRACKS
- TRUSSES PERPENDICULAR TO TRACKS
- MEGATRUSS
- MEGACOLUMN

NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date
2	DRAWINGS UPDATE	12/21/2018
1	DRAWINGS UPDATE	11/20/2018

Key Plan



Discipline:

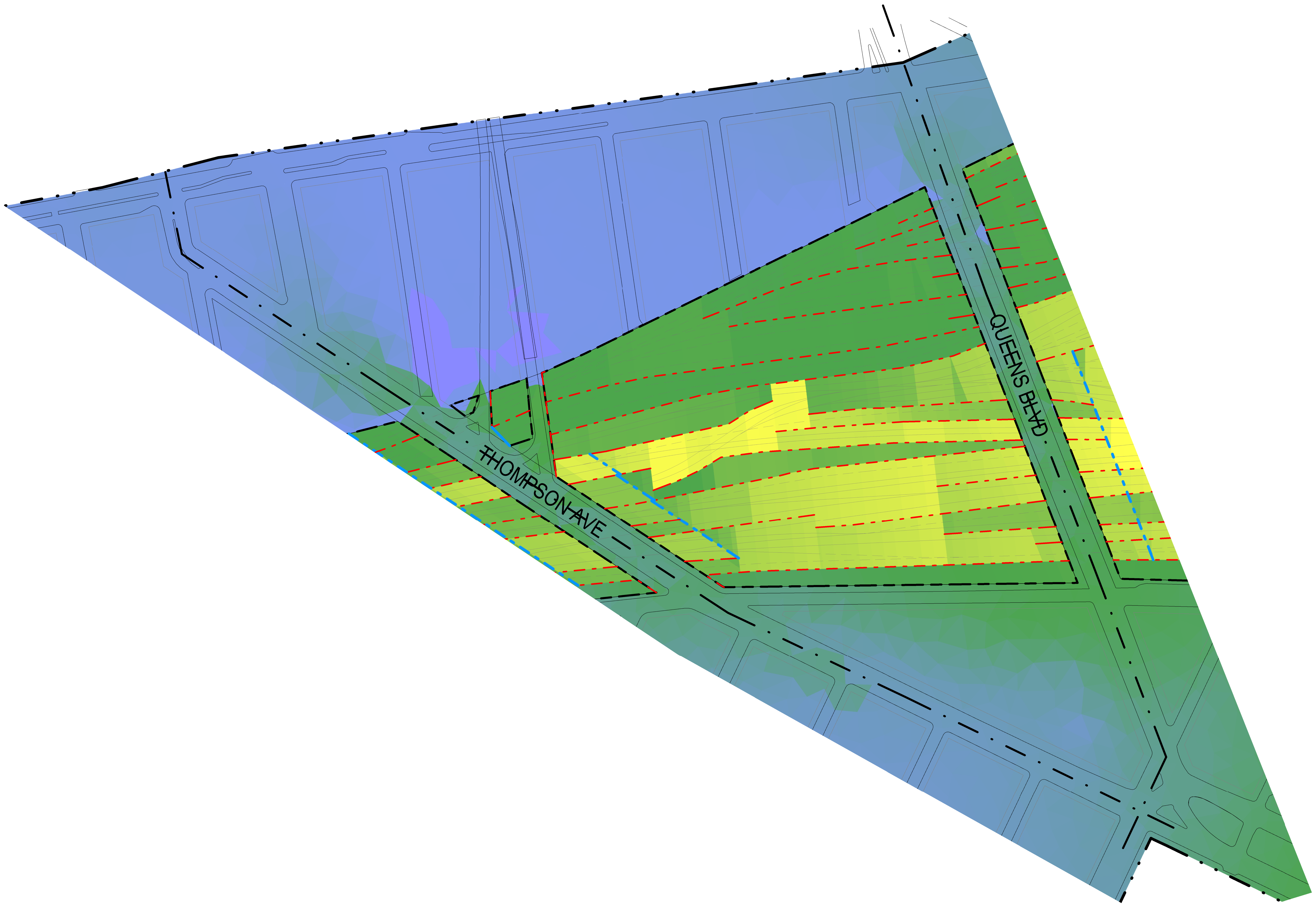
STRUCTURE

Title

TOP OF STRUCTURE STEEL - HIGH CLEARANCE - SECTOR A

Thornton Tomasetti

Designed by	CC
Drawn by	AP
Checked by	JB
Date	09/14/2018
Drawing Number	S-130A.00



LEGEND

120	
109	
98	
87	
76	
65	
54	
43	
32	
21	
10	

ELEVATIONS IN FEET ACCORDING TO THE NAVD88 VERTICAL DATUM

22' CLEARANCE FOR ZONE 1

35'-6" CLEARANCE FOR ZONES 2-8

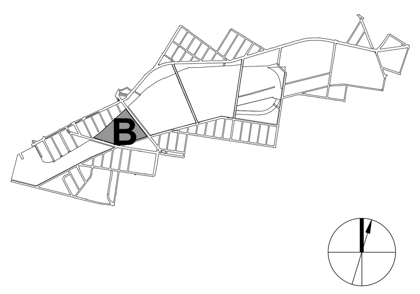
- PROJECT BOUNDARY
- SITE BOUNDARY
- MATCHLINE
- EXISTING TRACKS
- PROPOSED TRACKS
- COLUMN LINES
- TRUSSES PARALLEL TO TRACKS
- TRUSSES PERPENDICULAR TO TRACKS
- MEGATRUSS
- MEGACOLUMN

NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date
2	DRAWINGS UPDATE	12/21/2018
1	DRAWINGS UPDATE	11/20/2018

Key Plan



Discipline: **STRUCTURE**

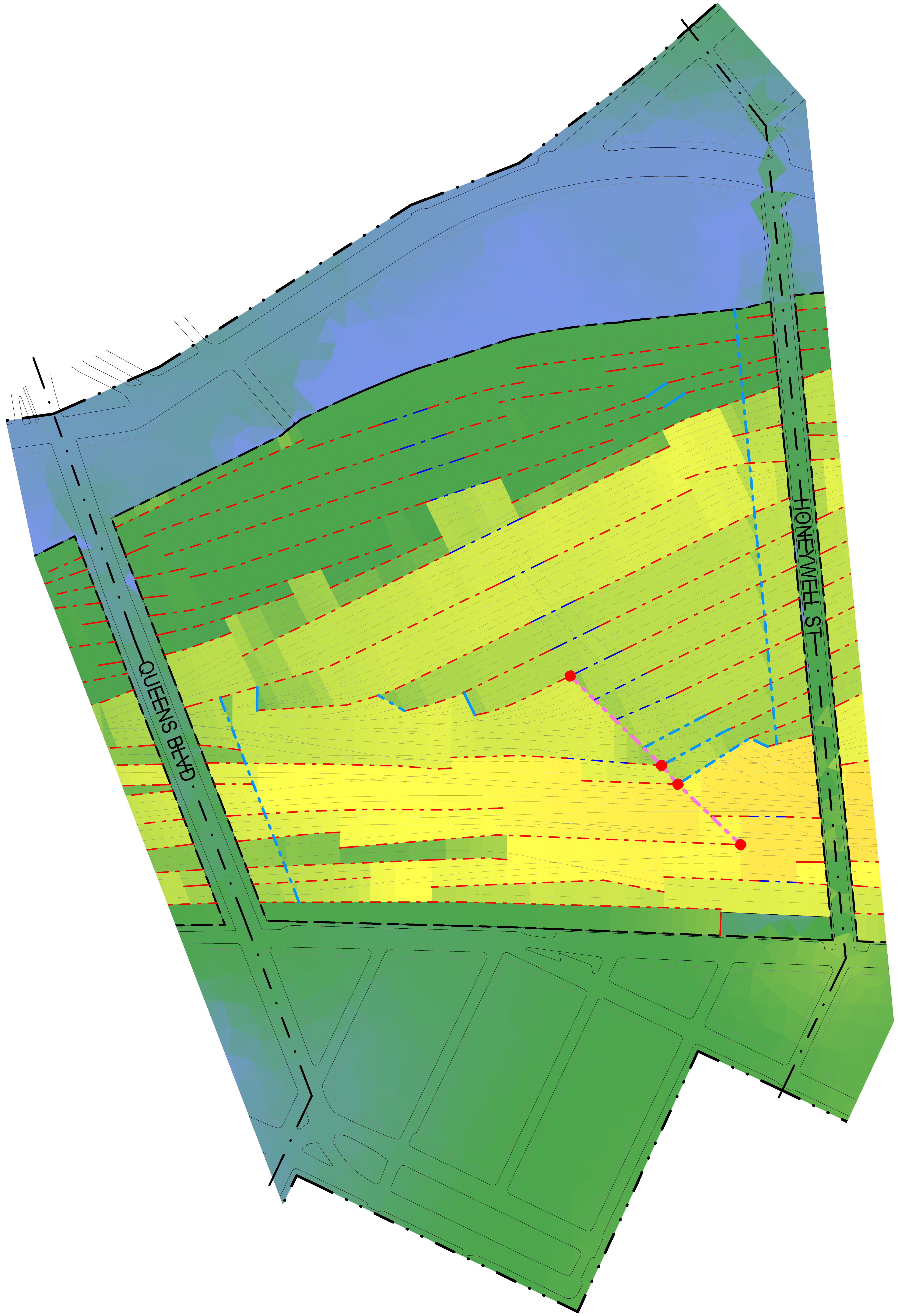
Title

TOP OF STRUCTURE STEEL - HIGH CLEARANCE - SECTOR B

Thornton Tomasetti

Designed by	CC
Drawn by	AP
Checked by	JB
Date	09/14/2018
Drawing Number	S-130B.00

Appendix I



LEGEND

120	
109	
98	
87	
76	
65	
54	
43	
32	
21	
10	

ELEVATIONS IN FEET ACCORDING TO THE NAVD88 VERTICAL DATUM

22' CLEARANCE FOR ZONE 1

35'-6" CLEARANCE FOR ZONES 2-8

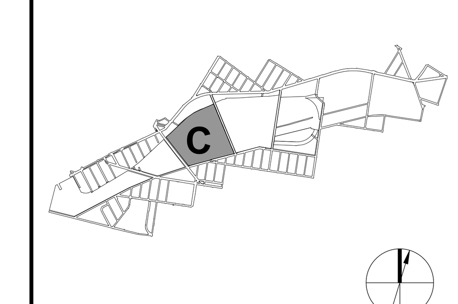
- PROJECT BOUNDARY
- SITE BOUNDARY
- MATCHLINE
- EXISTING TRACKS
- PROPOSED TRACKS
- COLUMN LINES
- TRUSSES PARALLEL TO TRACKS
- TRUSSES PERPENDICULAR TO TRACKS
- MEGATRUSS
- MEGACOLUMN

NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date
2	DRAWINGS UPDATE	12/21/2018
1	DRAWINGS UPDATE	11/20/2018

Key Plan



Discipline:

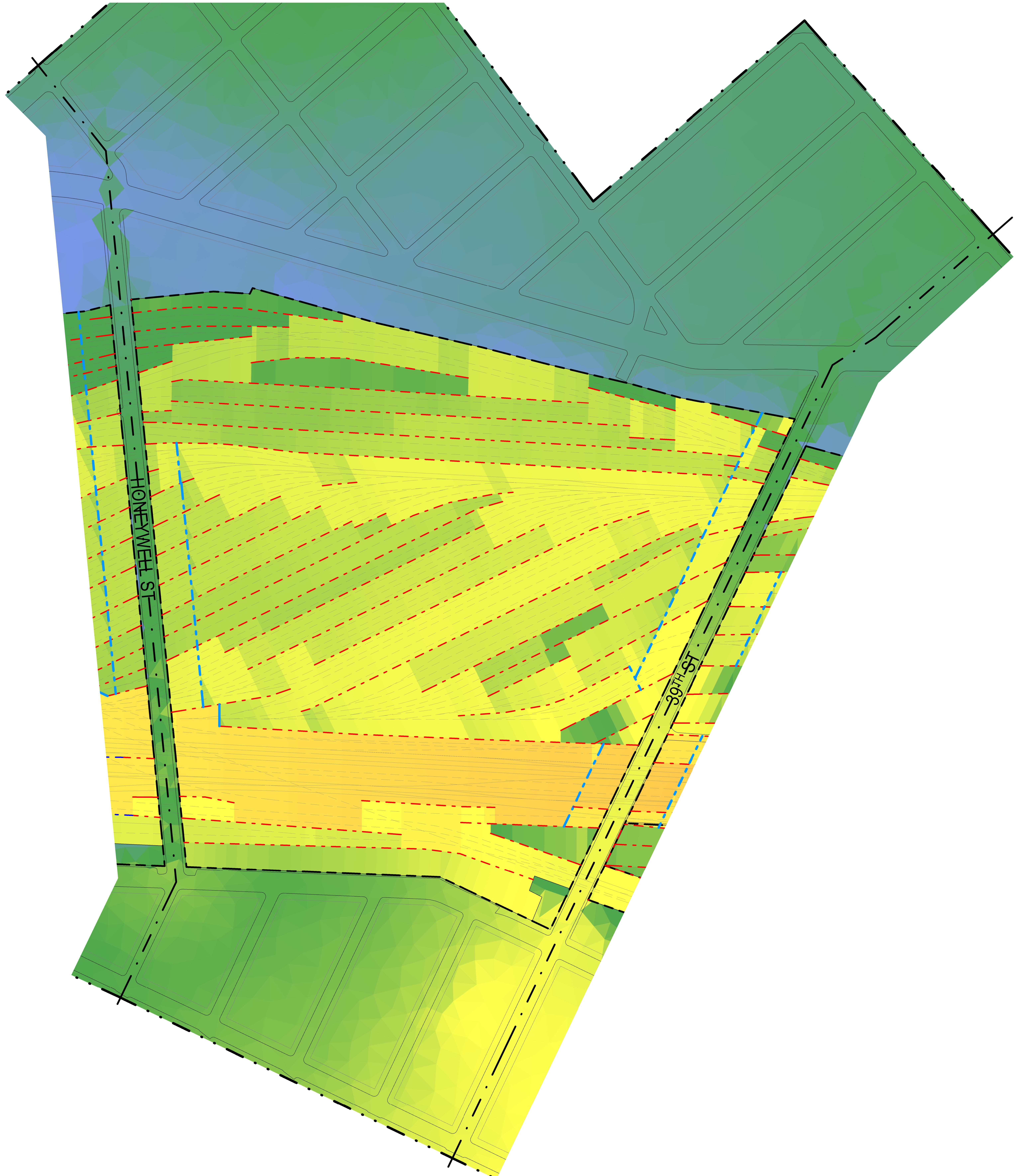
STRUCTURE

Title

TOP OF STRUCTURE STEEL - HIGH CLEARANCE - SECTOR C

Thornton Tomasetti

Designed by	CC
Drawn by	AP
Checked by	JB
Date	09/14/2018
Drawing Number	S-130C.00



LEGEND

120
109
98
87
76
65
54
43
32
21
10

ELEVATIONS IN FEET ACCORDING TO THE NAVD88 VERTICAL DATUM

22' CLEARANCE FOR ZONE 1

35'-6" CLEARANCE FOR ZONES 2-8

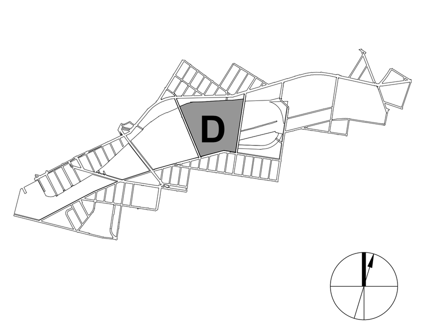
PROJECT BOUNDARY
SITE BOUNDARY
MATCHLINE
EXISTING TRACKS
PROPOSED TRACKS
COLUMN LINES
TRUSSES PARALLEL TO TRACKS
TRUSSES PERPENDICULAR TO TRACKS
MEGATRUSS
MEGACOLUMN

NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date
2	DRAWINGS UPDATE	12/21/2018
1	DRAWINGS UPDATE	11/20/2018

Key Plan



Discipline:
STRUCTURE

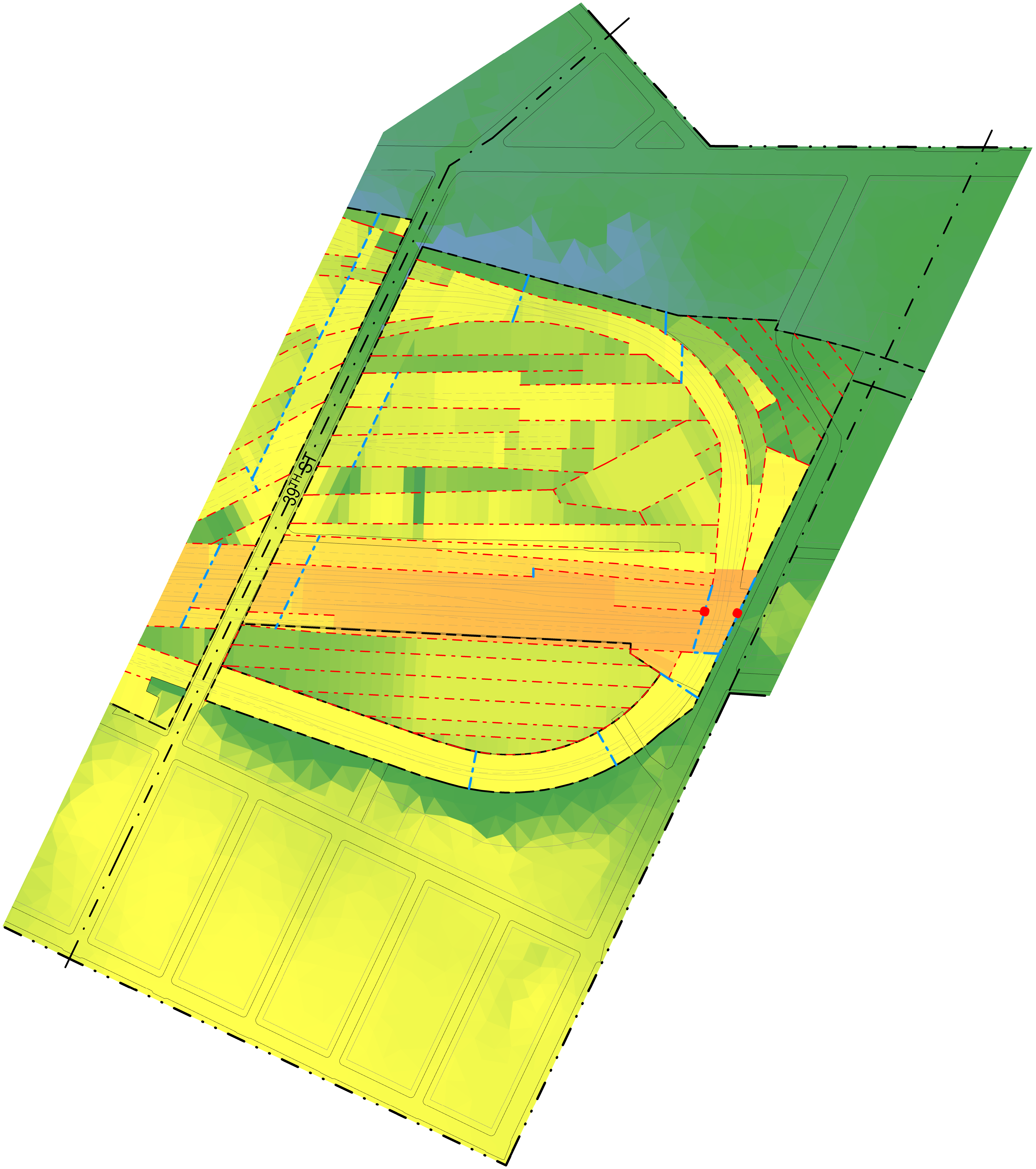
Title

TOP OF STRUCTURE STEEL - HIGH CLEARANCE - SECTOR D

Thornton Tomasetti

Designed by CC
Drawn by AP
Checked by JB
Date 09/14/2018
Drawing Number S-130D.00

Appendix I



LEGEND

Elevation
120
109
98
87
76
65
54
43
32
21
10

ELEVATIONS IN FEET ACCORDING TO THE NAVD88 VERTICAL DATUM

22' CLEARANCE FOR ZONE 1

35'-6" CLEARANCE FOR ZONES 2-8

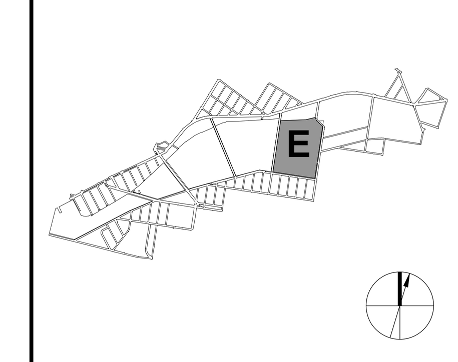
- PROJECT BOUNDARY
- SITE BOUNDARY
- MATCHLINE
- EXISTING TRACKS
- PROPOSED TRACKS
- COLUMN LINES
- TRUSSES PARALLEL TO TRACKS
- TRUSSES PERPENDICULAR TO TRACKS
- MEGATRUSS
- MEGACOLUMN

NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date
2	DRAWINGS UPDATE	12/21/2018
1	DRAWINGS UPDATE	11/20/2018

Key Plan



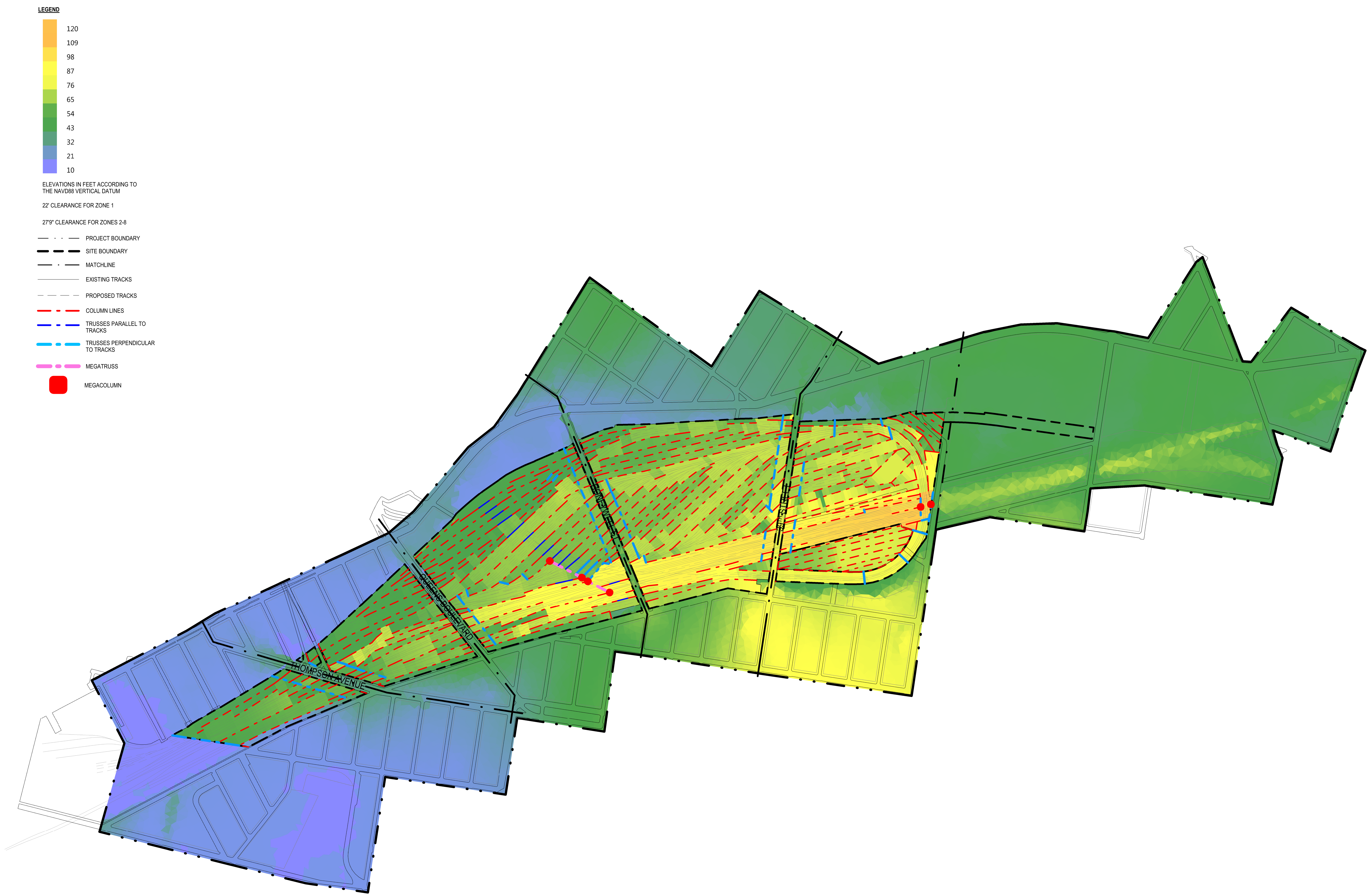
Discipline: **STRUCTURE**

Title

TOP OF STRUCTURE STEEL - HIGH CLEARANCE - SECTOR E

Thornton Tomasetti

Designed by	CC
Drawn by	AP
Checked by	JB
Date	09/14/2018
Drawing Number	S-130E.00

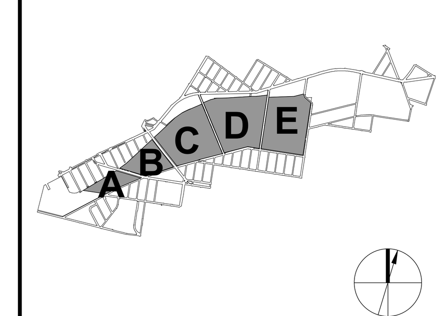


NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date
2	DRAWINGS UPDATE	12/21/2018
1	DRAWINGS UPDATE	11/20/2018

Key Plan



Discipline:

STRUCTURE

Title

TOP OF STRUCTURE STEEL - LOW CLEARANCE

Thornton Tomasetti

Designed by CC

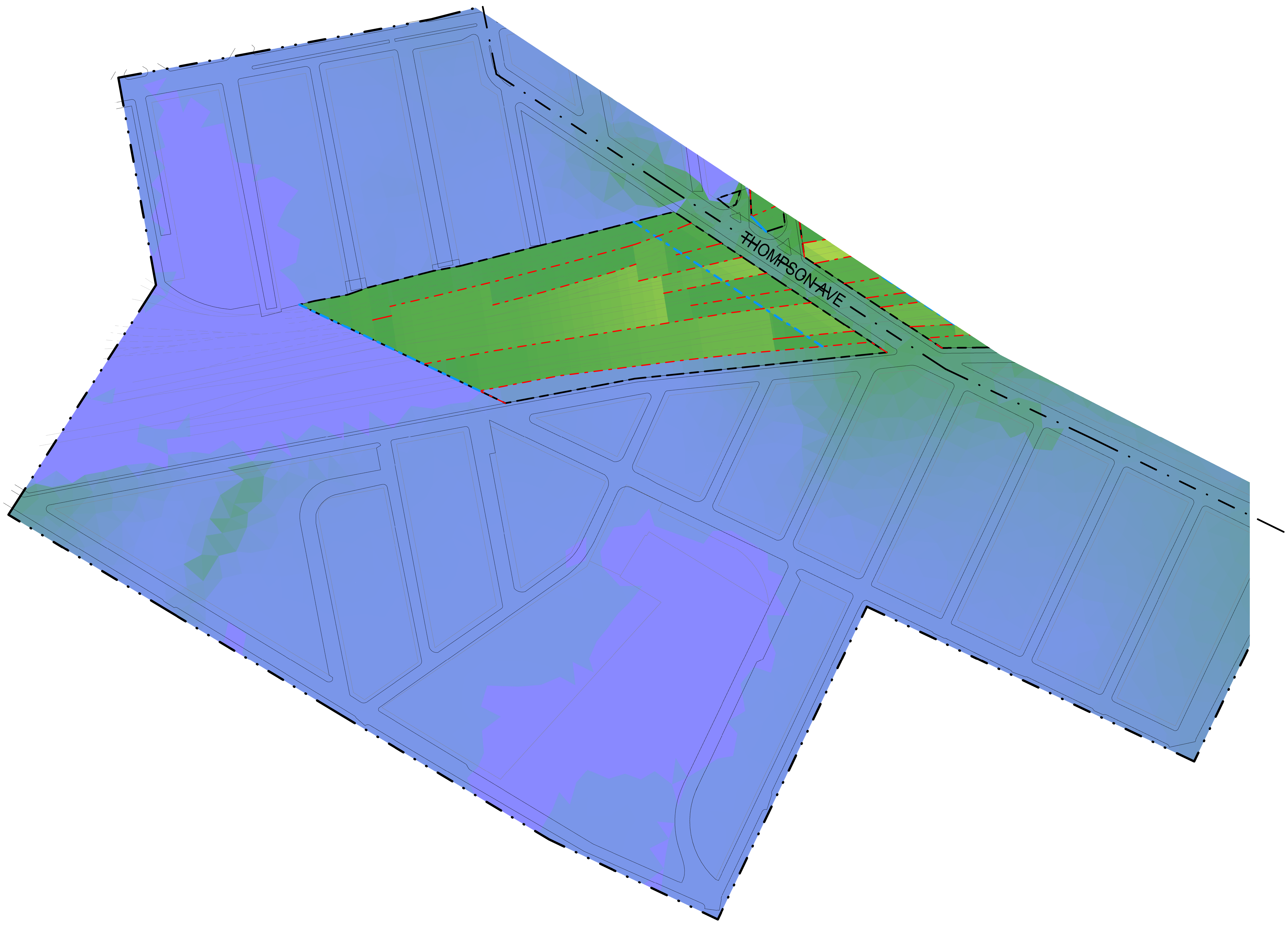
Drawn by AP

Checked by JB

Date 09/14/2018

Drawing Number

S-140.00



LEGEND

120	
109	
98	
87	
76	
65	
54	
43	
32	
21	
10	

ELEVATIONS IN FEET ACCORDING TO THE NAVD88 VERTICAL DATUM

22' CLEARANCE FOR ZONE 1

27'9" CLEARANCE FOR ZONES 2-8

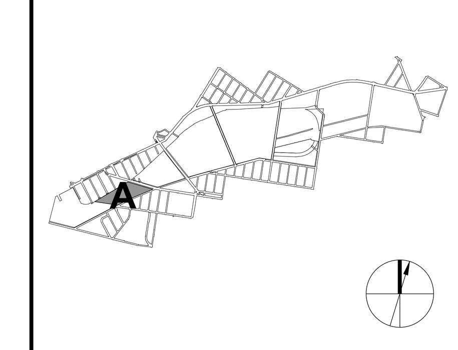
- PROJECT BOUNDARY
- SITE BOUNDARY
- MATCHLINE
- EXISTING TRACKS
- PROPOSED TRACKS
- COLUMN LINES
- TRUSSES PARALLEL TO TRACKS
- TRUSSES PERPENDICULAR TO TRACKS
- MEGATRUSS
- MEGACOLUMN

NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date
2	DRAWINGS UPDATE	12/21/2018
1	DRAWINGS UPDATE	11/20/2018

Key Plan



Discipline:

STRUCTURE

Title

TOP OF STRUCTURE STEEL - LOW CLEARANCE - SECTOR A

Thornton Tomasetti

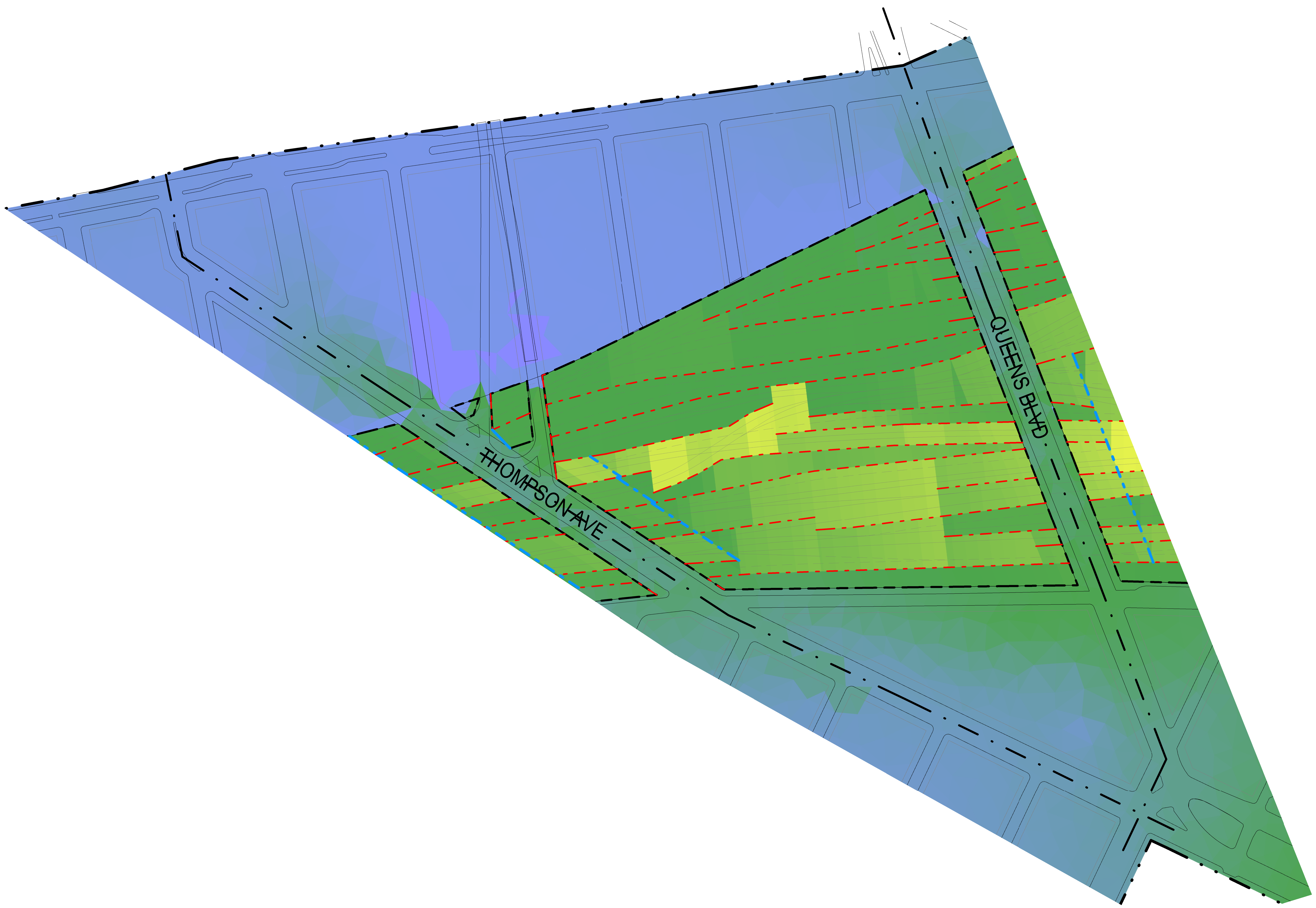
Designed by CC

Drawn by AP

Checked by JB

Date 09/14/2018

Drawing Number S-140A.00



LEGEND

	120
	109
	98
	87
	76
	65
	54
	43
	32
	21
	10

ELEVATIONS IN FEET ACCORDING TO THE NAVD88 VERTICAL DATUM

22' CLEARANCE FOR ZONE 1

27'9" CLEARANCE FOR ZONES 2-8

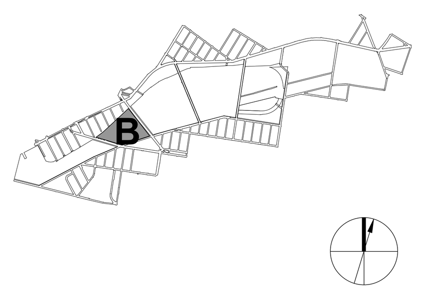
PROJECT BOUNDARY
SITE BOUNDARY
MATCHLINE
EXISTING TRACKS
PROPOSED TRACKS
COLUMN LINES
TRUSSES PARALLEL TO TRACKS
TRUSSES PERPENDICULAR TO TRACKS
MEGATRUSS
MEGACOLUMN

NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date
2	DRAWINGS UPDATE	12/21/2018
1	DRAWINGS UPDATE	11/20/2018

Key Plan



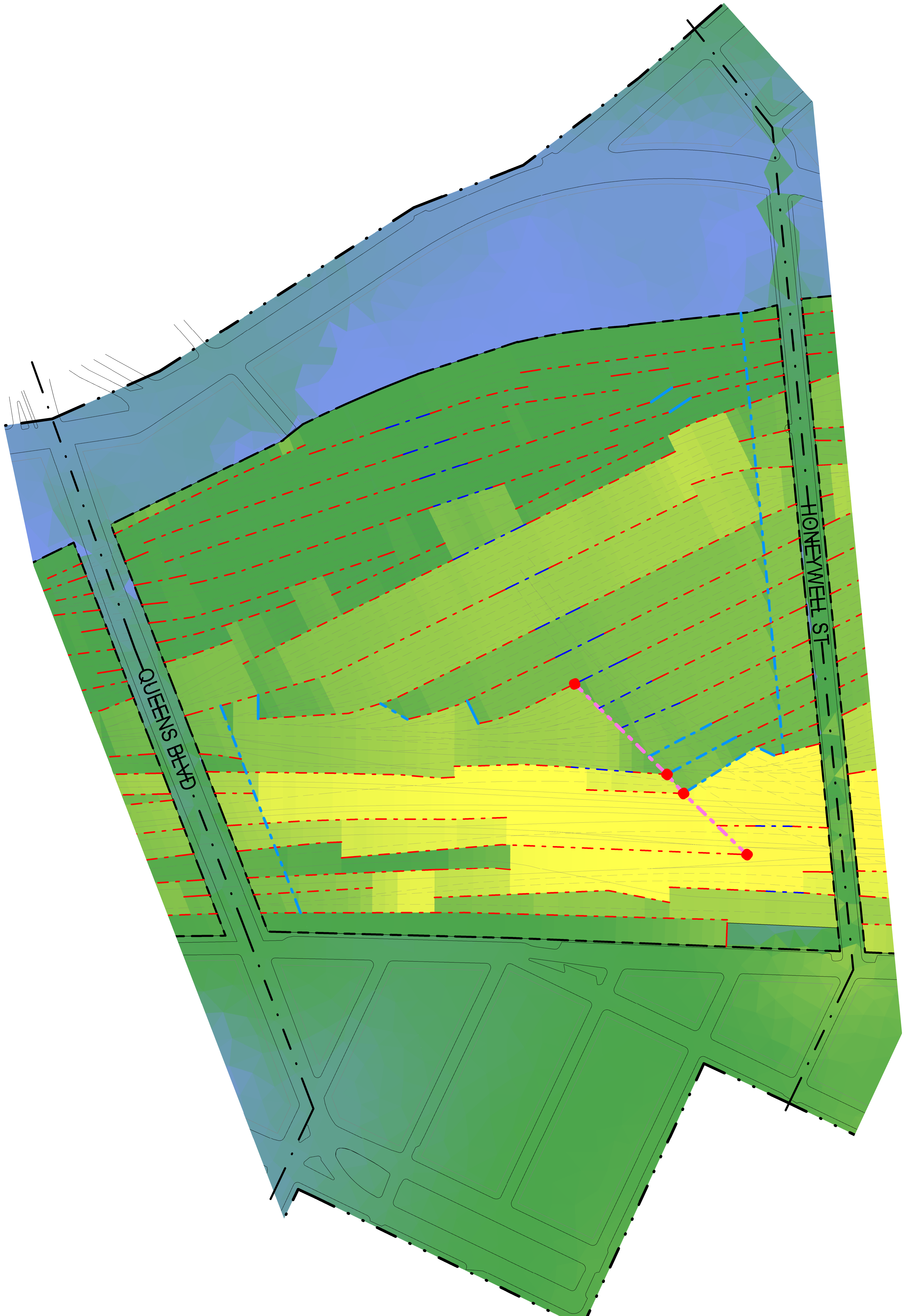
Discipline:
STRUCTURE

Title

TOP OF STRUCTURE STEEL
- LOW CLEARANCE -
SECTOR B

Thornton Tomasetti

Designed by	CC
Drawn by	AP
Checked by	Checker
Date	09/14/2018
Drawing Number	S-140B.00



LEGEND

	120
	109
	98
	87
	76
	65
	54
	43
	32
	21
	10

ELEVATIONS IN FEET ACCORDING TO THE NAVD88 VERTICAL DATUM

22' CLEARANCE FOR ZONE 1

27'9" CLEARANCE FOR ZONES 2-8

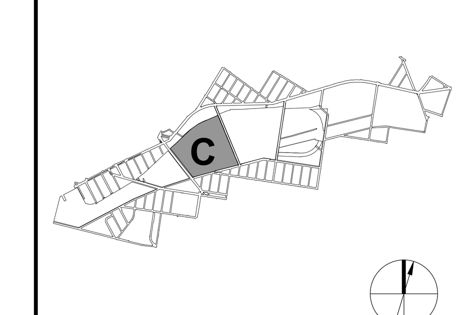
- PROJECT BOUNDARY
- SITE BOUNDARY
- MATCHLINE
- EXISTING TRACKS
- PROPOSED TRACKS
- COLUMN LINES
- TRUSSES PARALLEL TO TRACKS
- TRUSSES PERPENDICULAR TO TRACKS
- MEGATRUSS
- MEGACOLUMN

NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date
2	DRAWINGS UPDATE	12/21/2018
1	DRAWINGS UPDATE	11/20/2018

Key Plan



Discipline:

STRUCTURE

Title

TOP OF STRUCTURE STEEL - LOW CLEARANCE - SECTOR C

Thornton Tomasetti

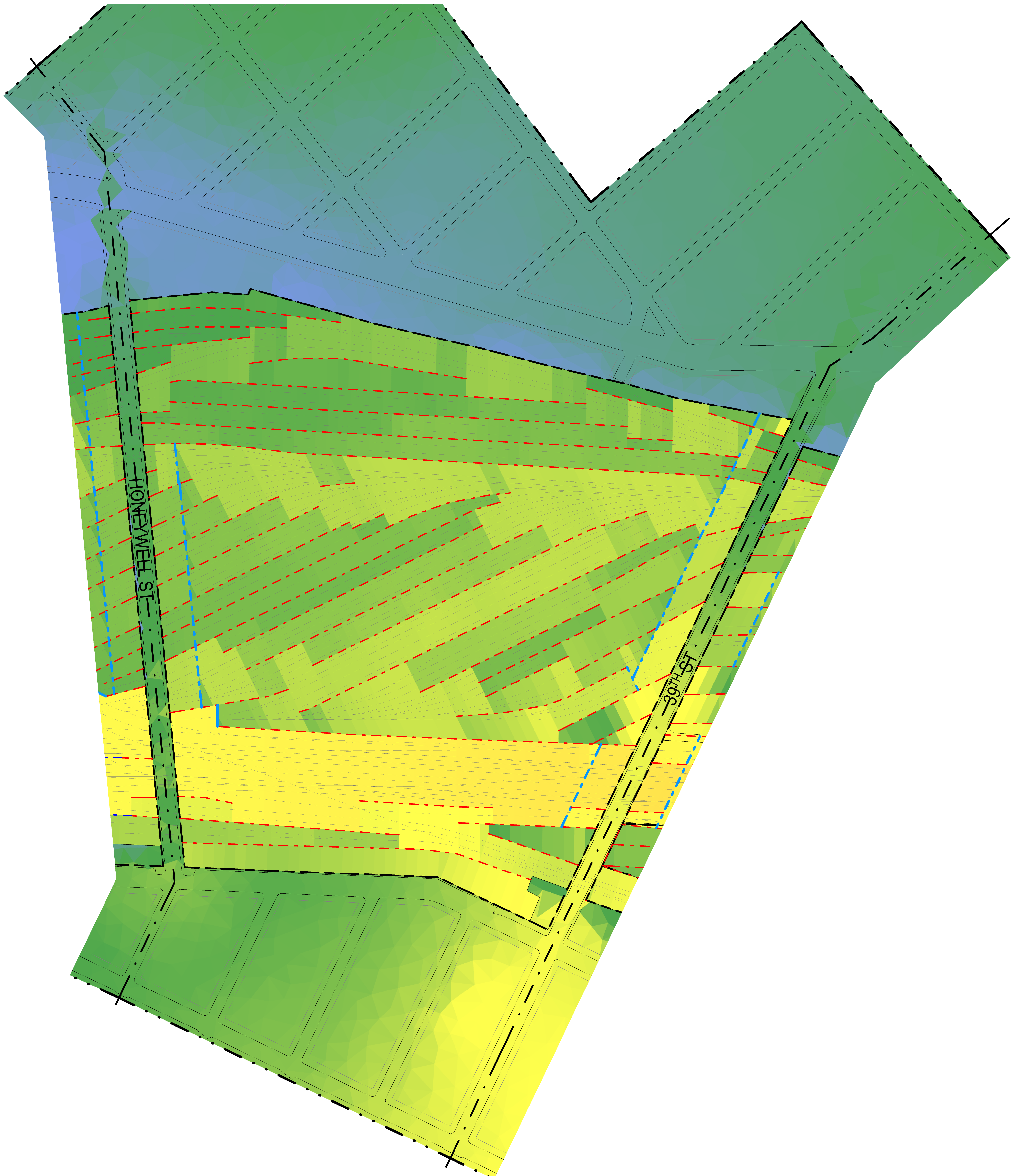
Designed by CC

Drawn by AP

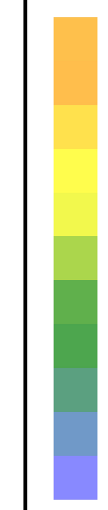
Checked by JB

Date 09/14/2018

Drawing Number S-140C.00



LEGEND



120	
109	
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87	
76	
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54	
43	
32	
21	
10	

ELEVATIONS IN FEET ACCORDING TO THE NAVD88 VERTICAL DATUM

22' CLEARANCE FOR ZONE 1

27'9" CLEARANCE FOR ZONES 2-8

PROJECT BOUNDARY

SITE BOUNDARY

MATCHLINE

EXISTING TRACKS

PROPOSED TRACKS

COLUMN LINES

TRUSSES PARALLEL TO TRACKS

TRUSSES PERPENDICULAR TO TRACKS

MEGATRUSS

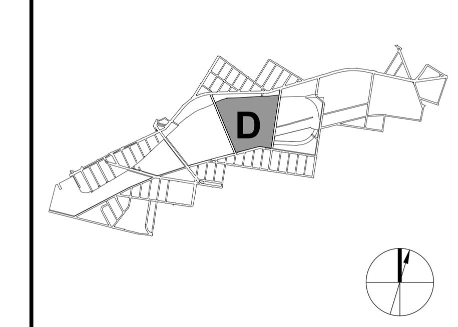
MEGACOLUMN

NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date
2	DRAWINGS UPDATE	12/21/2018
1	DRAWINGS UPDATE	11/20/2018

Key Plan



Discipline: **STRUCTURE**

Title

TOP OF STRUCTURE STEEL - LOW CLEARANCE - SECTOR D

Thornton Tomasetti

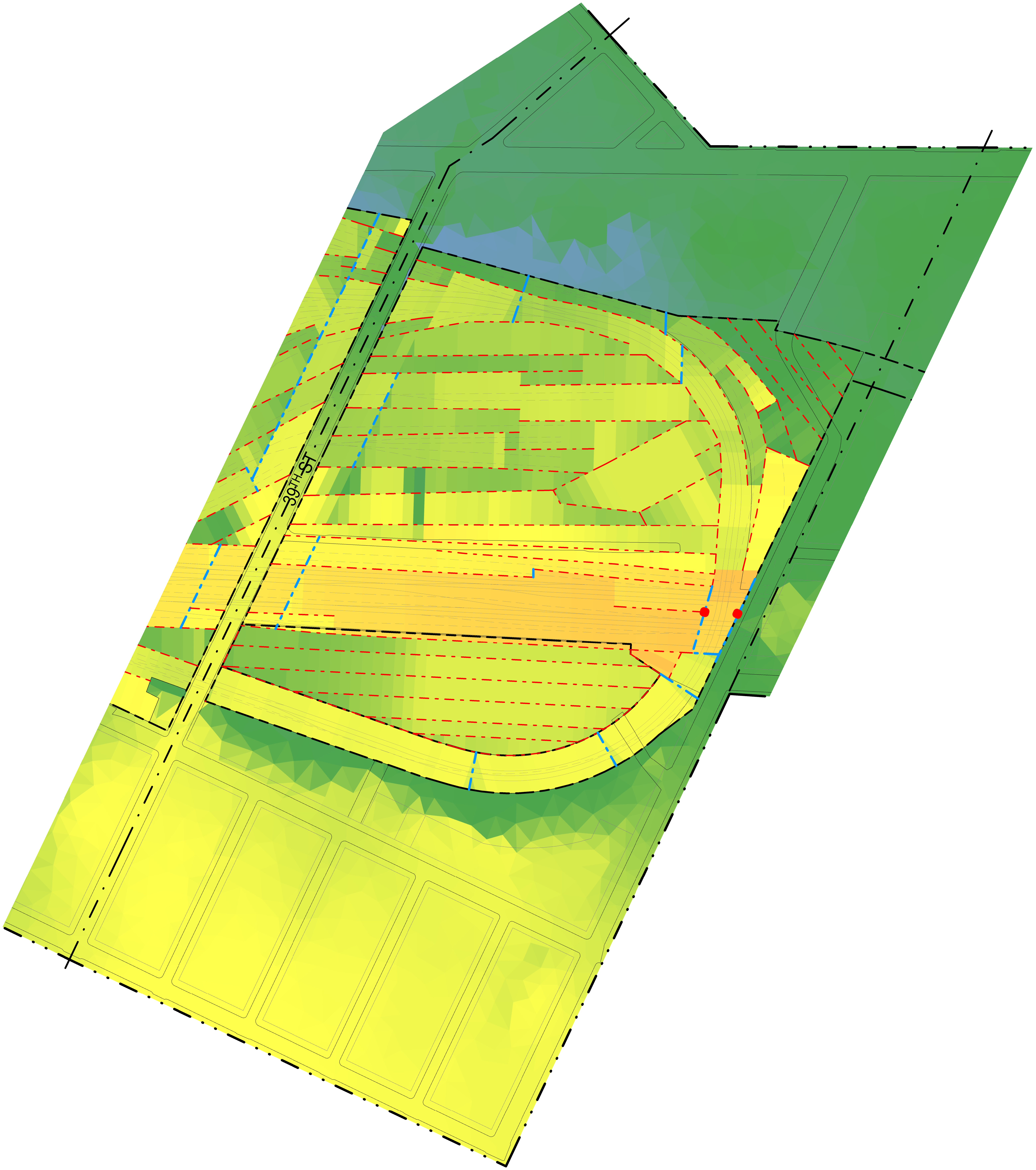
Designed by CC

Drawn by AP

Checked by JB

Date 09/14/2018

Drawing Number S-140D.00



LEGEND

120	
109	
98	
87	
76	
65	
54	
43	
32	
21	
10	

ELEVATIONS IN FEET ACCORDING TO THE NAVD88 VERTICAL DATUM

22' CLEARANCE FOR ZONE 1

27'9" CLEARANCE FOR ZONES 2-8

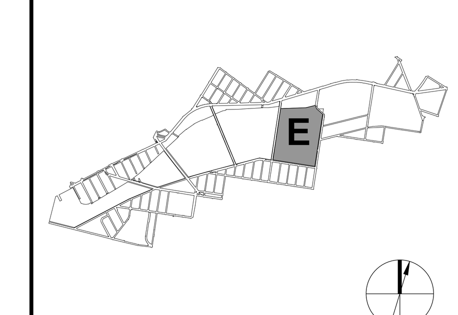
PROJECT BOUNDARY
SITE BOUNDARY
MATCHLINE
EXISTING TRACKS
PROPOSED TRACKS
COLUMN LINES
TRUSSES PARALLEL TO TRACKS
TRUSSES PERPENDICULAR TO TRACKS
MEGATRUSS
MEGACOLUMN

NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date
2	DRAWINGS UPDATE	12/21/2018
1	DRAWINGS UPDATE	11/20/2018

Key Plan



Discipline:

STRUCTURE

Title

TOP OF STRUCTURE STEEL - LOW CLEARANCE - SECTOR E

Thornton Tomasetti

Designed by CC
Drawn by AP
Checked by JB
Date 09/14/2018
Drawing Number S-140E.00

Appendix I

LEGEND

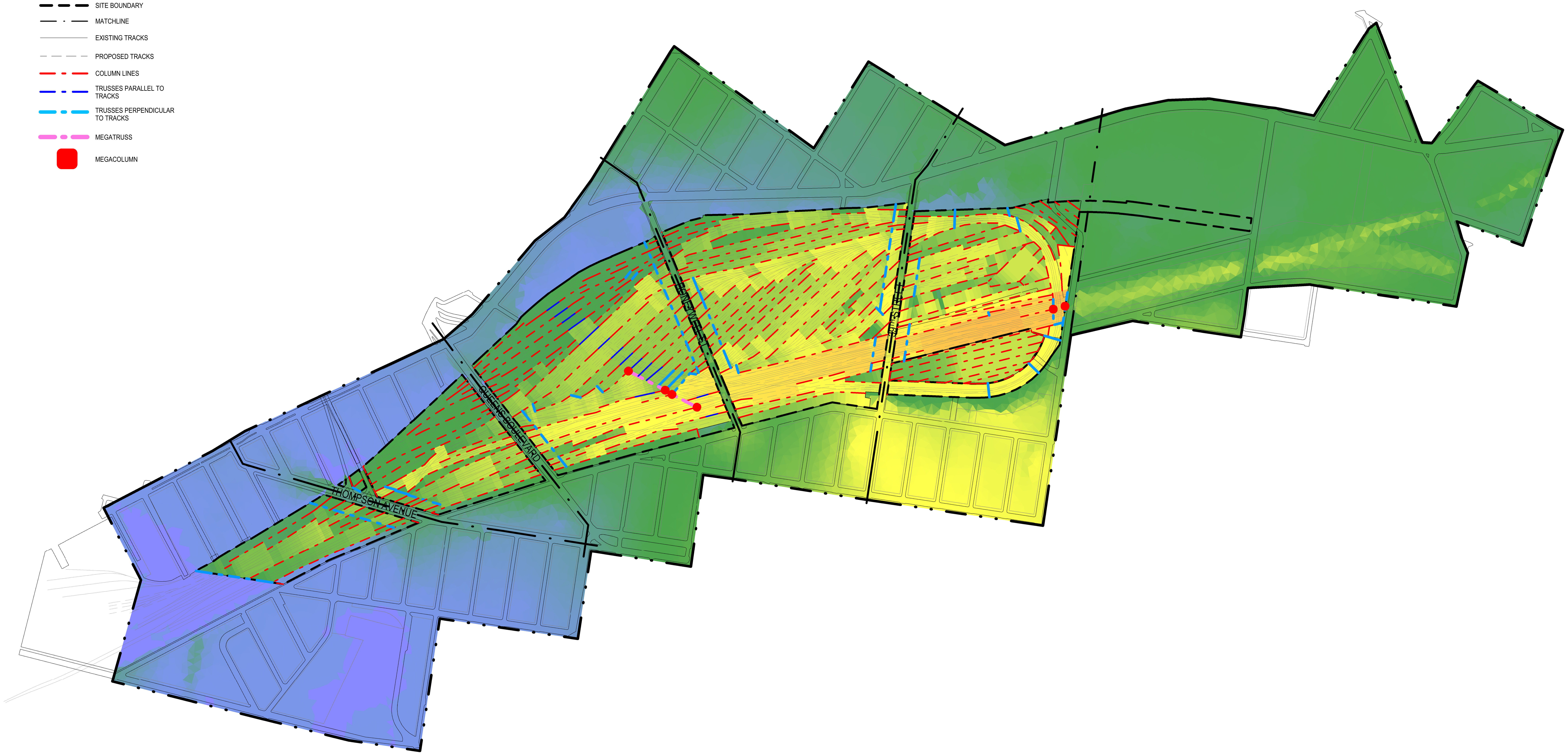
120	
109	
98	
87	
76	
65	
54	
43	
32	
21	
10	

ELEVATIONS IN FEET ACCORDING TO THE NAVD88 VERTICAL DATUM

22' CLEARANCE FOR ZONE 1

35'-6" CLEARANCE FOR ZONES 2-8

- PROJECT BOUNDARY
- SITE BOUNDARY
- MATCHLINE
- EXISTING TRACKS
- PROPOSED TRACKS
- COLUMN LINES
- TRUSSES PARALLEL TO TRACKS
- TRUSSES PERPENDICULAR TO TRACKS
- MEGATRUSS
- MEGACOLUMN



NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date
2	DRAWINGS UPDATE	12/21/2018
1	DRAWINGS UPDATE	11/20/2018

Key Plan

A B C D E

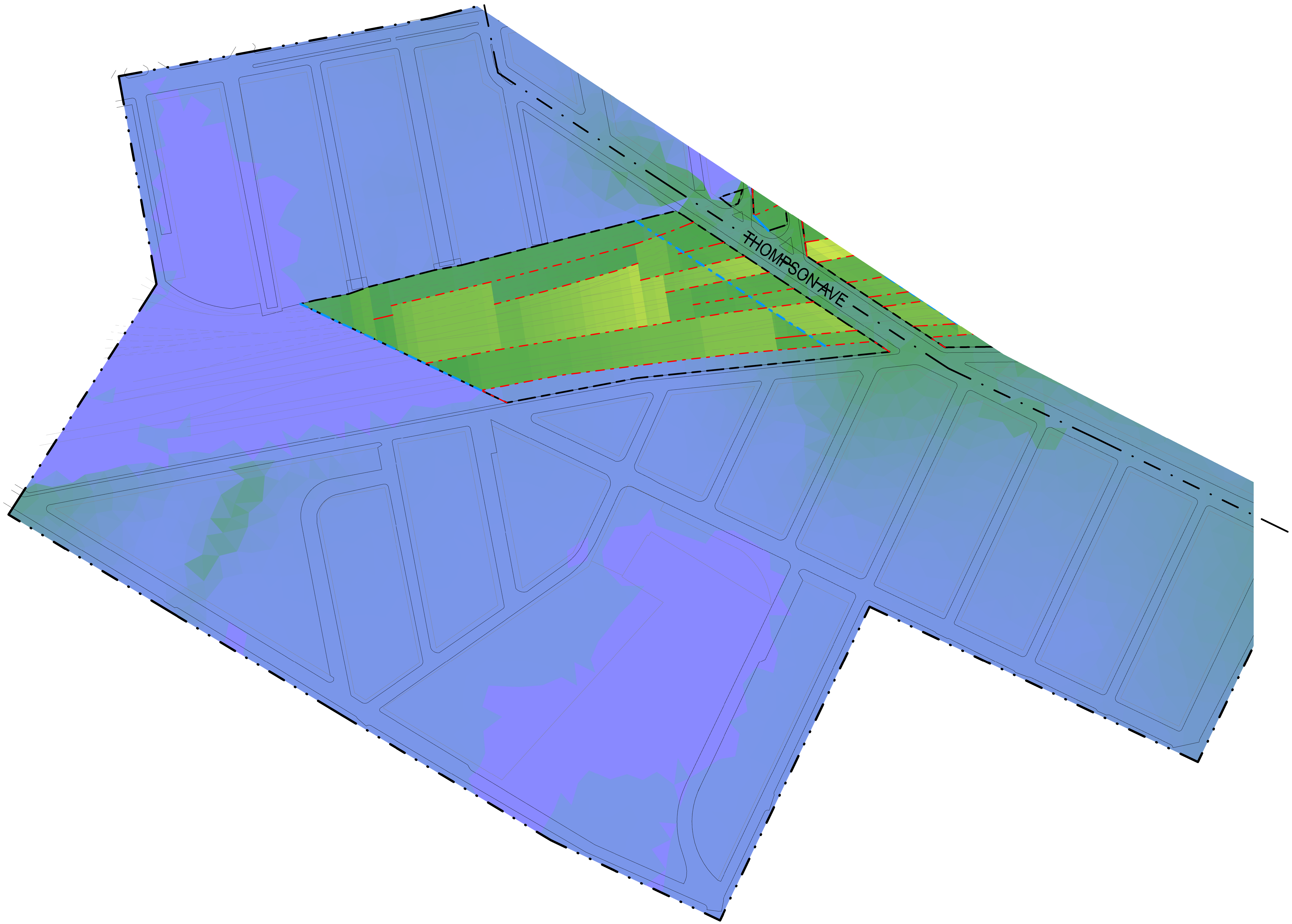
Discipline: **STRUCTURE**

Title

TOP OF STRUCTURE CONCRETE - HIGH CLEARANCE

Thornton Tomasetti

Designed by	CC
Drawn by	AP
Checked by	JB
Date	09/14/2018
Drawing Number	S-150.00



LEGEND

	120
	109
	98
	87
	76
	65
	54
	43
	32
	21
	10

ELEVATIONS IN FEET ACCORDING TO THE NAVD88 VERTICAL DATUM

22' CLEARANCE FOR ZONE 1

35'-6" CLEARANCE FOR ZONES 2-8

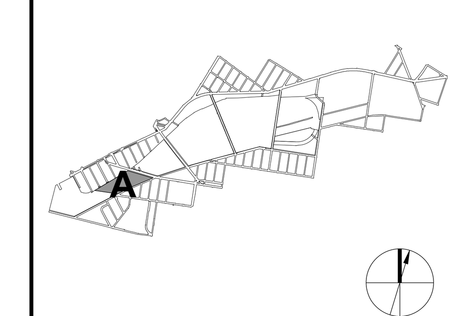
PROJECT BOUNDARY
SITE BOUNDARY
MATCHLINE
EXISTING TRACKS
PROPOSED TRACKS
COLUMN LINES
TRUSSES PARALLEL TO TRACKS
TRUSSES PERPENDICULAR TO TRACKS
MEGATRUSS
MEGACOLUMN

NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date
2	DRAWINGS UPDATE	12/21/2018
1	DRAWINGS UPDATE	11/20/2018

Key Plan



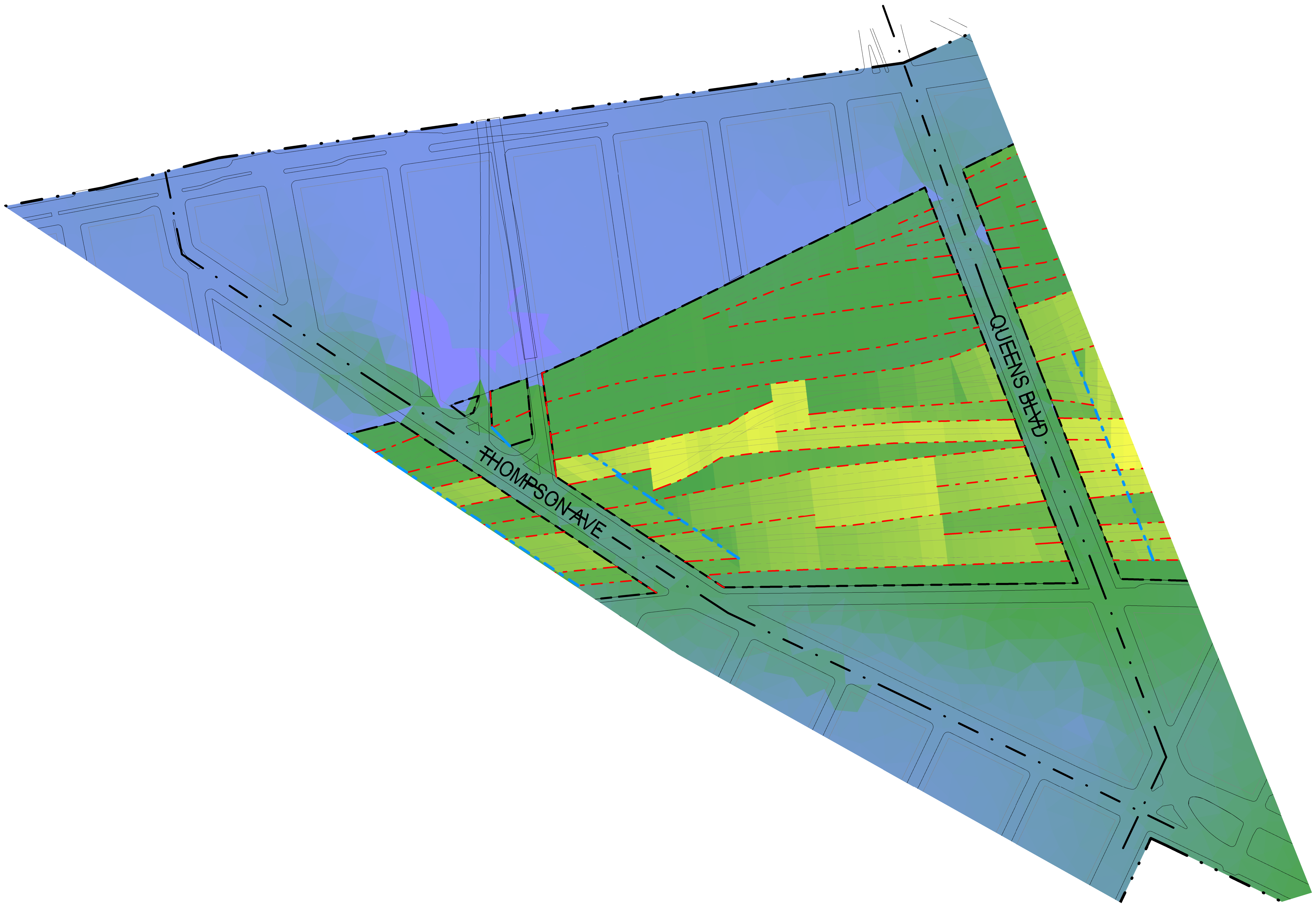
Discipline:
STRUCTURE

Title

TOP OF STRUCTURE CONCRETE - HIGH CLEARANCE - SECTOR A

Thornton Tomasetti

Designed by	CC
Drawn by	AP
Checked by	JB
Date	09/14/2018
Drawing Number	S-150A.00



LEGEND

120	
109	
98	
87	
76	
65	
54	
43	
32	
21	
10	

ELEVATIONS IN FEET ACCORDING TO THE NAVD88 VERTICAL DATUM

22' CLEARANCE FOR ZONE 1

35'-6" CLEARANCE FOR ZONES 2-8

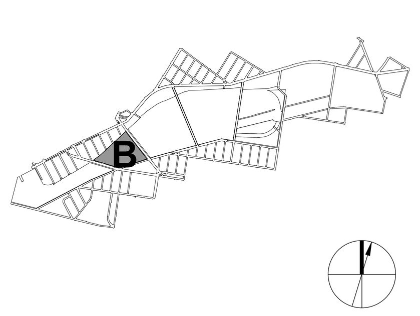
- PROJECT BOUNDARY
- SITE BOUNDARY
- MATCHLINE
- EXISTING TRACKS
- PROPOSED TRACKS
- COLUMN LINES
- TRUSSES PARALLEL TO TRACKS
- TRUSSES PERPENDICULAR TO TRACKS
- MEGATRUSS
- MEGACOLUMN

NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date
2	DRAWINGS UPDATE	12/21/2018
1	DRAWINGS UPDATE	11/20/2018

Key Plan



Discipline:

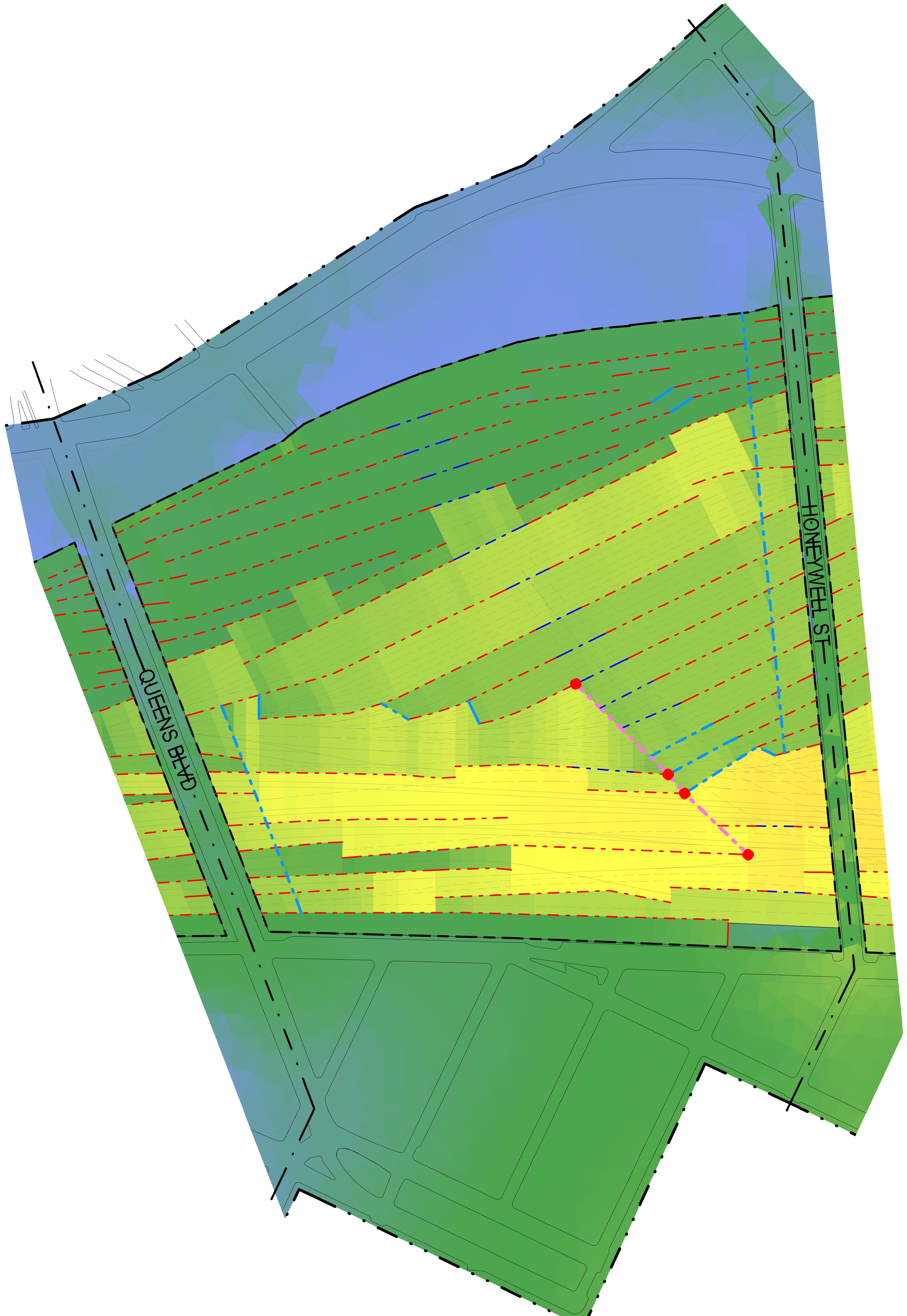
STRUCTURE

Title

TOP OF STRUCTURE CONCRETE - HIGH CLEARANCE - SECTOR B

Thornton Tomasetti

Designed by	CC
Drawn by	AP
Checked by	JB
Date	09/14/2018
Drawing Number	S-150B.00



LEGEND

	120
	109
	98
	87
	76
	65
	54
	43
	32
	21
	10

ELEVATIONS IN FEET ACCORDING TO THE NAVD88 VERTICAL DATUM

22' CLEARANCE FOR ZONE 1

35'-6" CLEARANCE FOR ZONES 2-8

PROJECT BOUNDARY

SITE BOUNDARY

MATCHLINE

EXISTING TRACKS

PROPOSED TRACKS

COLUMN LINES

TRUSSES PARALLEL TO TRACKS

TRUSSES PERPENDICULAR TO TRACKS

MEGATRUSS

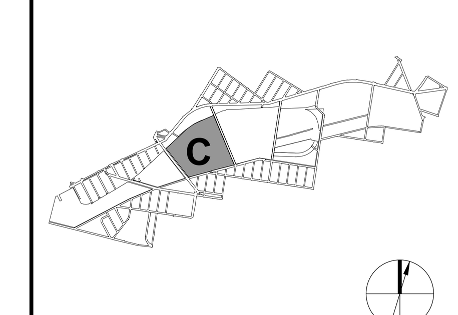
MEGACOLUMN

NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date
2	DRAWINGS UPDATE	12/21/2018
1	DRAWINGS UPDATE	11/20/2018

Key Plan



Discipline:

STRUCTURE

Title

TOP OF STRUCTURE CONCRETE - HIGH CLEARANCE - SECTOR C

Thornton Tomasetti

Designed by CC

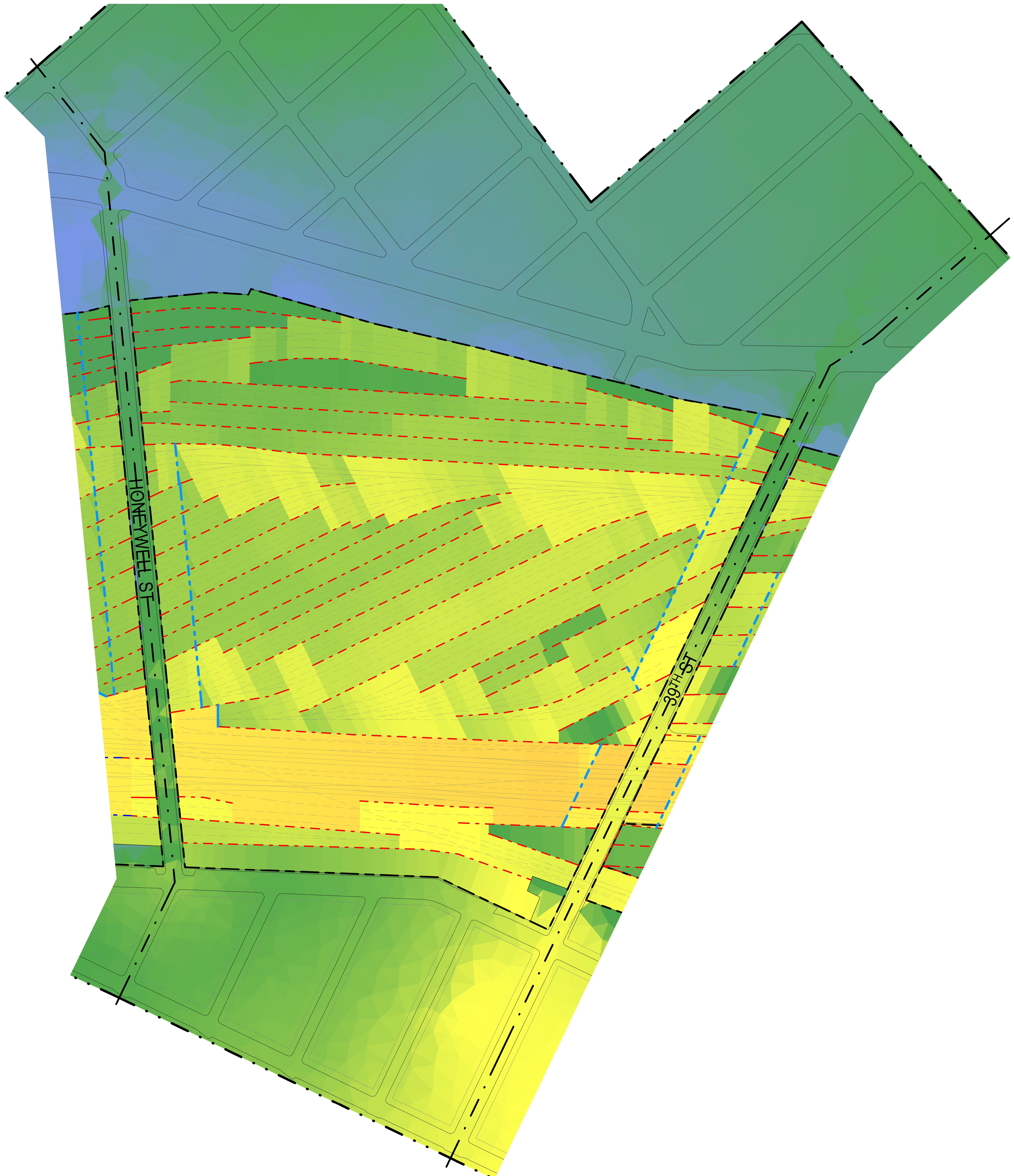
Drawn by AP

Checked by JB

Date 09/14/2018

Drawing Number

S-150C.00



LEGEND

120	
109	
98	
87	
76	
65	
54	
43	
32	
21	
10	

ELEVATIONS IN FEET ACCORDING TO THE NAVD88 VERTICAL DATUM

22' CLEARANCE FOR ZONE 1

35'-6" CLEARANCE FOR ZONES 2-8

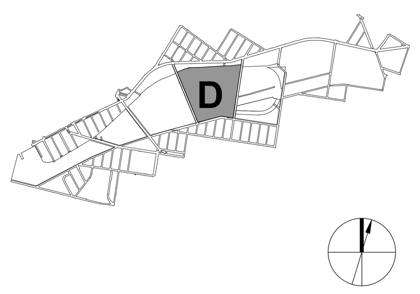
PROJECT BOUNDARY
SITE BOUNDARY
MATCHLINE
EXISTING TRACKS
PROPOSED TRACKS
COLUMN LINES
TRUSSES PARALLEL TO TRACKS
TRUSSES PERPENDICULAR TO TRACKS
MEGATRUSS
MEGACOLUMN

NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date
2	DRAWINGS UPDATE	12/21/2018
1	DRAWINGS UPDATE	11/20/2018

Key Plan



Discipline:

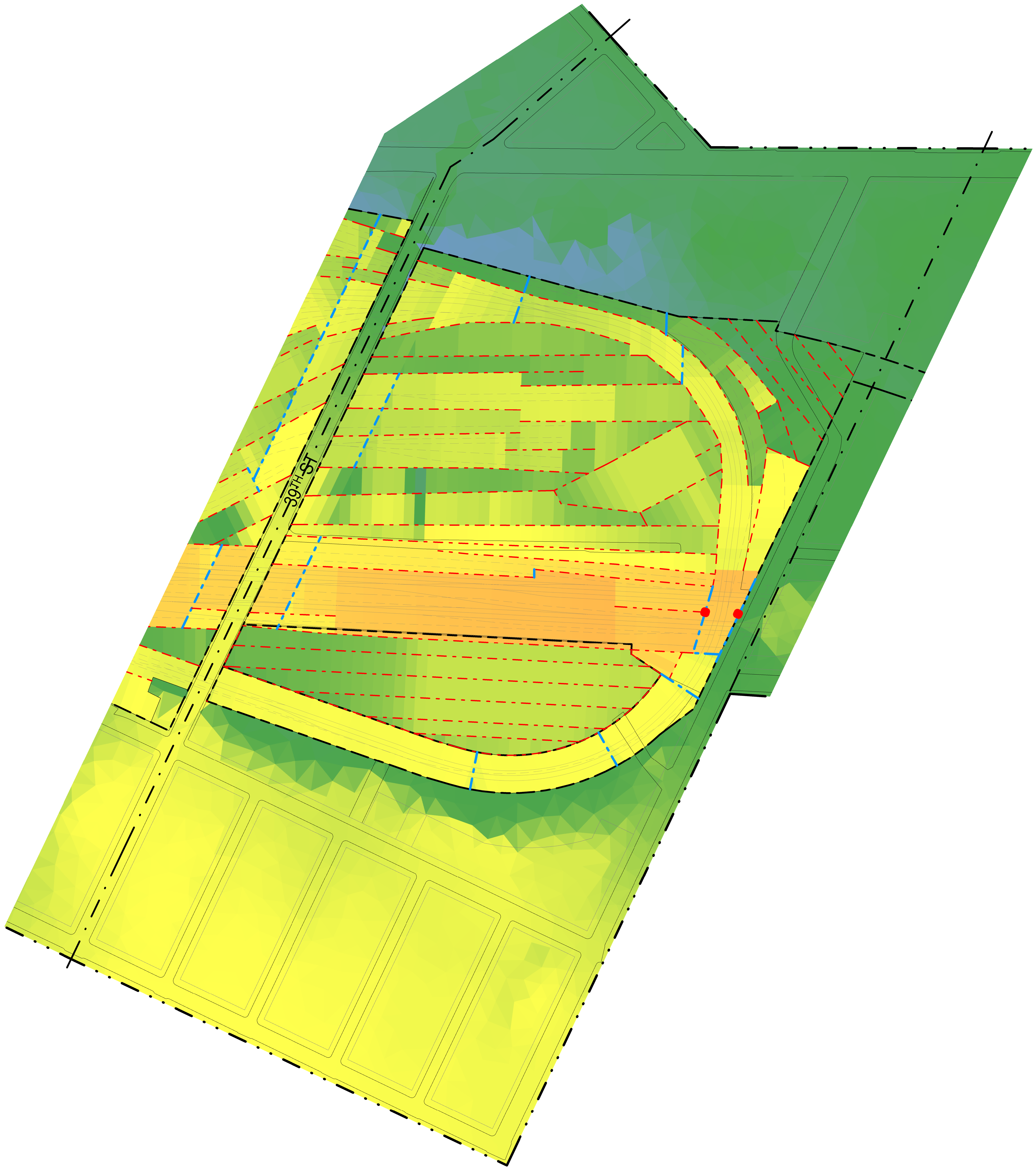
STRUCTURE

Title

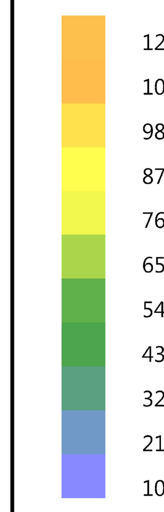
TOP OF STRUCTURE CONCRETE - HIGH CLEARANCE - SECTOR D

Thornton Tomasetti

Designed by CC
Drawn by AP
Checked by JB
Date 09/14/2018
Drawing Number S-150D.00



LEGEND



ELEVATIONS IN FEET ACCORDING TO THE NAVD88 VERTICAL DATUM

22' CLEARANCE FOR ZONE 1

35'-6" CLEARANCE FOR ZONES 2-8

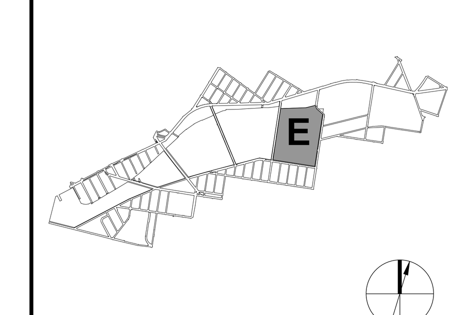
PROJECT BOUNDARY
SITE BOUNDARY
MATCHLINE
EXISTING TRACKS
PROPOSED TRACKS
COLUMN LINES
TRUSSES PARALLEL TO TRACKS
TRUSSES PERPENDICULAR TO TRACKS
MEGATRUSS
MEGACOLUMN

NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date
2	DRAWINGS UPDATE	12/21/2018
1	DRAWINGS UPDATE	11/20/2018

Key Plan



Discipline:

STRUCTURE

Title

TOP OF STRUCTURE CONCRETE - HIGH CLEARANCE - SECTOR E

Thornton Tomasetti

Designed by CC
Drawn by AP
Checked by JB
Date 09/14/2018
Drawing Number S-150E.00

Appendix I

NYCEDC

LEGEND

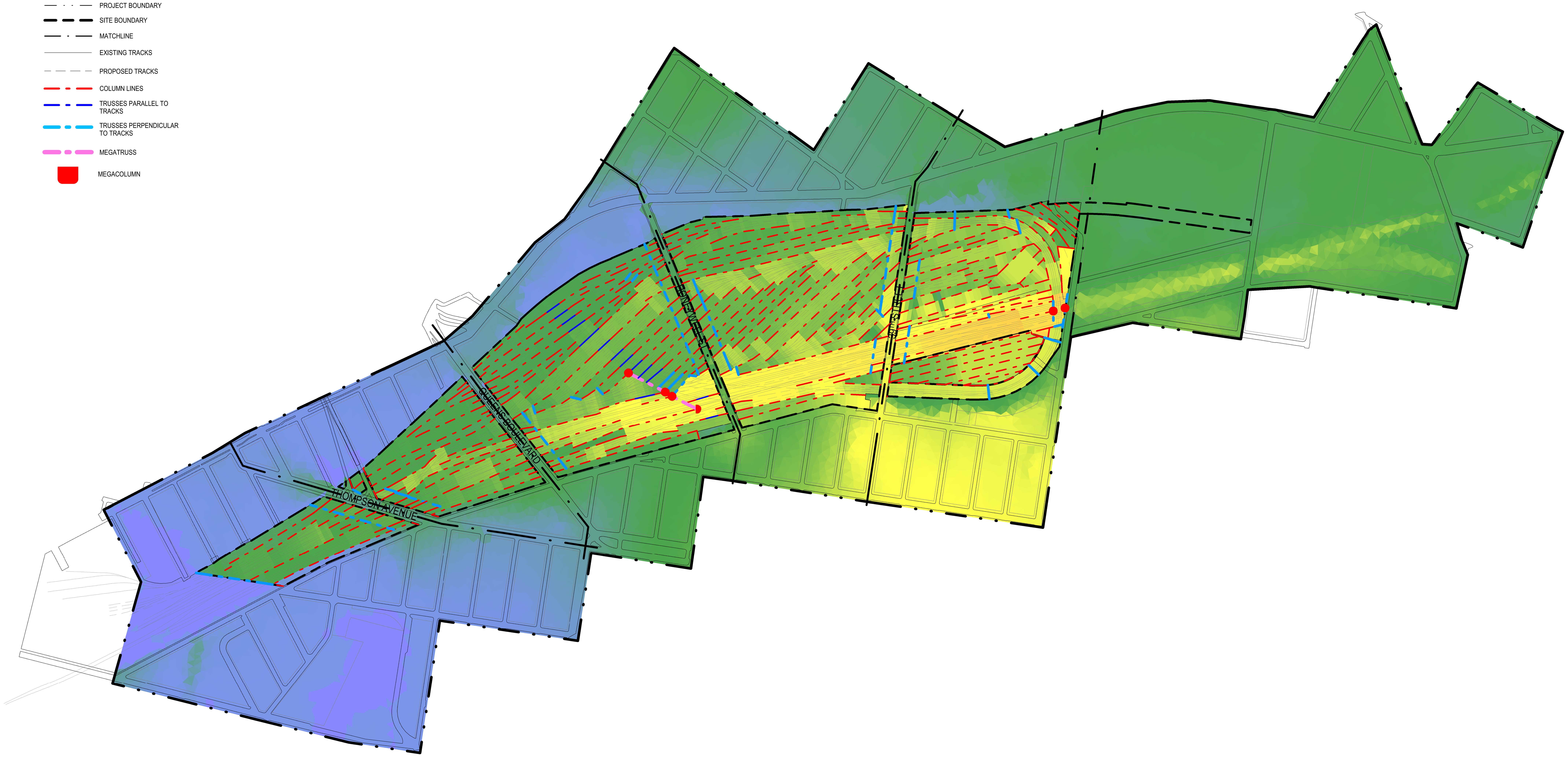
120	
109	
98	
87	
76	
65	
54	
43	
32	
21	
10	

ELEVATIONS IN FEET ACCORDING TO THE NAVD88 VERTICAL DATUM

22' CLEARANCE FOR ZONE 1

27'9" CLEARANCE FOR ZONES 2-8

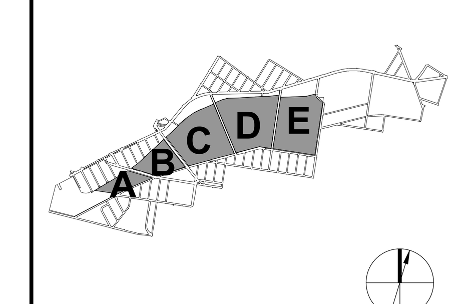
- PROJECT BOUNDARY
- SITE BOUNDARY
- MATCHLINE
- EXISTING TRACKS
- PROPOSED TRACKS
- COLUMN LINES
- TRUSSES PARALLEL TO TRACKS
- TRUSSES PERPENDICULAR TO TRACKS
- MEGATRUSS
- MEGACOLUMN



SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date
2	DRAWINGS UPDATE	12/21/2018
1	DRAWINGS UPDATE	11/20/2018

Key Plan



Discipline:

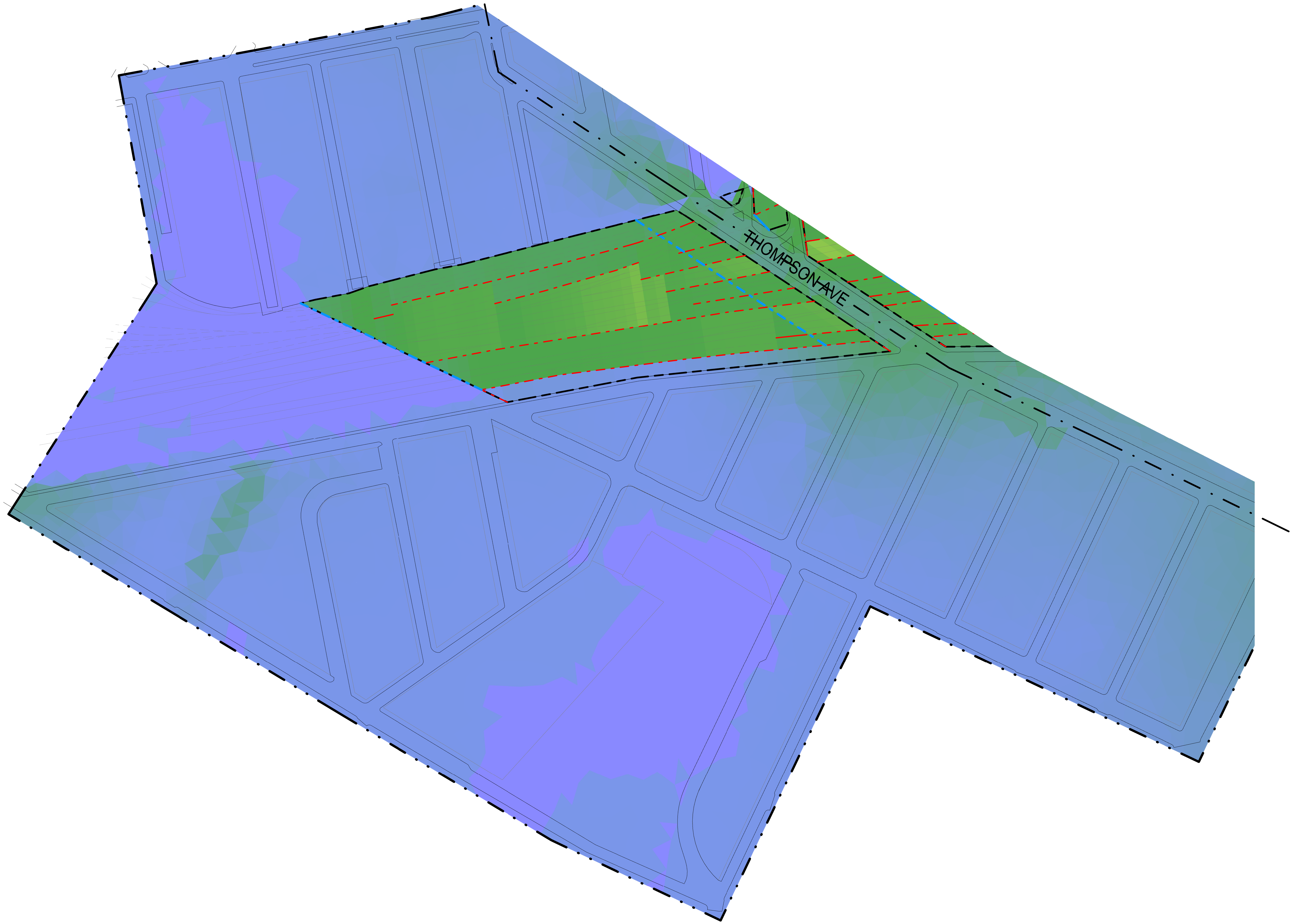
STRUCTURE

Title

TOP OF STRUCTURE CONCRETE - LOW CLEARANCE

Thornton Tomasetti

Designed by	CC
Drawn by	AP
Checked by	JB
Date	09/14/2018
Drawing Number	S-160.00



LEGEND

	120
	109
	98
	87
	76
	65
	54
	43
	32
	21
	10

ELEVATIONS IN FEET ACCORDING TO THE NAVD88 VERTICAL DATUM

22' CLEARANCE FOR ZONE 1

27'9" CLEARANCE FOR ZONES 2-8

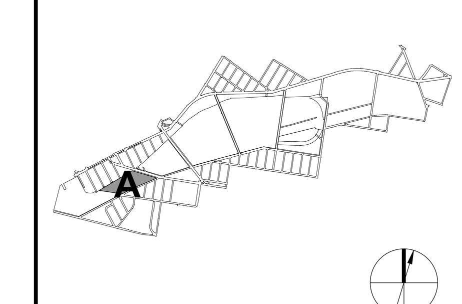
- PROJECT BOUNDARY
- SITE BOUNDARY
- MATCHLINE
- EXISTING TRACKS
- PROPOSED TRACKS
- COLUMN LINES
- TRUSSES PARALLEL TO TRACKS
- TRUSSES PERPENDICULAR TO TRACKS
- MEGATRUSS
- MEGACOLUMN

NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date
2	DRAWINGS UPDATE	12/21/2018
1	DRAWINGS UPDATE	11/20/2018

Key Plan



Discipline:

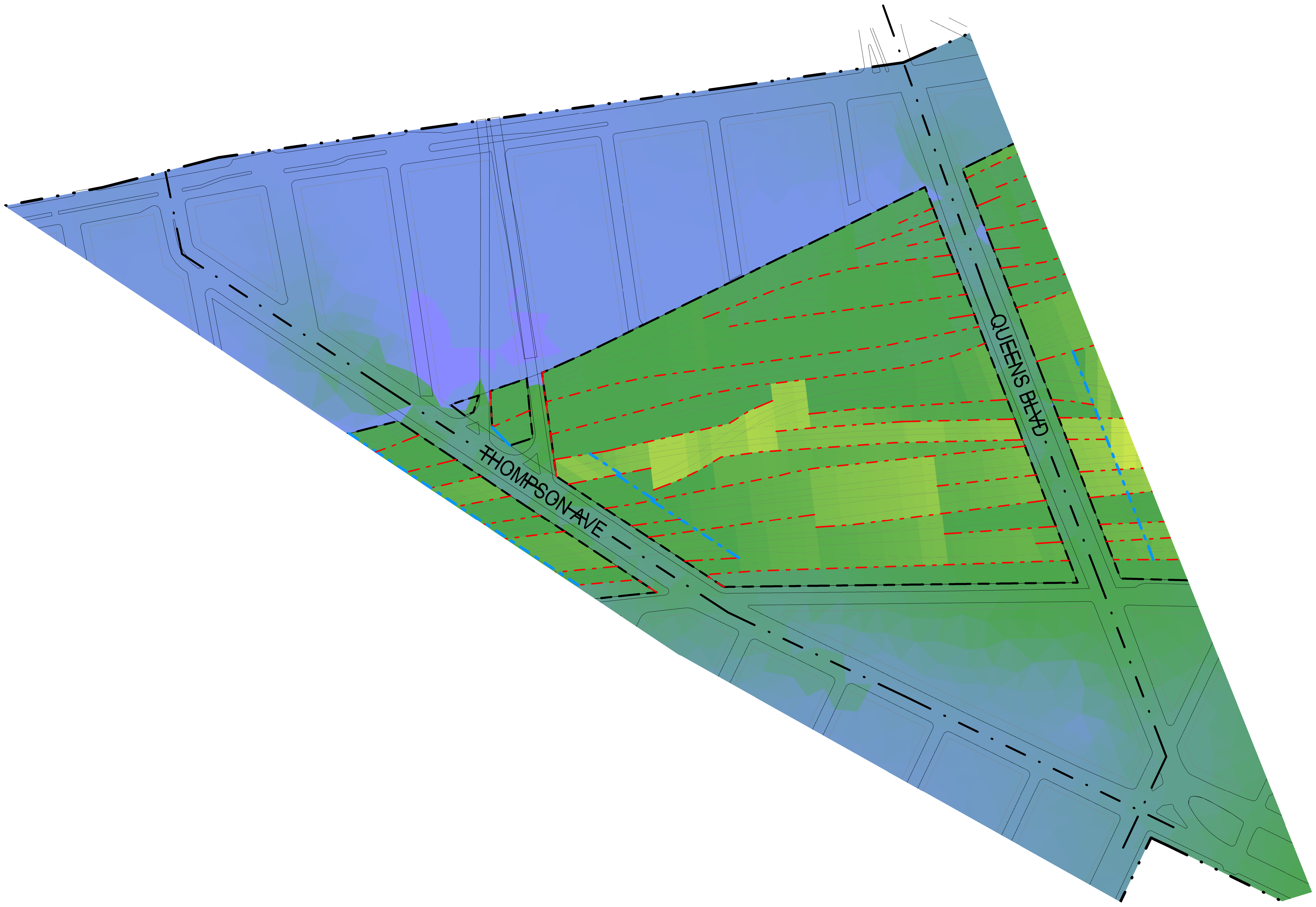
STRUCTURE

Title

TOP OF STRUCTURE CONCRETE - LOW CLEARANCE - SECTOR A

Thornton Tomasetti

Designed by	CC
Drawn by	AP
Checked by	JB
Date	09/14/2018
Drawing Number	S-160A.00



LEGEND

120	
109	
98	
87	
76	
65	
54	
43	
32	
21	
10	

ELEVATIONS IN FEET ACCORDING TO THE NAVD88 VERTICAL DATUM

22' CLEARANCE FOR ZONE 1

27'9" CLEARANCE FOR ZONES 2-8

PROJECT BOUNDARY

SITE BOUNDARY

MATCHLINE

EXISTING TRACKS

PROPOSED TRACKS

COLUMN LINES

TRUSSES PARALLEL TO TRACKS

TRUSSES PERPENDICULAR TO TRACKS

MEGATRUSS

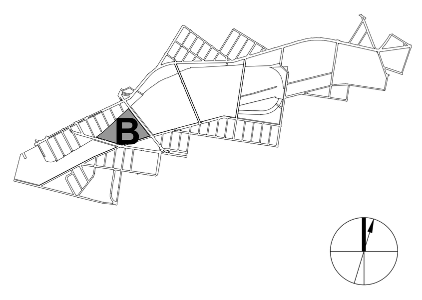
MEGACOLUMN

NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date
2	DRAWINGS UPDATE	12/21/2018
1	DRAWINGS UPDATE	11/20/2018

Key Plan



Discipline:

STRUCTURE

Title

TOP OF STRUCTURE CONCRETE - LOW CLEARANCE - SECTOR B

Thornton Tomasetti

Designed by CC

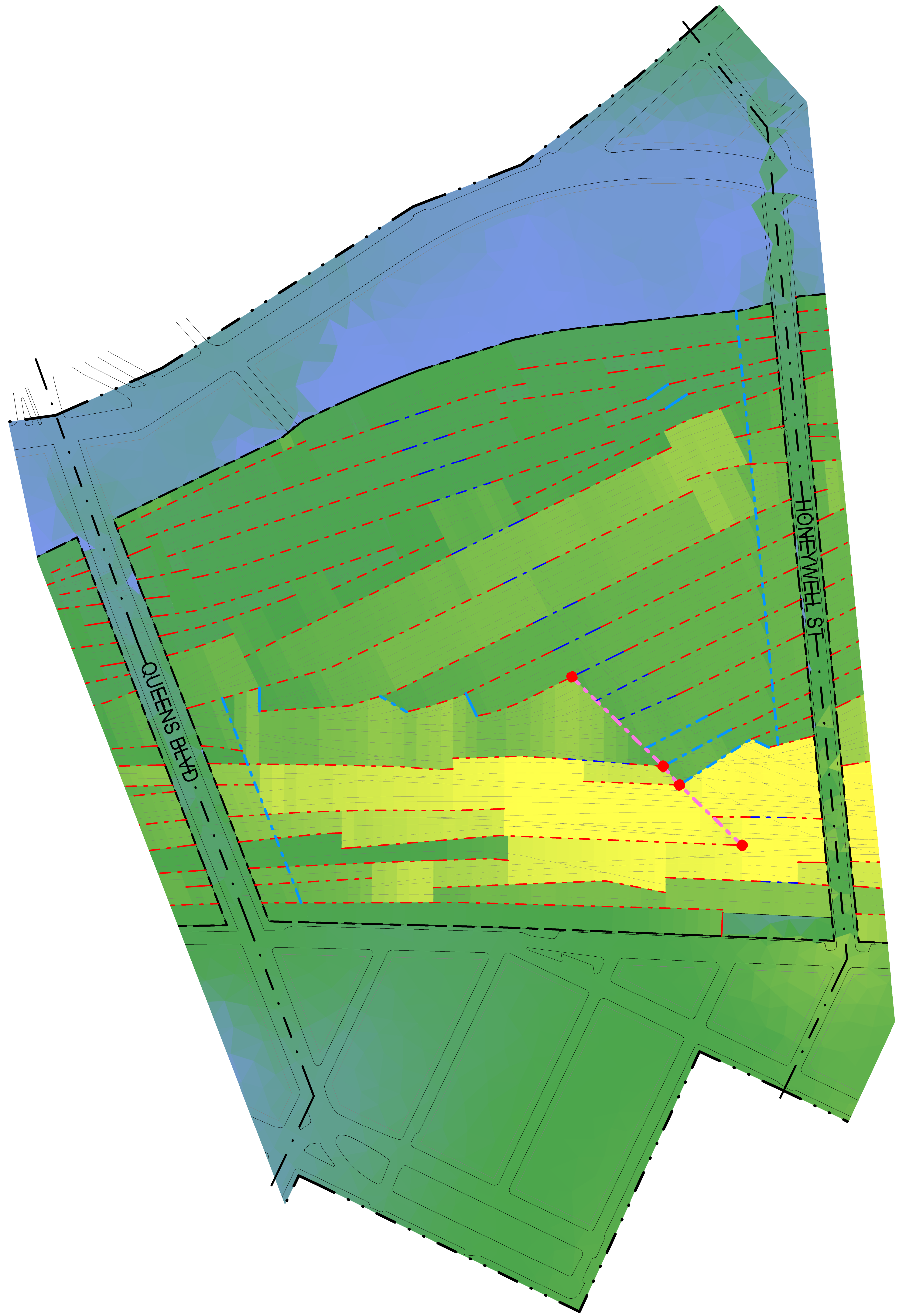
Drawn by AP

Checked by JB

Date 09/14/2018

Drawing Number

S-160B.00



LEGEND

120	
109	
98	
87	
76	
65	
54	
43	
32	
21	
10	

ELEVATIONS IN FEET ACCORDING TO THE NAVD88 VERTICAL DATUM

22' CLEARANCE FOR ZONE 1

27'9" CLEARANCE FOR ZONES 2-8

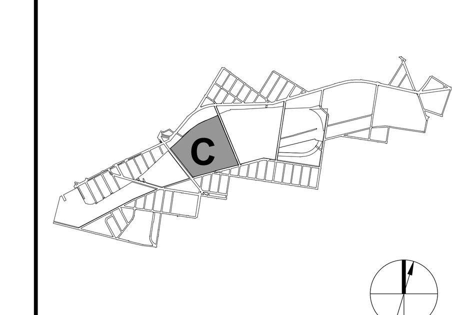
- PROJECT BOUNDARY
- SITE BOUNDARY
- MATCHLINE
- EXISTING TRACKS
- PROPOSED TRACKS
- COLUMN LINES
- TRUSSES PARALLEL TO TRACKS
- TRUSSES PERPENDICULAR TO TRACKS
- MEGATRUSS
- MEGACOLUMN

NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date
2	DRAWINGS UPDATE	12/21/2018
1	DRAWINGS UPDATE	11/20/2018

Key Plan



Discipline:

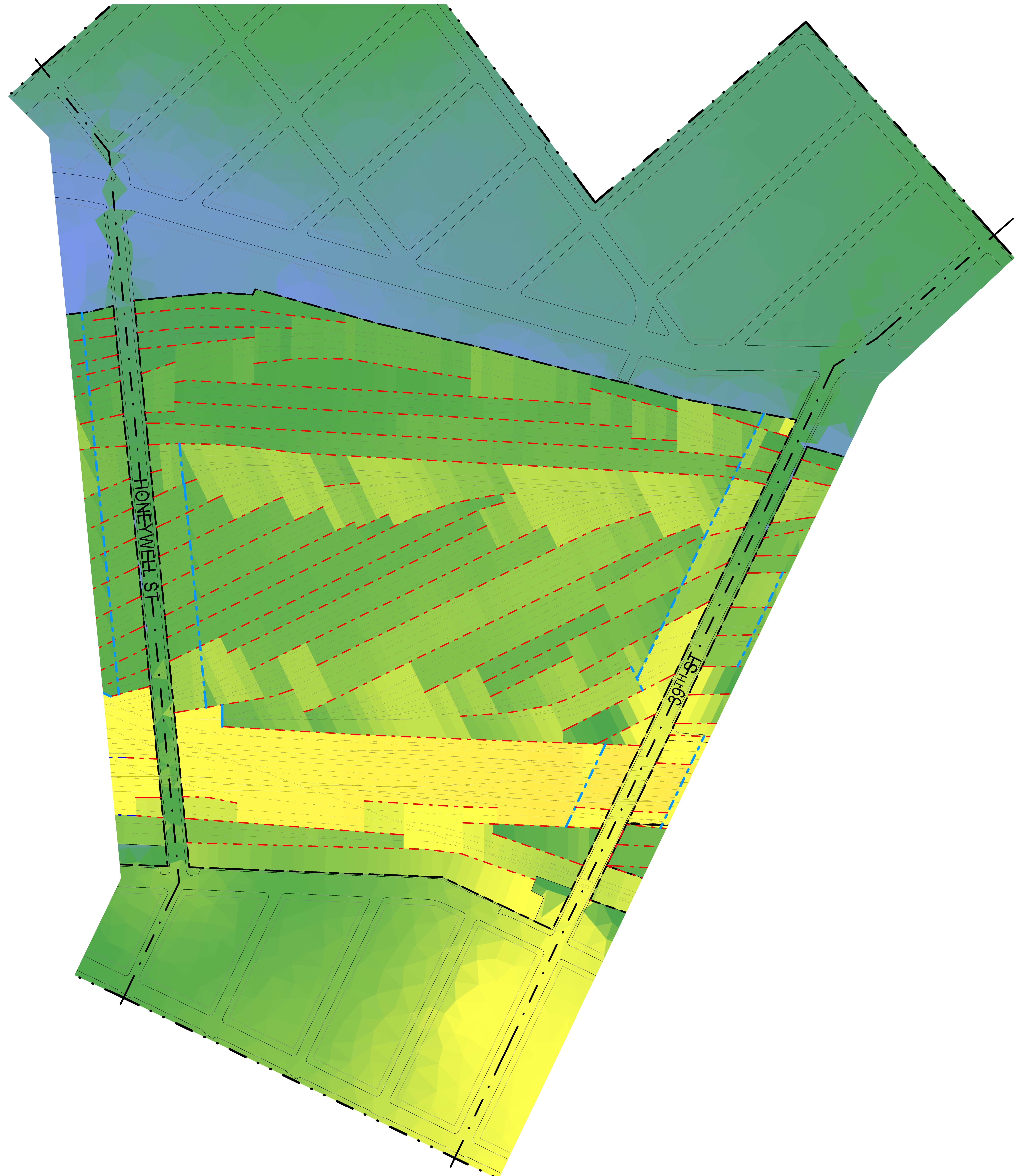
STRUCTURE

Title

TOP OF STRUCTURE CONCRETE - LOW CLEARANCE - SECTOR C

Thornton Tomasetti

Designed by	CC
Drawn by	AP
Checked by	JB
Date	09/14/2018
Drawing Number	S-160C.00



LEGEND

120
109
98
87
76
65
54
43
32
21
10

ELEVATIONS IN FEET ACCORDING TO THE NAVD88 VERTICAL DATUM

22' CLEARANCE FOR ZONE 1

27'9" CLEARANCE FOR ZONES 2-8

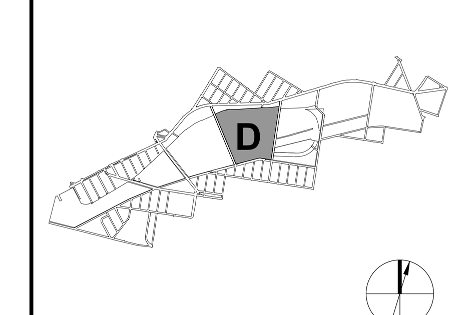
- PROJECT BOUNDARY
- SITE BOUNDARY
- MATCHLINE
- EXISTING TRACKS
- PROPOSED TRACKS
- COLUMN LINES
- TRUSSES PARALLEL TO TRACKS
- TRUSSES PERPENDICULAR TO TRACKS
- MEGATRUSS
- MEGACOLUMN

NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date
2	DRAWINGS UPDATE	12/21/2018
1	DRAWINGS UPDATE	11/20/2018

Key Plan



Discipline:

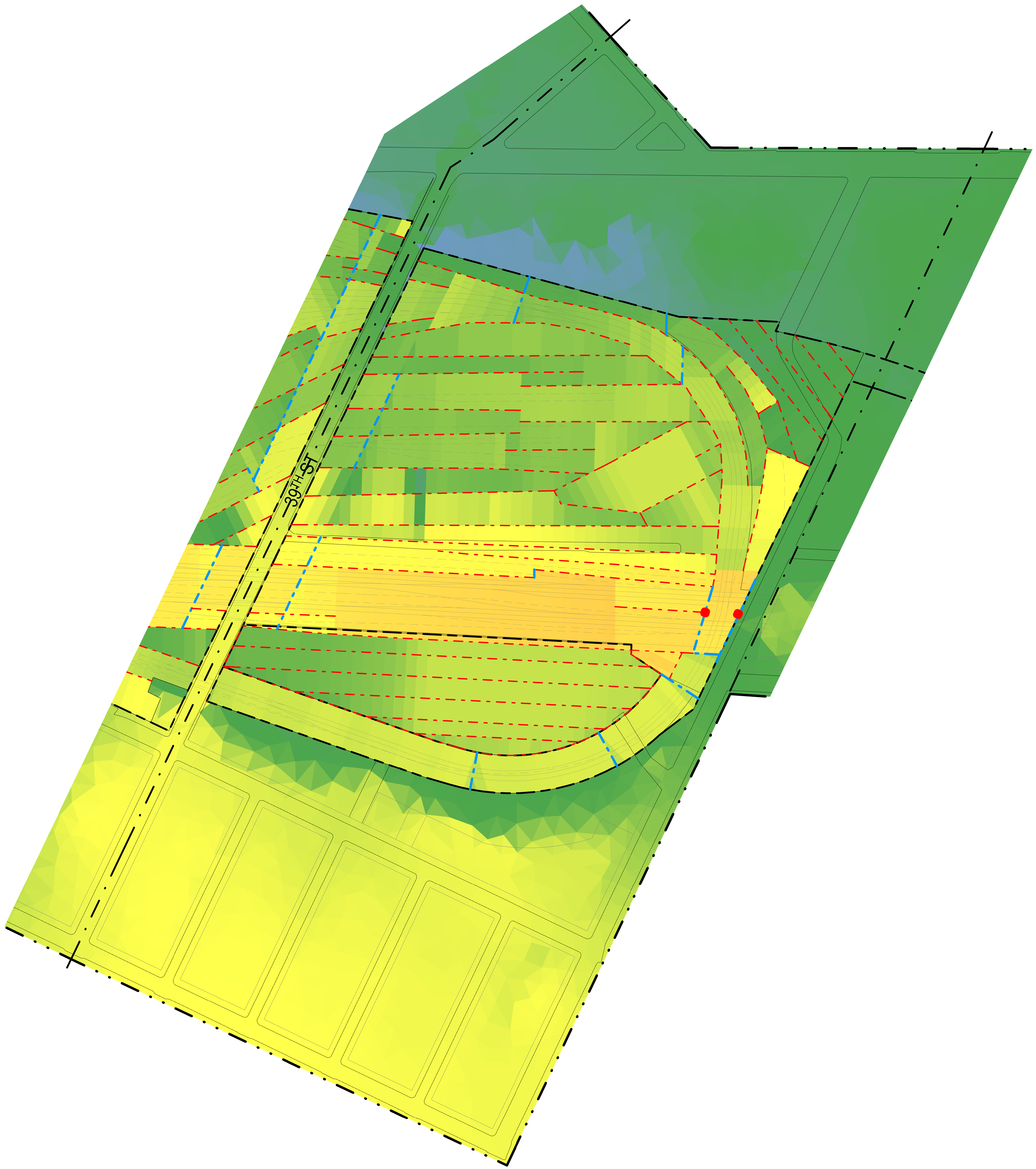
STRUCTURE

Title

TOP OF STRUCTURE CONCRETE - LOW CLEARANCE - SECTOR D

Thornton Tomasetti

Designed by CC
Drawn by AP
Checked by JB
Date 09/14/2018
Drawing Number S-160D.00



LEGEND

120
109
98
87
76
65
54
43
32
21
10

ELEVATIONS IN FEET ACCORDING TO THE NAVD88 VERTICAL DATUM

22' CLEARANCE FOR ZONE 1

27'9" CLEARANCE FOR ZONES 2-8

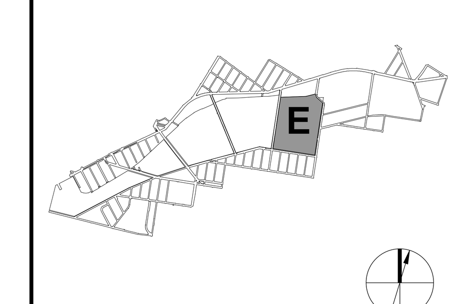
PROJECT BOUNDARY
SITE BOUNDARY
MATCHLINE
EXISTING TRACKS
PROPOSED TRACKS
COLUMN LINES
TRUSSES PARALLEL TO TRACKS
TRUSSES PERPENDICULAR TO TRACKS
MEGATRUSS
MEGACOLUMN

NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date
2	DRAWINGS UPDATE	12/21/2018
1	DRAWINGS UPDATE	11/20/2018

Key Plan



Discipline:
STRUCTURE

Title

TOP OF STRUCTURE CONCRETE - LOW CLEARANCE - SECTOR E

Thornton Tomasetti

Designed by CC
Drawn by AP
Checked by JB
Date 09/14/2018
Drawing Number S-160E.00

Appendix I

LEGEND

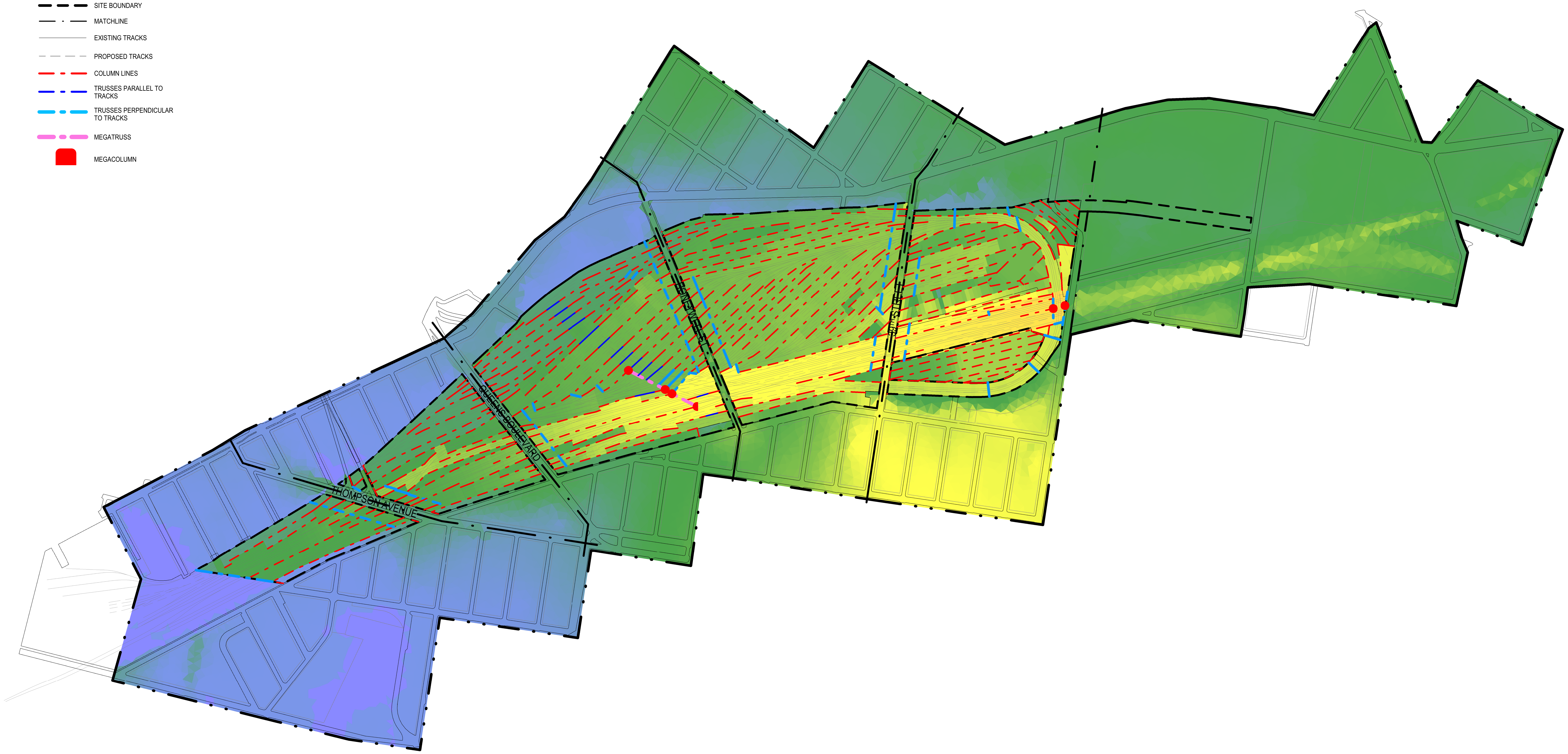
	120
	109
	98
	87
	76
	65
	54
	43
	32
	21
	10

ELEVATIONS IN FEET ACCORDING TO THE NAVD88 VERTICAL DATUM

22' CLEARANCE FOR ZONE 1

35'-6" CLEARANCE FOR ZONES 2-8

- PROJECT BOUNDARY
- SITE BOUNDARY
- MATCHLINE
- EXISTING TRACKS
- PROPOSED TRACKS
- COLUMN LINES
- TRUSSES PARALLEL TO TRACKS
- TRUSSES PERPENDICULAR TO TRACKS
- MEGATRUSS
- MEGACOLUMN

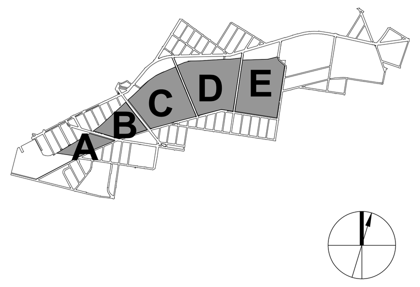


NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date
2	DRAWINGS UPDATE	12/21/2018
1	DRAWINGS UPDATE	11/20/2018

Key Plan



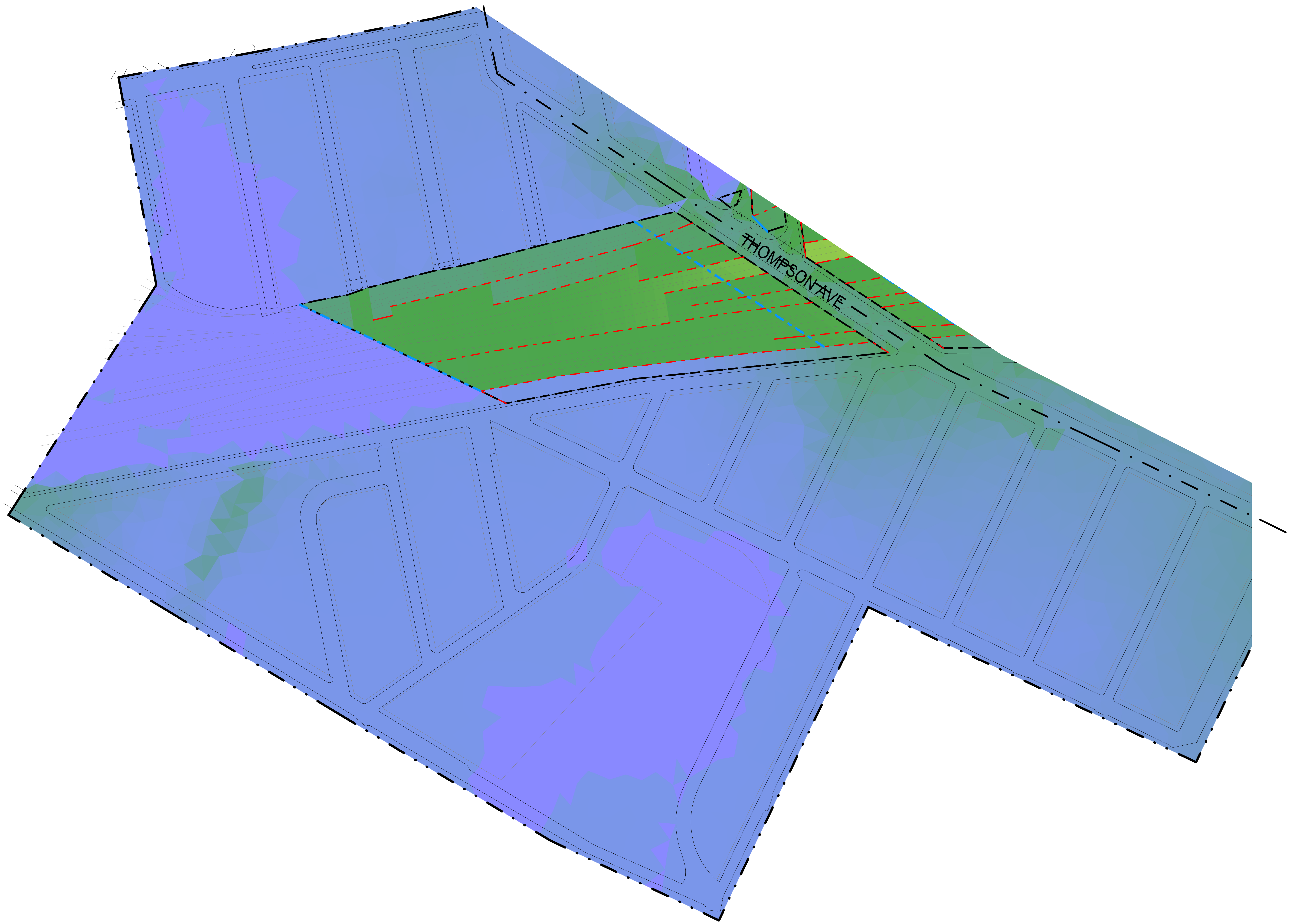
Discipline:
STRUCTURE

Title

BOTTOM OF STRUCTURE - HIGH CLEARANCE

Thornton Tomasetti

Designed by	CC
Drawn by	AP
Checked by	JB
Date	09/14/2018
Drawing Number	S-170.00



LEGEND

Elevation
120
109
98
87
76
65
54
43
32
21
10

ELEVATIONS IN FEET ACCORDING TO THE NAVD88 VERTICAL DATUM

22' CLEARANCE FOR ZONE 1

35'-6" CLEARANCE FOR ZONES 2-8

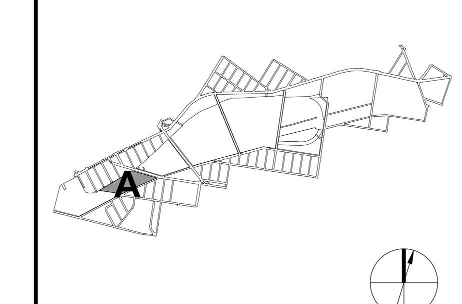
- PROJECT BOUNDARY
- SITE BOUNDARY
- MATCHLINE
- EXISTING TRACKS
- PROPOSED TRACKS
- COLUMN LINES
- TRUSSES PARALLEL TO TRACKS
- TRUSSES PERPENDICULAR TO TRACKS
- MEGATRUSS
- MEGACOLUMN

NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date
2	DRAWINGS UPDATE	12/21/2018
1	DRAWINGS UPDATE	11/20/2018

Key Plan



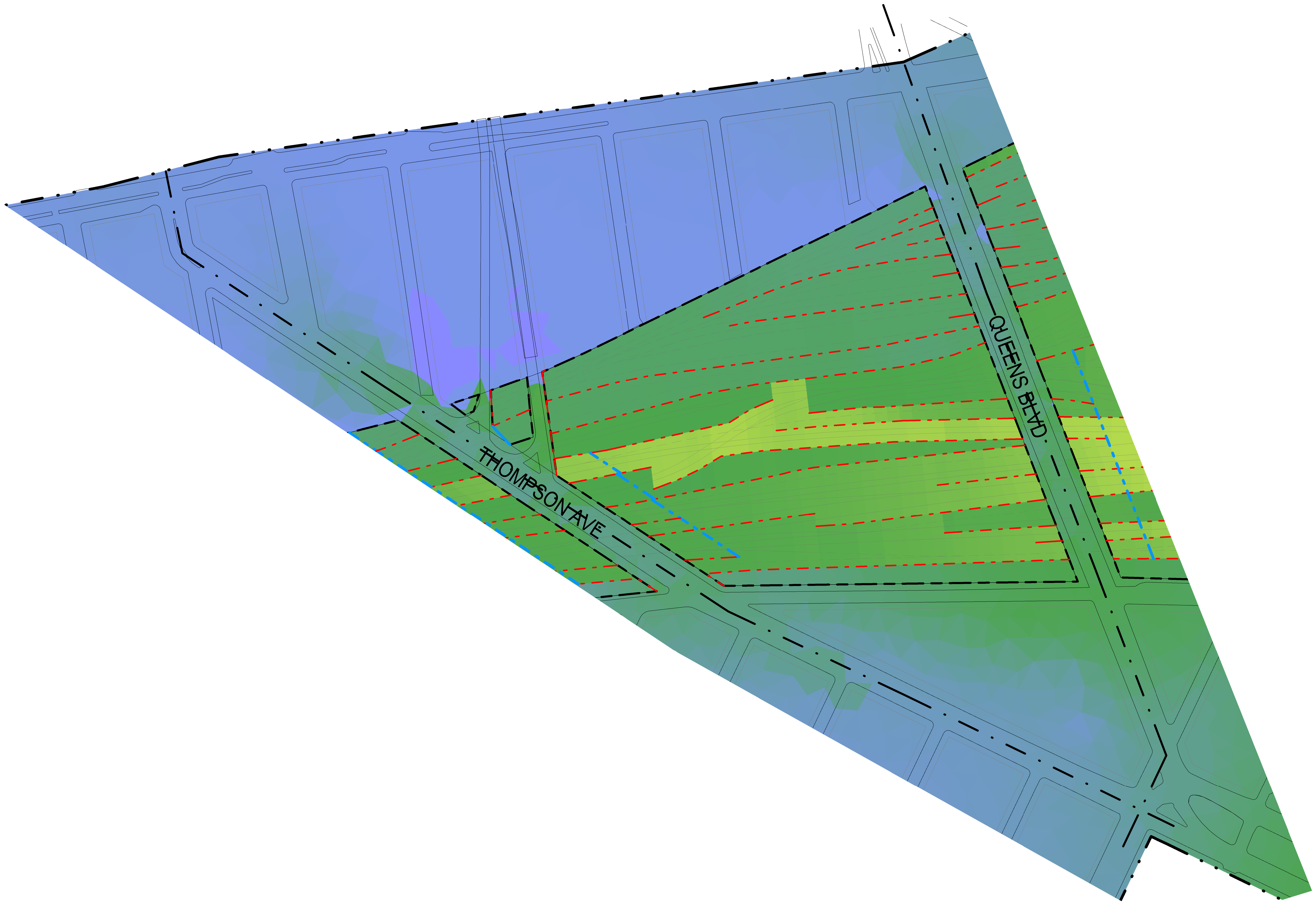
Discipline:
STRUCTURE

Title

BOTTOM OF STRUCTURE - HIGH CLEARANCE - SECTOR A

Thornton Tomasetti

Designed by CC
Drawn by AP
Checked by JB
Date 09/14/2018
Drawing Number S-170A.00



LEGEND

ELEVATIONS IN FEET ACCORDING TO THE NAVD88 VERTICAL DATUM

22' CLEARANCE FOR ZONE 1

35'-6" CLEARANCE FOR ZONES 2-8

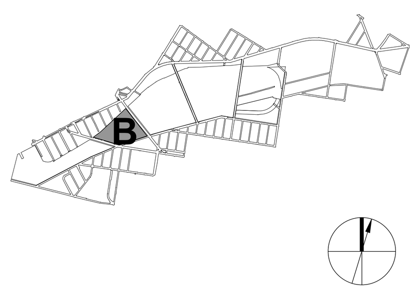
PROJECT BOUNDARY
SITE BOUNDARY
MATCHLINE
EXISTING TRACKS
PROPOSED TRACKS
COLUMN LINES
TRUSSES PARALLEL TO TRACKS
TRUSSES PERPENDICULAR TO TRACKS
MEGATRUSS
MEGACOLUMN

NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date
2	DRAWINGS UPDATE	12/21/2018
1	DRAWINGS UPDATE	11/20/2018

Key Plan



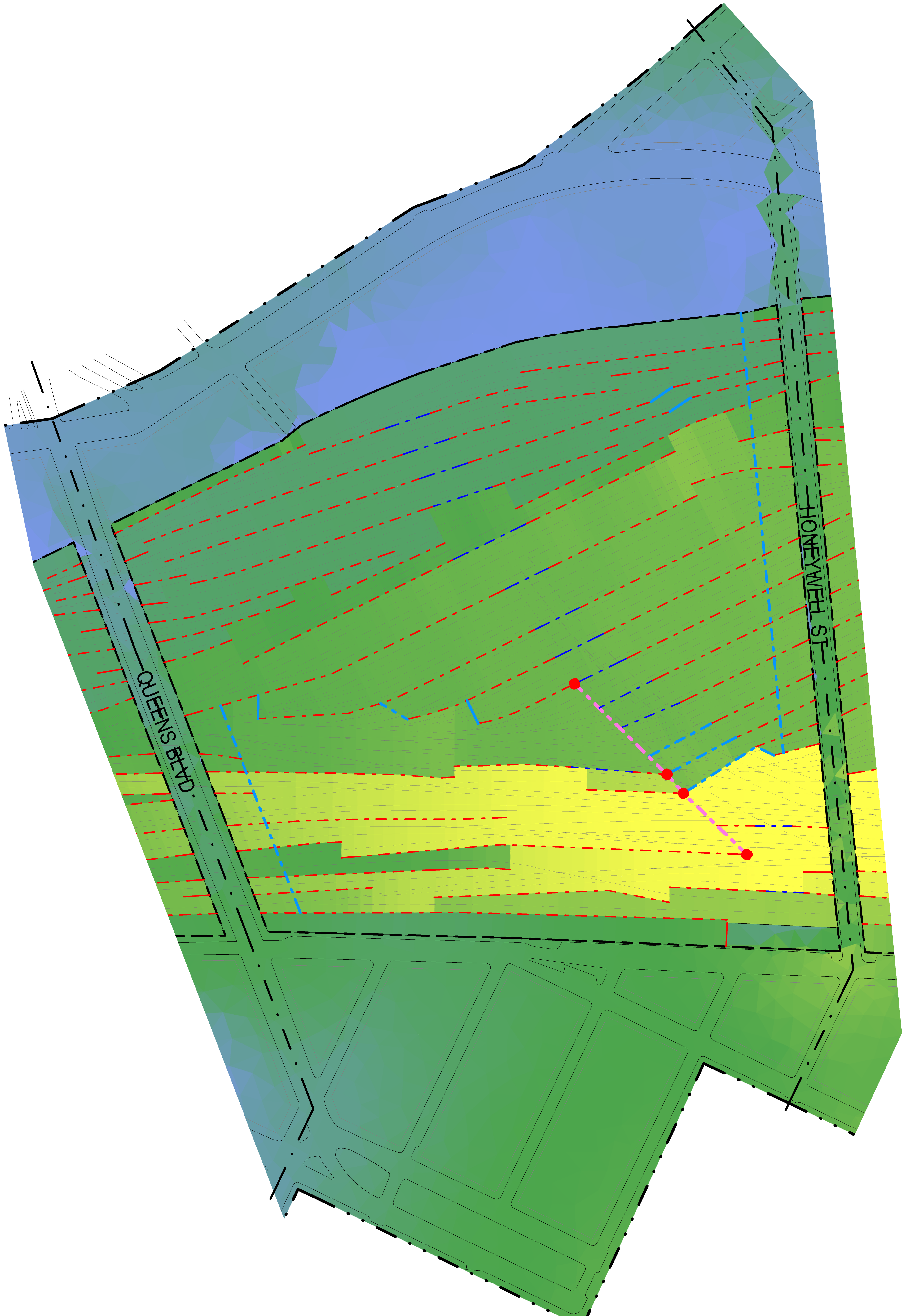
Discipline:
STRUCTURE

Title

BOTTOM OF STRUCTURE - HIGH CLEARANCE - SECTOR B

Thornton Tomasetti

Designed by CC
Drawn by AP
Checked by JB
Date 09/14/2018
Drawing Number S-170B.00



LEGEND

120	
109	
98	
87	
76	
65	
54	
43	
32	
21	
10	

ELEVATIONS IN FEET ACCORDING TO THE NAVD88 VERTICAL DATUM

22' CLEARANCE FOR ZONE 1

35'-6" CLEARANCE FOR ZONES 2-8

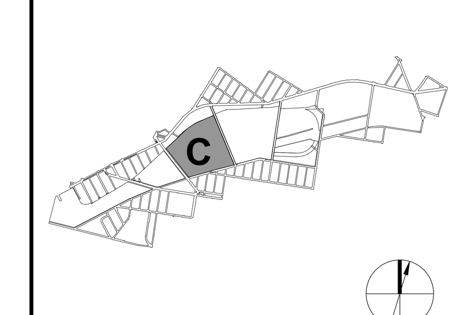
- PROJECT BOUNDARY
- SITE BOUNDARY
- MATCHLINE
- EXISTING TRACKS
- PROPOSED TRACKS
- COLUMN LINES
- TRUSSES PARALLEL TO TRACKS
- TRUSSES PERPENDICULAR TO TRACKS
- MEGATRUSS
- MEGACOLUMN

NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date
2	DRAWINGS UPDATE	12/21/2018
1	DRAWINGS UPDATE	11/20/2018

Key Plan



Discipline:

STRUCTURE

Title

BOTTOM OF STRUCTURE - HIGH CLEARANCE - SECTOR C

Thornton Tomasetti

Designed by CC

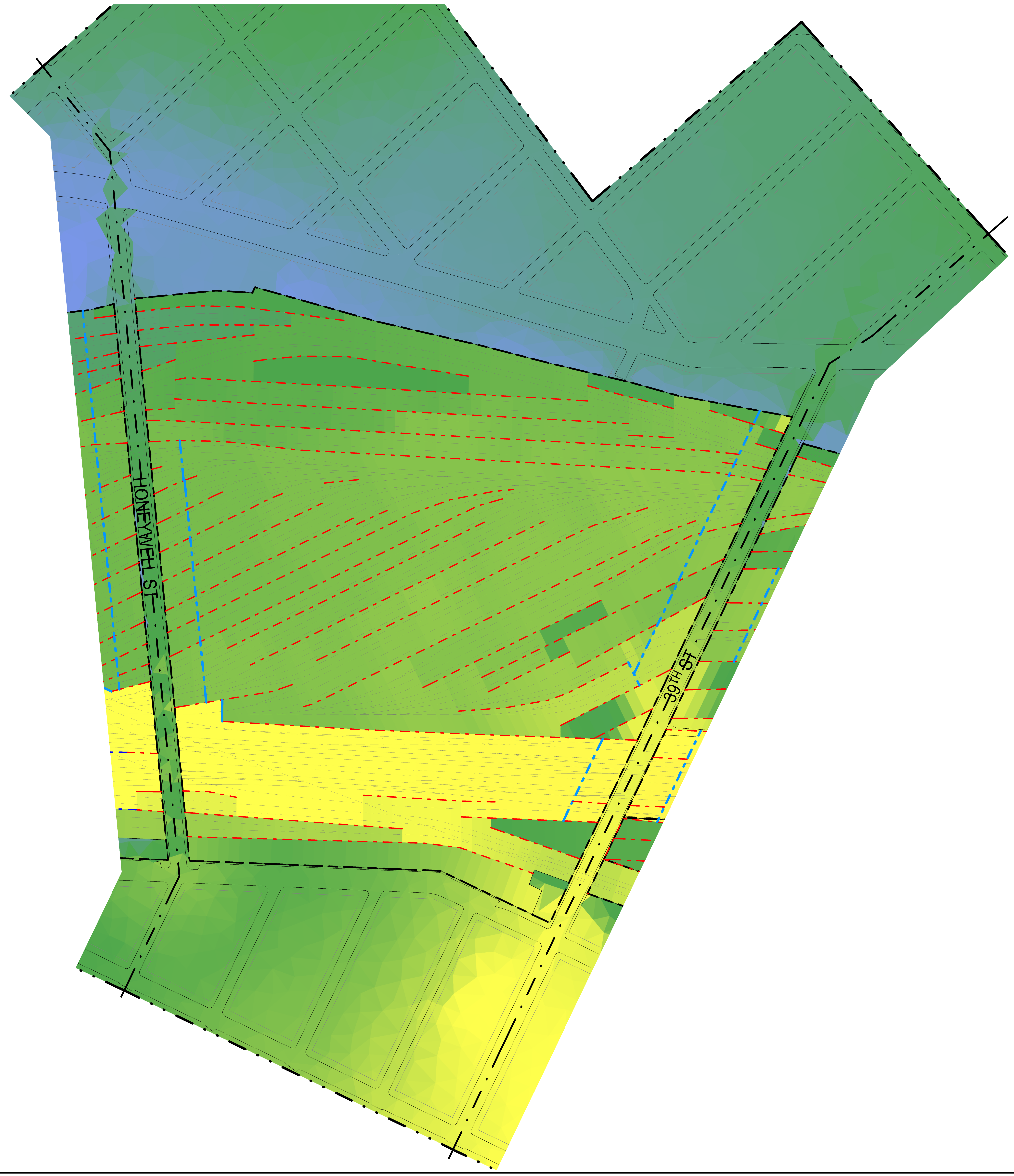
Drawn by AP

Checked by JB

Date 09/14/2018

Drawing Number

S-170C.00



LEGEND

ELEVATIONS IN FEET ACCORDING TO THE NAVD88 VERTICAL DATUM

22' CLEARANCE FOR ZONE 1

35'-6" CLEARANCE FOR ZONES 2-8

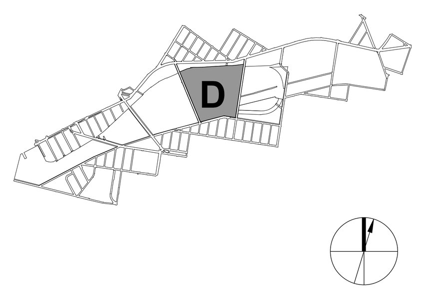
- PROJECT BOUNDARY
- SITE BOUNDARY
- MATCHLINE
- EXISTING TRACKS
- PROPOSED TRACKS
- COLUMN LINES
- TRUSSES PARALLEL TO TRACKS
- TRUSSES PERPENDICULAR TO TRACKS
- MEGATRUSS
- MEGACOLUMN

NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date
2	DRAWINGS UPDATE	12/21/2018
1	DRAWINGS UPDATE	11/20/2018

Key Plan



Discipline:

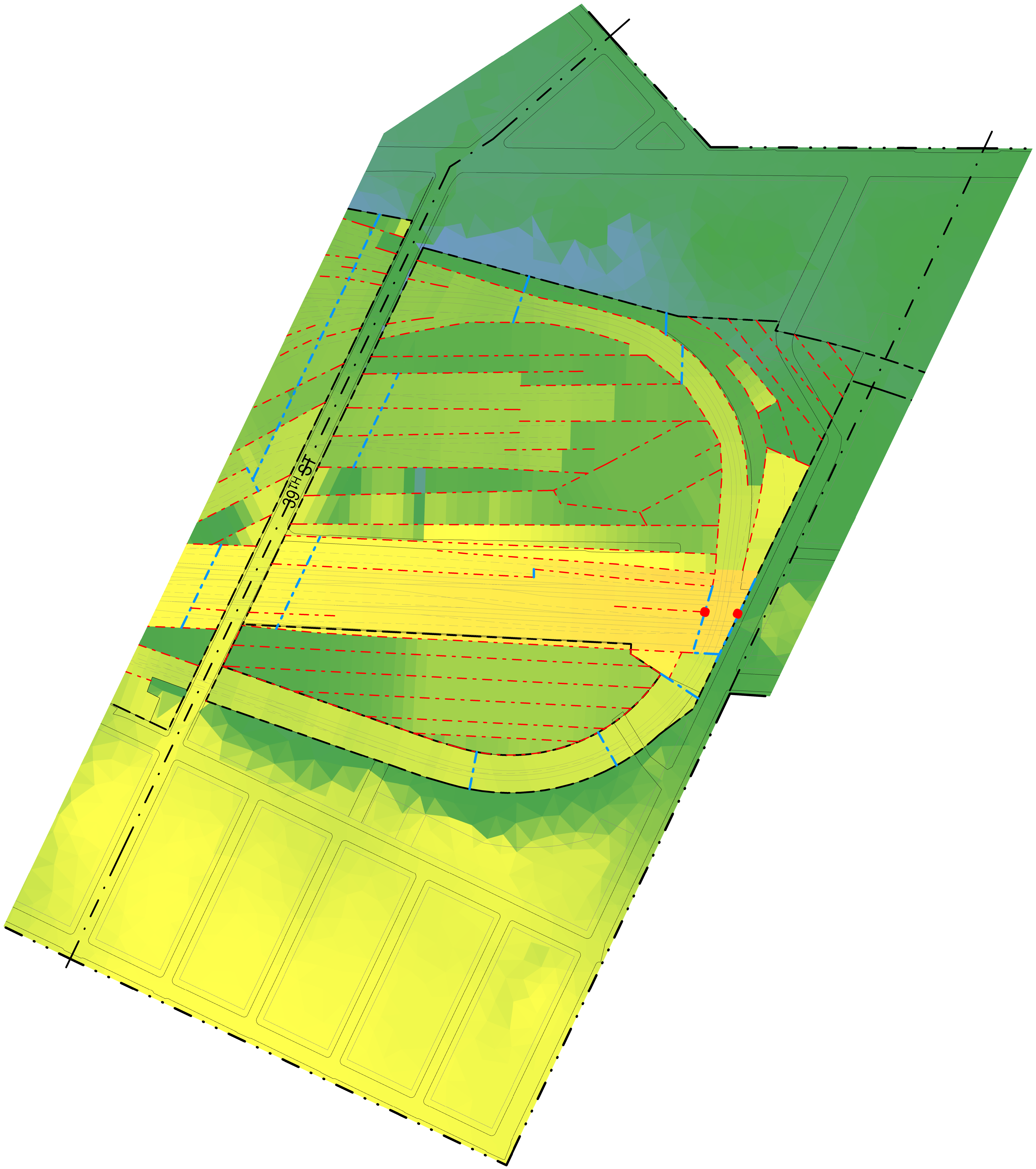
STRUCTURE

Title

BOTTOM OF STRUCTURE - HIGH CLEARANCE - SECTOR D

Thornton Tomasetti

Designed by	CC
Drawn by	AP
Checked by	JB
Date	09/14/2018
Drawing Number	S-170D.00



LEGEND

	120
	109
	98
	87
	76
	65
	54
	43
	32
	21
	10

ELEVATIONS IN FEET ACCORDING TO THE NAVD88 VERTICAL DATUM

22' CLEARANCE FOR ZONE 1

35'-6" CLEARANCE FOR ZONES 2-8

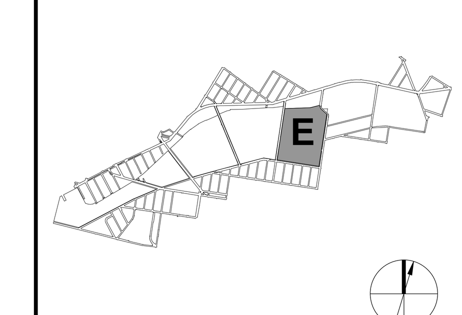
- PROJECT BOUNDARY
- SITE BOUNDARY
- MATCHLINE
- EXISTING TRACKS
- PROPOSED TRACKS
- COLUMN LINES
- TRUSSES PARALLEL TO TRACKS
- TRUSSES PERPENDICULAR TO TRACKS
- MEGATRUSS
- MEGACOLUMN

NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date
2	DRAWINGS UPDATE	12/21/2018
1	DRAWINGS UPDATE	11/20/2018

Key Plan



Discipline:

STRUCTURE

Title

BOTTOM OF STRUCTURE - HIGH CLEARANCE - SECTOR E

Thornton Tomasetti

Designed by	CC
Drawn by	AP
Checked by	JB
Date	09/14/2018
Drawing Number	S-170E.00

LEGEND

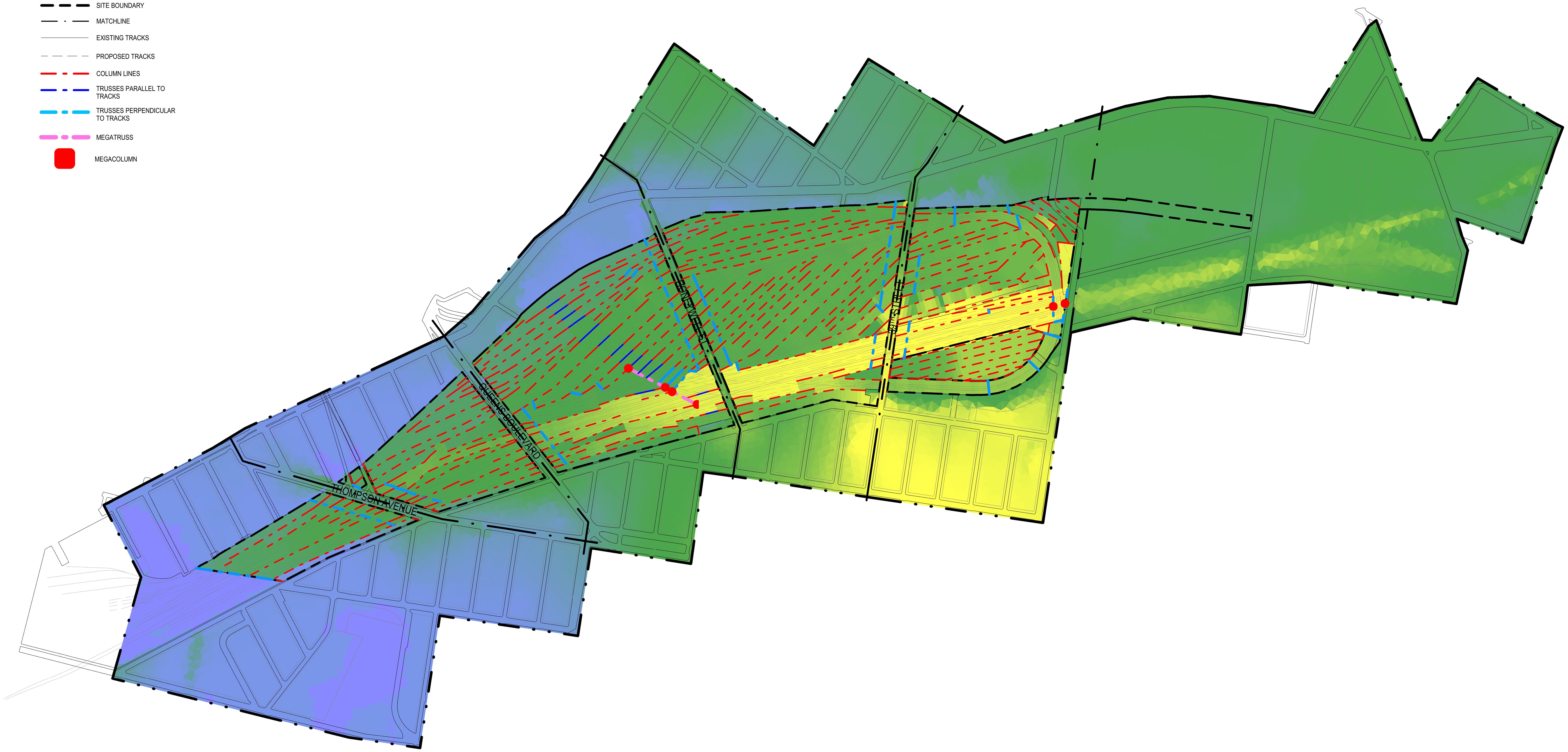
	120
	109
	98
	87
	76
	65
	54
	43
	32
	21
	10

ELEVATIONS IN FEET ACCORDING TO THE NAVD88 VERTICAL DATUM

22' CLEARANCE FOR ZONE 1

27'9" CLEARANCE FOR ZONES 2-8

- PROJECT BOUNDARY
- SITE BOUNDARY
- MATCHLINE
- EXISTING TRACKS
- PROPOSED TRACKS
- COLUMN LINES
- TRUSSES PARALLEL TO TRACKS
- TRUSSES PERPENDICULAR TO TRACKS
- MEGATRUSS
- MEGACOLUMN

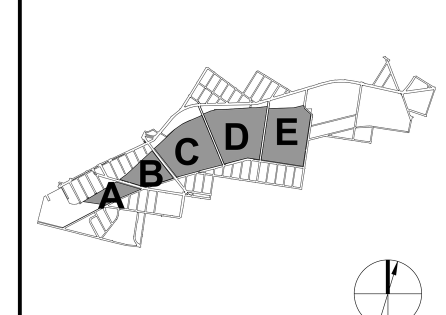


NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date
2	DRAWINGS UPDATE	12/21/2018
1	DRAWINGS UPDATE	11/20/2018

Key Plan



Discipline:

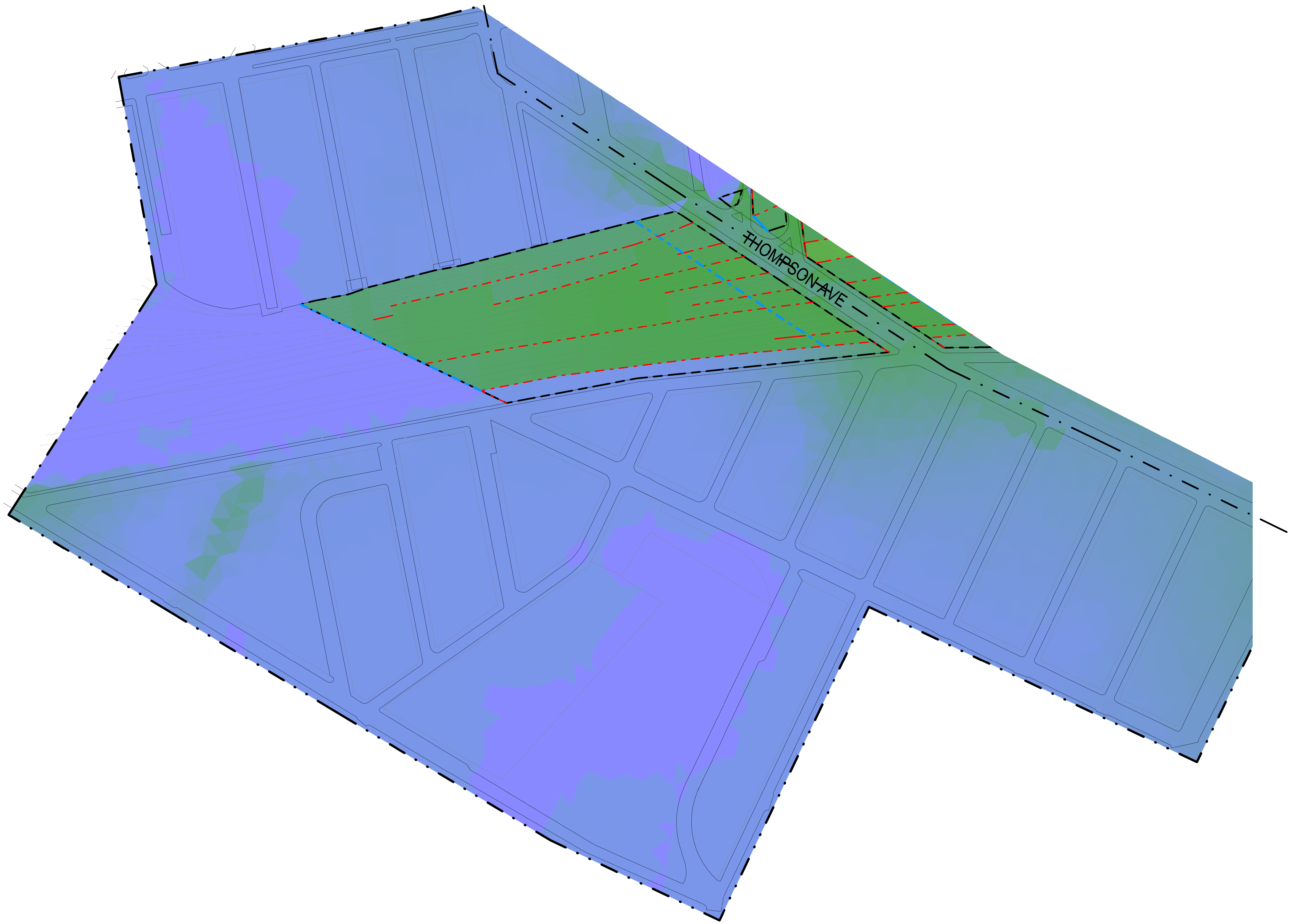
STRUCTURE

Title

BOTTOM OF STRUCTURE - LOW CLEARANCE

Thornton Tomasetti

Designed by	CC
Drawn by	AP
Checked by	JB
Date	09/14/2018
Drawing Number	S-180.00



LEGEND

120	
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43	
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ELEVATIONS IN FEET ACCORDING TO THE NAVD88 VERTICAL DATUM

22' CLEARANCE FOR ZONE 1

27'9" CLEARANCE FOR ZONES 2-8

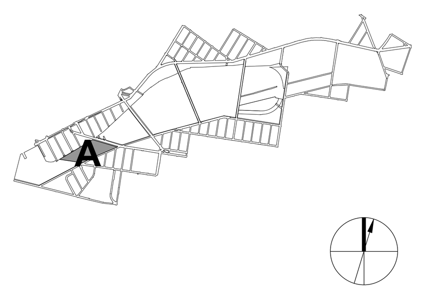
PROJECT BOUNDARY
SITE BOUNDARY
MATCHLINE
EXISTING TRACKS
PROPOSED TRACKS
COLUMN LINES
TRUSSES PARALLEL TO TRACKS
TRUSSES PERPENDICULAR TO TRACKS
MEGATRUSS
MEGACOLUMN

NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date
2	DRAWINGS UPDATE	12/21/2018
1	DRAWINGS UPDATE	11/20/2018

Key Plan



Discipline:

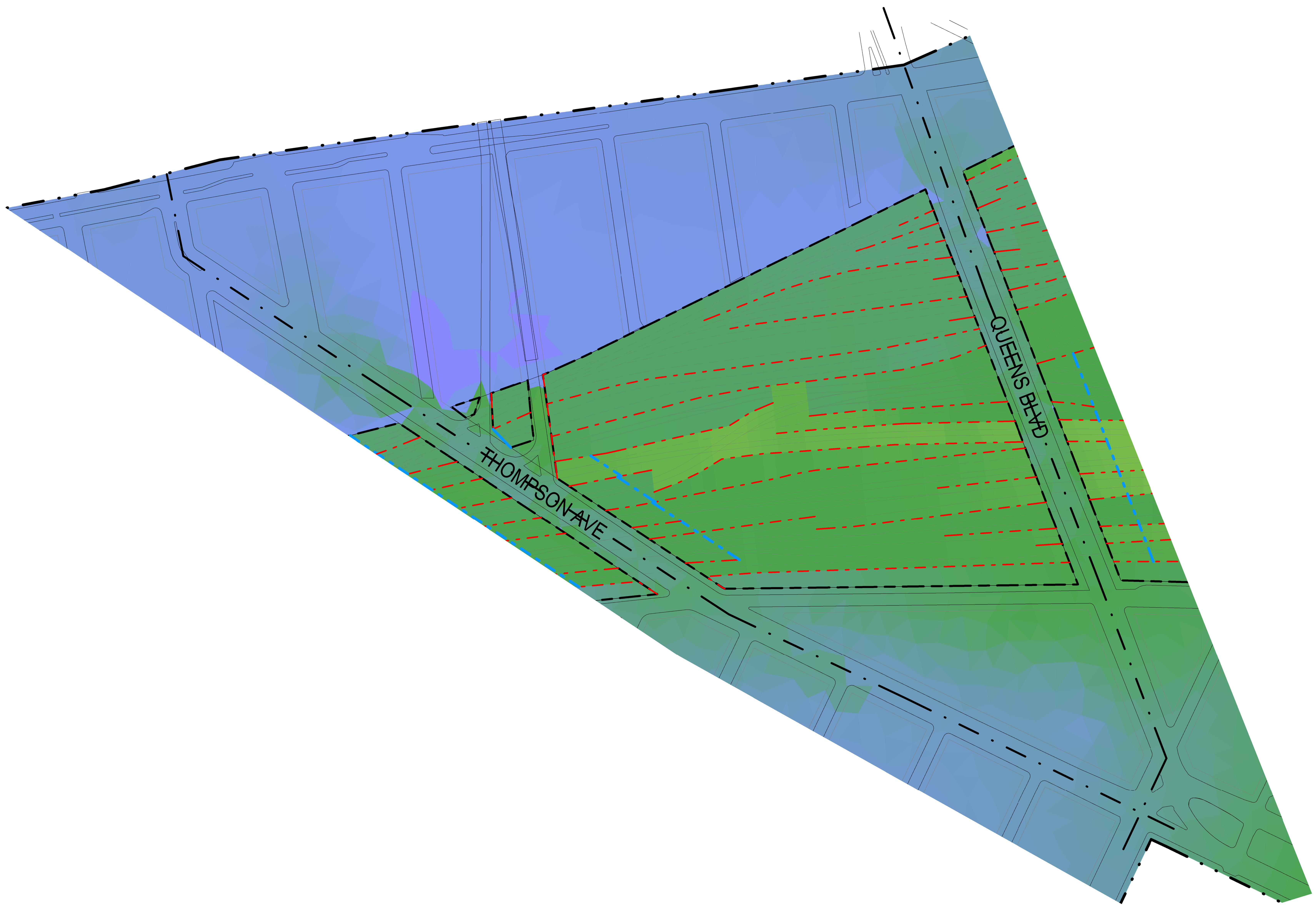
STRUCTURE

Title

BOTTOM OF STRUCTURE - LOW CLEARANCE - SECTOR A

Thornton Tomasetti

Designed by	CC
Drawn by	AP
Checked by	JB
Date	09/14/2018
Drawing Number	S-180A.00



LEGEND

120	
109	
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ELEVATIONS IN FEET ACCORDING TO THE NAVD88 VERTICAL DATUM

22' CLEARANCE FOR ZONE 1

27'9" CLEARANCE FOR ZONES 2-8

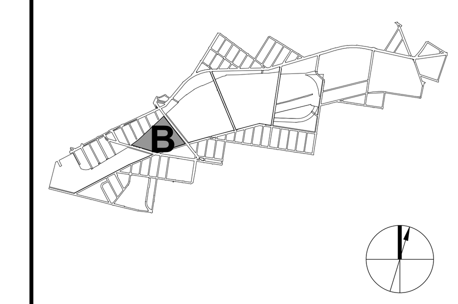
PROJECT BOUNDARY
SITE BOUNDARY
MATCHLINE
EXISTING TRACKS
PROPOSED TRACKS
COLUMN LINES
TRUSSES PARALLEL TO TRACKS
TRUSSES PERPENDICULAR TO TRACKS
MEGATRUSS
MEGACOLUMN

NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date
2	DRAWINGS UPDATE	12/21/2018
1	DRAWINGS UPDATE	11/20/2018

Key Plan



Discipline:

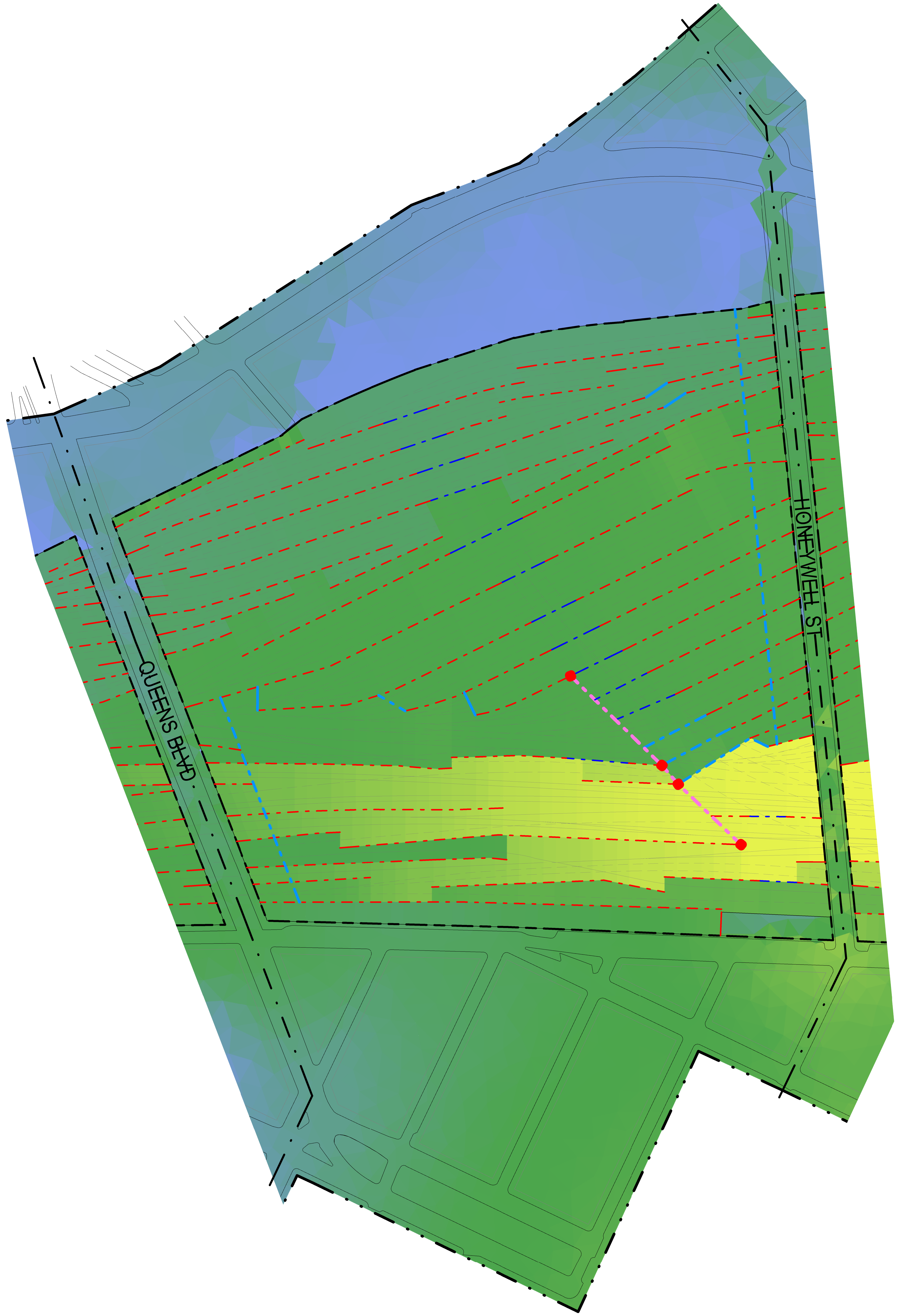
STRUCTURE

Title

BOTTOM OF STRUCTURE - LOW CLEARANCE - SECTOR B

Thornton Tomasetti

Designed by CC
Drawn by AP
Checked by JB
Date 09/14/2018
Drawing Number S-180B.00



LEGEND

120	
109	
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87	
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43	
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10	

ELEVATIONS IN FEET ACCORDING TO THE NAVD88 VERTICAL DATUM

22' CLEARANCE FOR ZONE 1

27'9" CLEARANCE FOR ZONES 2-8

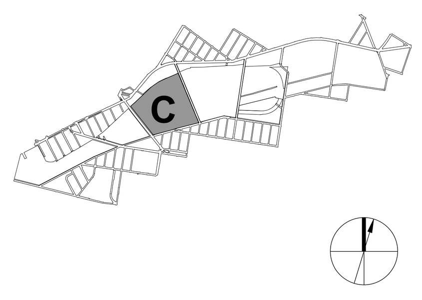
- PROJECT BOUNDARY
- SITE BOUNDARY
- MATCHLINE
- EXISTING TRACKS
- PROPOSED TRACKS
- COLUMN LINES
- TRUSSES PARALLEL TO TRACKS
- TRUSSES PERPENDICULAR TO TRACKS
- MEGATRUSS
- MEGACOLUMN

NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date
2	DRAWINGS UPDATE	12/21/2018
1	DRAWINGS UPDATE	11/20/2018

Key Plan



Discipline:

STRUCTURE

Title

BOTTOM OF STRUCTURE - LOW CLEARANCE - SECTOR C

Thornton Tomasetti

Designed by CC

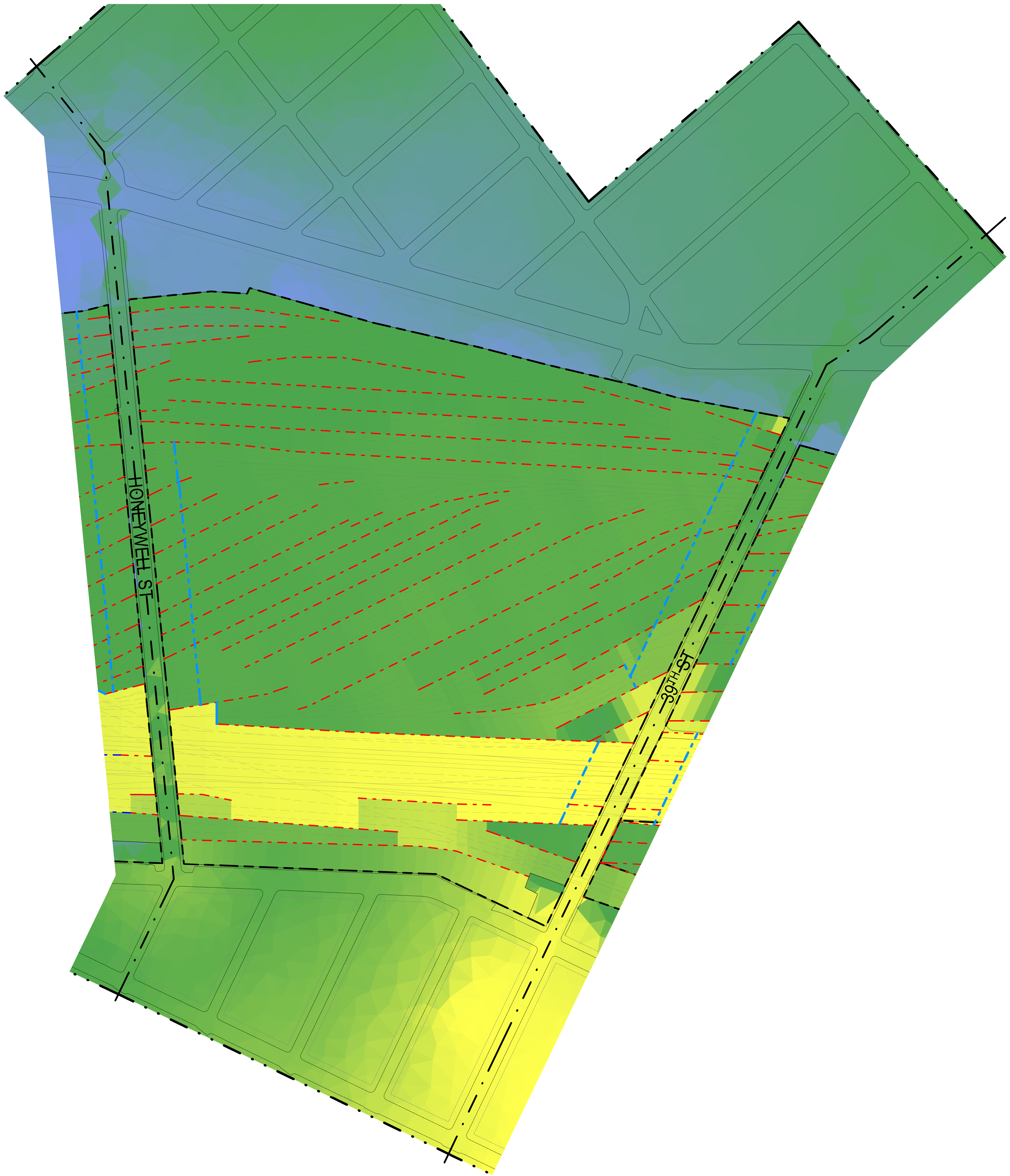
Drawn by AP

Checked by JB

Date 09/14/2018

Drawing Number

S-180C.00



LEGEND

120	
109	
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ELEVATIONS IN FEET ACCORDING TO THE NAVD88 VERTICAL DATUM

22' CLEARANCE FOR ZONE 1

27'9" CLEARANCE FOR ZONES 2-8

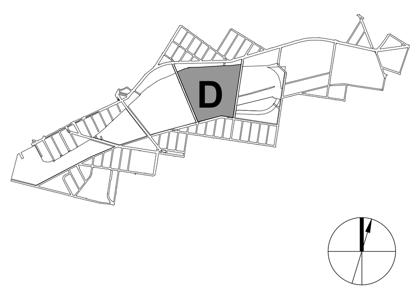
- PROJECT BOUNDARY
- SITE BOUNDARY
- MATCHLINE
- EXISTING TRACKS
- PROPOSED TRACKS
- COLUMN LINES
- TRUSSES PARALLEL TO TRACKS
- TRUSSES PERPENDICULAR TO TRACKS
- MEGATRUSS
- MEGACOLUMN

NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date
2	DRAWINGS UPDATE	12/21/2018
1	DRAWINGS UPDATE	11/20/2018

Key Plan



Discipline:

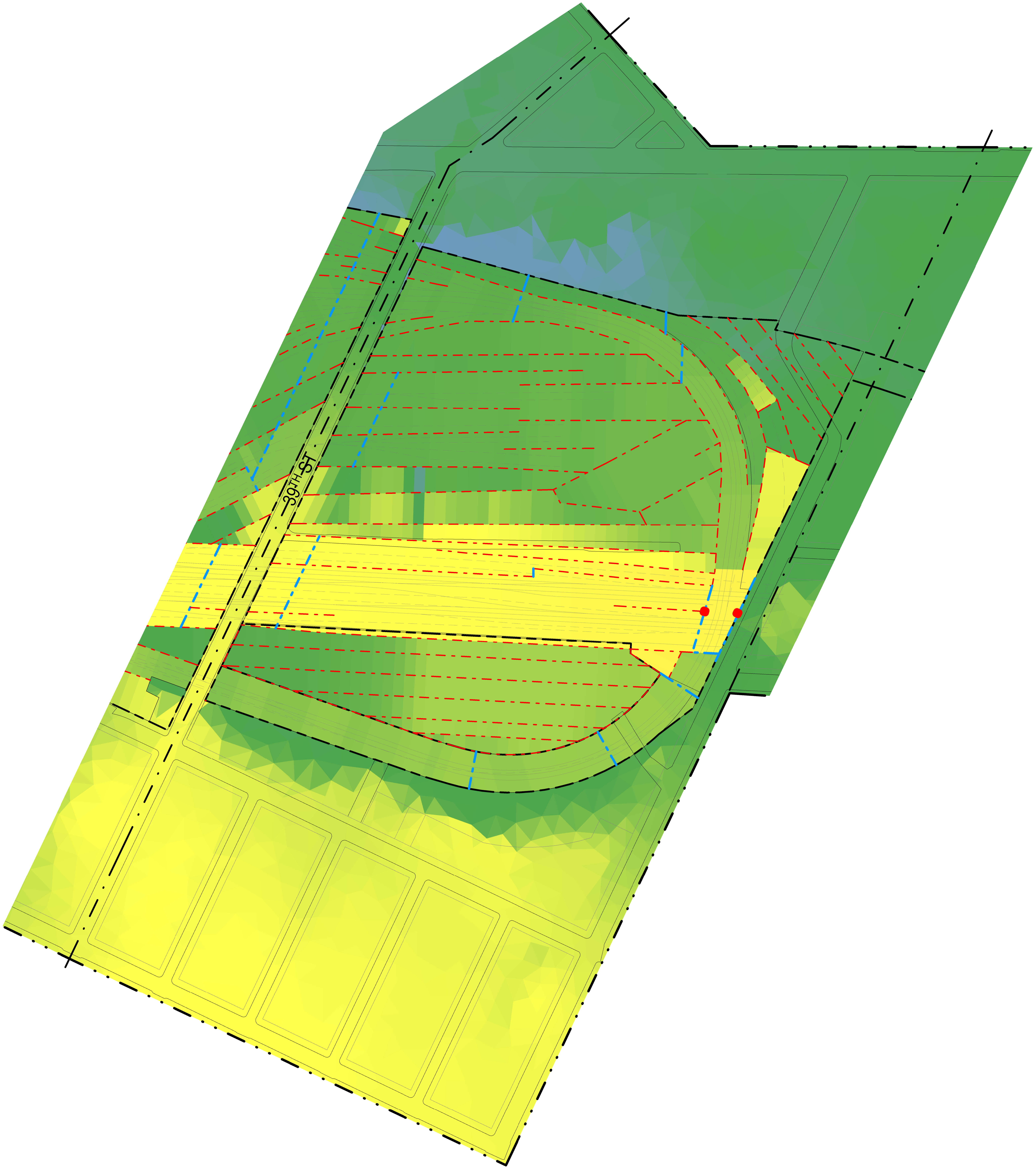
STRUCTURE

Title

BOTTOM OF STRUCTURE - LOW CLEARANCE - SECTOR D

Thornton Tomasetti

Designed by	CC
Drawn by	AP
Checked by	JB
Date	09/14/2018
Drawing Number	S-180D.00



LEGEND

120
109
98
87
76
65
54
43
32
21
10

ELEVATIONS IN FEET ACCORDING TO THE NAVD88 VERTICAL DATUM

22' CLEARANCE FOR ZONE 1

27'9" CLEARANCE FOR ZONES 2-8

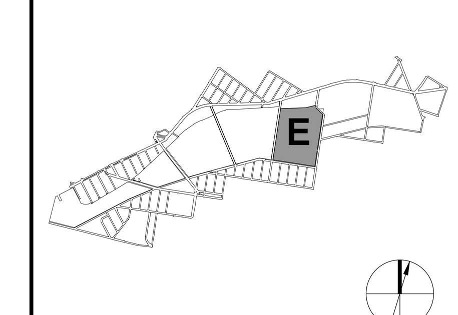
PROJECT BOUNDARY
SITE BOUNDARY
MATCHLINE
EXISTING TRACKS
PROPOSED TRACKS
COLUMN LINES
TRUSSES PARALLEL TO TRACKS
TRUSSES PERPENDICULAR TO TRACKS
MEGATRUSS
MEGACOLUMN

NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date
2	DRAWINGS UPDATE	12/21/2018
1	DRAWINGS UPDATE	11/20/2018

Key Plan



Discipline: **STRUCTURE**

Title

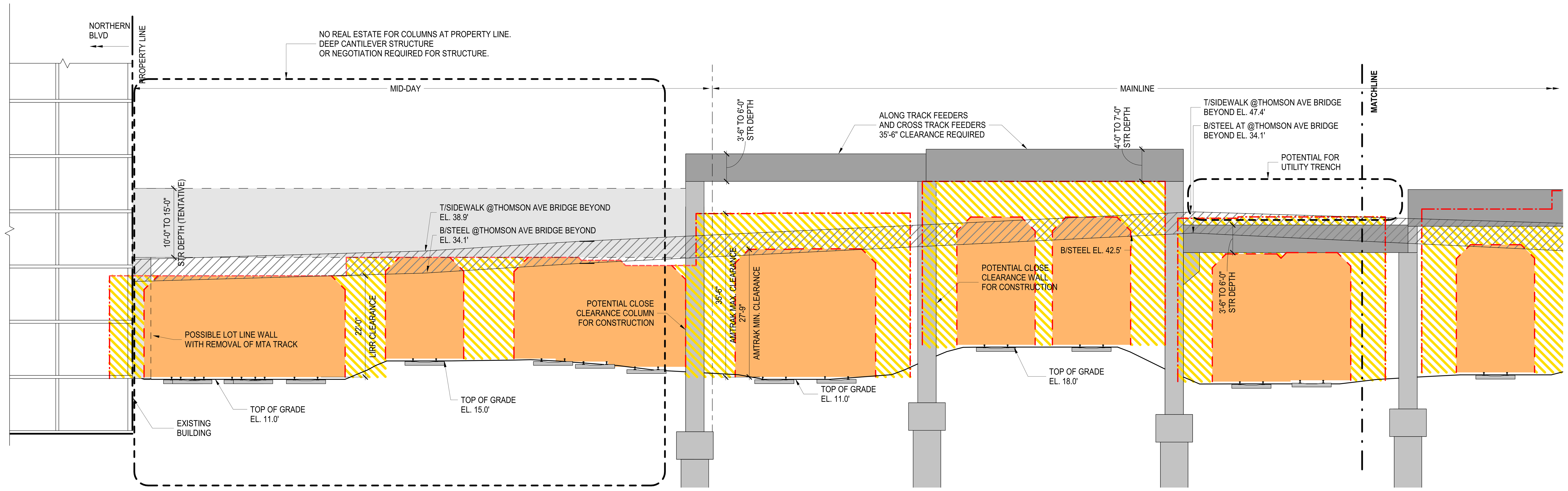
BOTTOM OF STRUCTURE - LOW CLEARANCE - SECTOR E

Thornton Tomasetti

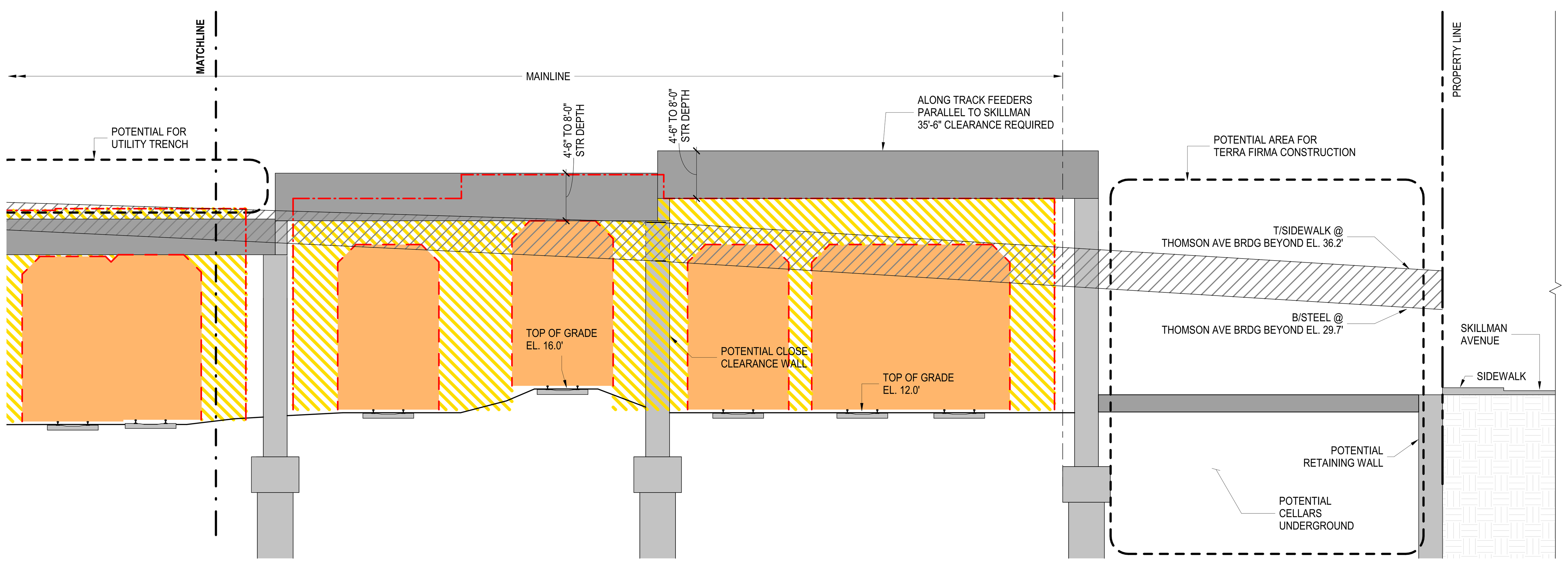
Designed by	CC
Drawn by	AP
Checked by	JB
Date	09/14/2018
Drawing Number	S-180E.00

APPENDIX A.5.J

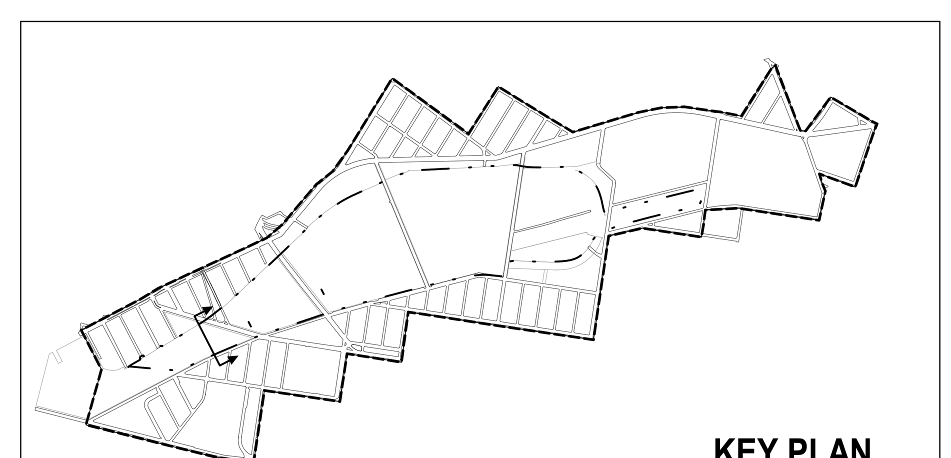
EDGE CONDITIONS / CROSS SECTIONS



① **CROSS SECTION - BETWEEN 49TH STREET AND THOMSON AVENUE**
SCALE: 3/32" = 1'-0"



② **CROSS SECTION - BETWEEN 49TH STREET AND THOMSON AVENUE**
SCALE: 3/32" = 1'-0"



KEY PLAN

LEGEND

VERTICAL CLEARANCE

- BOTTOM OF STRUCTURE SET @27'-9" AMTRAK MIN. CLEARANCE
- BOTTOM OF STRUCTURE SET @22'-0" LIRR CLEARANCE
- BOTTOM OF STRUCTURE SET @SIGNAL BRIDGE ELEVATION (VARIES)
- BOTTOM OF STRUCTURE SET @35'-6" AMTRAK MAX. CLEARANCE DUE TO CROSS-TRACK FEEDERS

HORIZONTAL CLEARANCE

- 8'-6" ABSOLUTE CLEARANCE LINE
- 16'-0" FOULING LINE

CLEARANCE BOXES

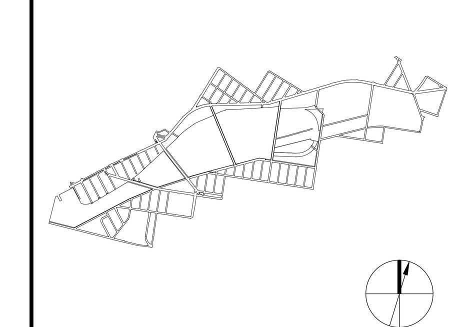
- LIRR / AMTRAK LOW CLEARANCE (V) + 8'-6" ABSOLUTE CLEARANCE (H)
- LIRR / AMTRAK HIGH CLEARANCE (V) + 16'-0" FOULING CLEARANCE (H)

NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date
1	DRAWINGS UPDATE	11/20/2018

Key Plan



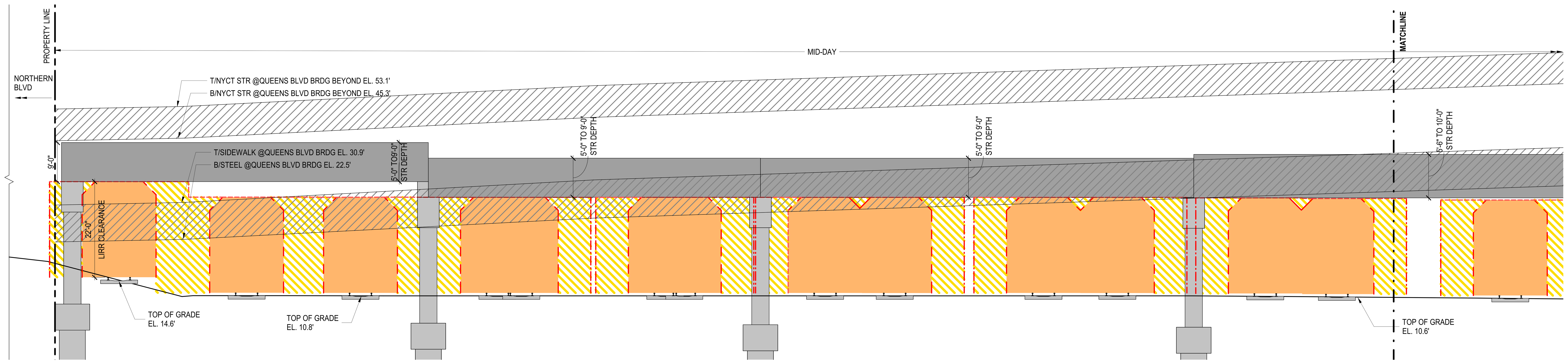
Discipline: **STRUCTURE**

Title

CROSS SECTION - BETWEEN 49TH AVENUE AND THOMSON AVENUE

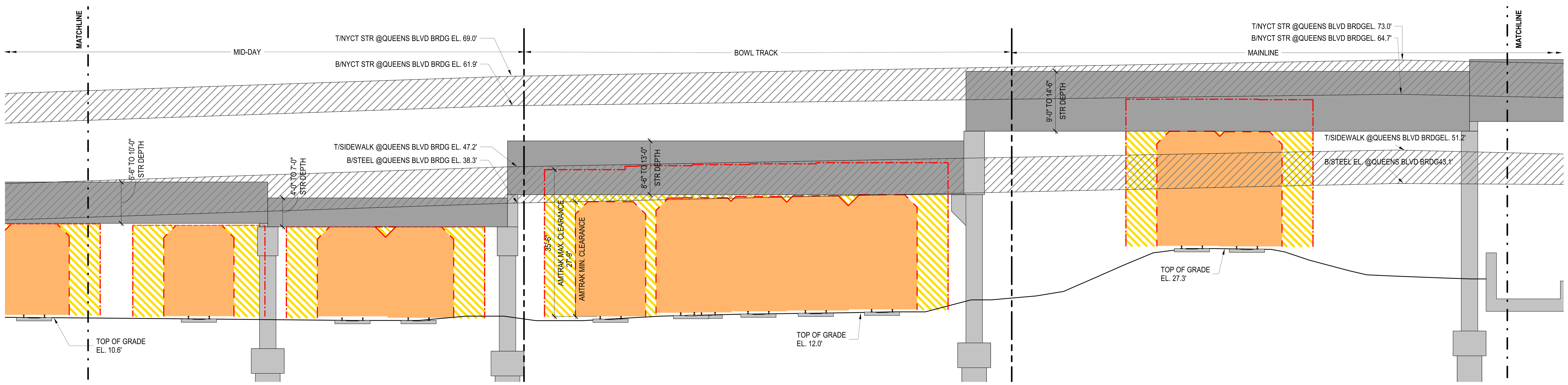
Thornton Tomasetti

Designed by	CCG
Drawn by	AP
Checked by	JB
Date	09/14/2018
Drawing Number	S-300.00



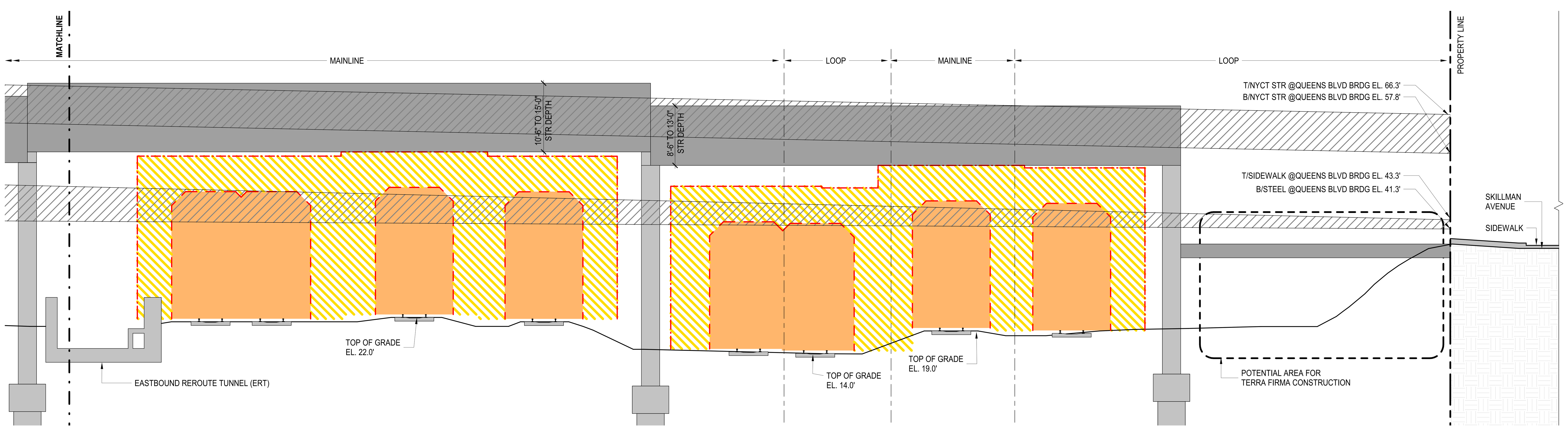
1 CROSS SECTION - BETWEEN THOMSON AVENUE AND QUEENS BOULEVARD

SCALE: 3/32" = 1'-0"



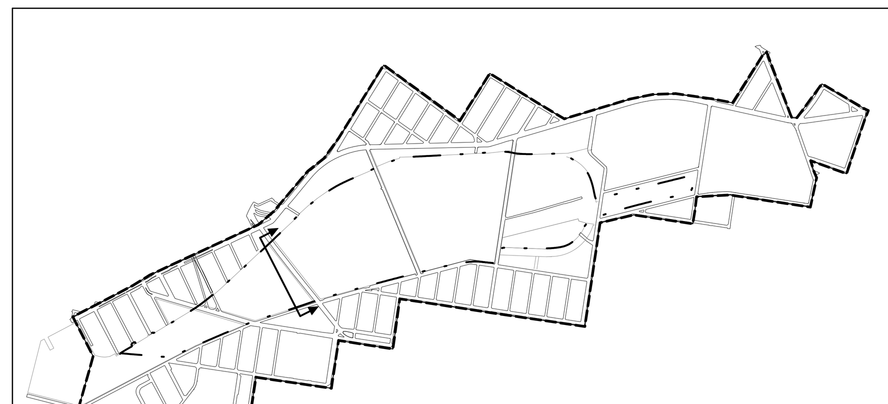
2 CROSS SECTION - BETWEEN THOMSON AVENUE AND QUEENS BOULEVARD

SCALE: 3/32" = 1'-0"



3 CROSS SECTION - BETWEEN THOMSON AVENUE AND QUEENS BOULEVARD

SCALE: 3/32" = 1'-0"



KEY PLAN

LEGEND

VERTICAL CLEARANCE

- BOTTOM OF STRUCTURE SET @27'-9" AMTRAK MIN. CLEARANCE
- BOTTOM OF STRUCTURE SET @22'-0" LIRR CLEARANCE
- BOTTOM OF STRUCTURE SET @SIGNAL BRIDGE ELEVATION (VARIES)
- BOTTOM OF STRUCTURE SET @35'-6" AMTRAK MAX. CLEARANCE DUE TO CROSS-TRACK FEEDERS

HORIZONTAL CLEARANCE

- 8'-6" ABSOLUTE CLEARANCE LINE
- 16'-0" FOULING LINE

CLEARANCE BOXES

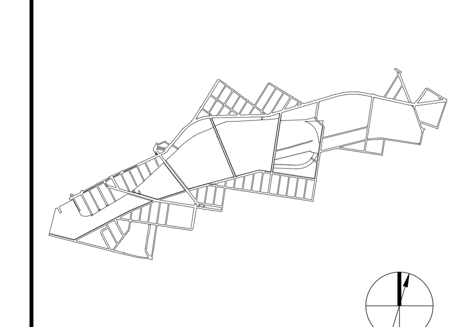
- LIRR / AMTRAK LOW CLEARANCE (V) + 8'-6" ABSOLUTE CLEARANCE (H)
- LIRR / AMTRAK HIGH CLEARANCE (V) + 16'-0" FOULING CLEARANCE (H)

NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date

Key Plan



Discipline:

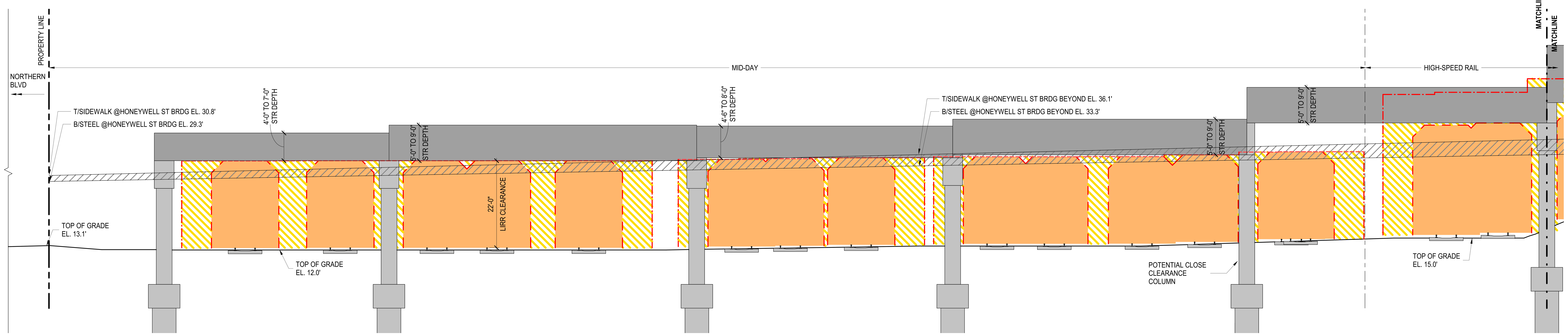
STRUCTURE

Title

CROSS SECTION - BETWEEN THOMSON AVENUE AND QUEENS BOULEVARD

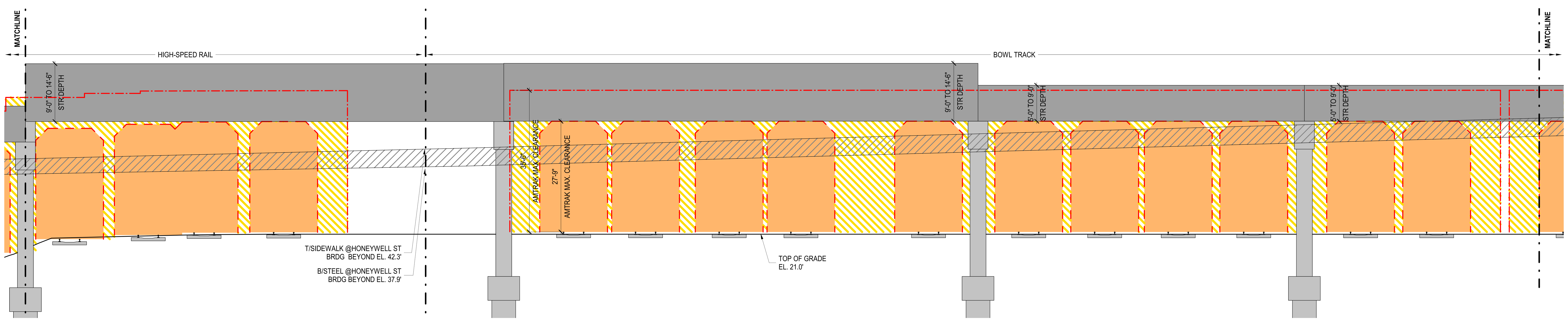
Thornton Tomasetti

Designed by	CCG
Drawn by	AP
Checked by	JB
Date	09/14/2018
Drawing Number	S-301.00



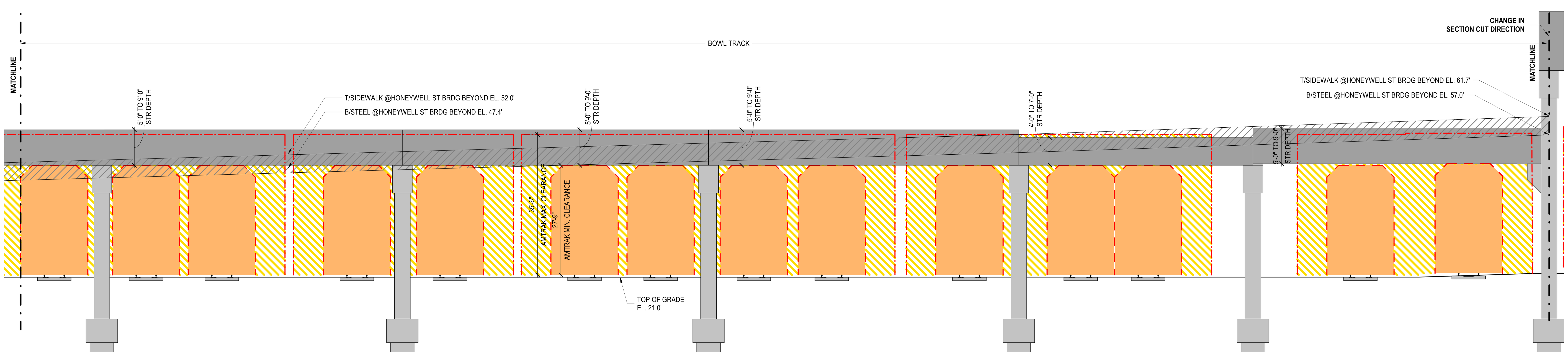
1 CROSS SECTION - BETWEEN QUEENS BOULEVARD AND HONEYWELL STREET

SCALE: 3/32" = 1'-0"



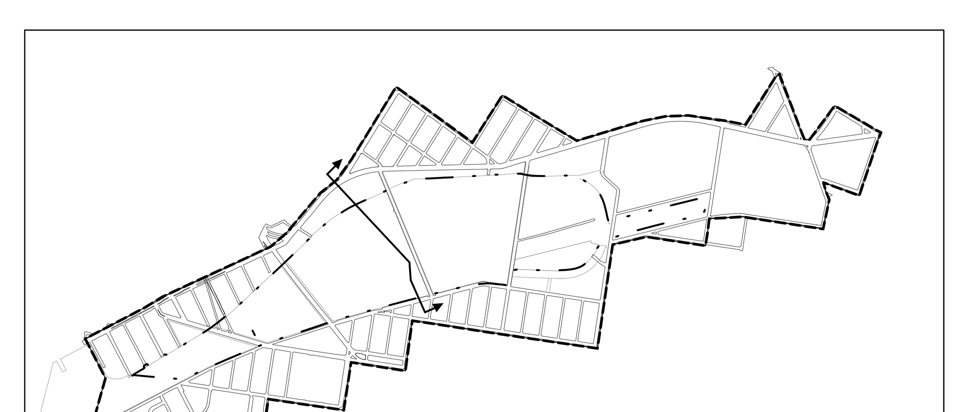
2 CROSS SECTION - BETWEEN QUEENS BOULEVARD AND HONEYWELL STREET

SCALE: 3/32" = 1'-0"



3 CROSS SECTION - BETWEEN QUEENS BOULEVARD AND HONEYWELL STREET

SCALE: 3/32" = 1'-0"



KEY PLAN

LEGEND

VERTICAL CLEARANCE

- BOTTOM OF STRUCTURE SET @27'-9" AMTRAK MIN. CLEARANCE
- BOTTOM OF STRUCTURE SET @22'-0" LIRR CLEARANCE
- BOTTOM OF STRUCTURE SET @SIGNAL BRIDGE ELEVATION (VARIES)
- BOTTOM OF STRUCTURE SET @35'-6" AMTRAK MAX. CLEARANCE DUE TO CROSS-TRACK FEEDERS

HORIZONTAL CLEARANCE

- 8'-6" ABSOLUTE CLEARANCE LINE
- 16'-0" FOULING LINE

CLEARANCE BOXES

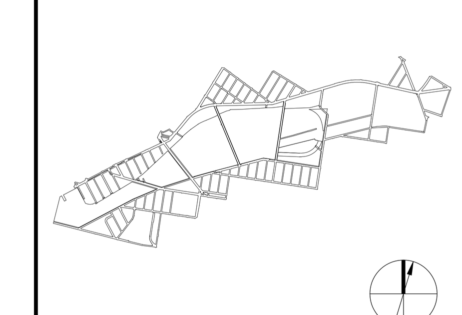
- LIRR / AMTRAK LOW CLEARANCE (V) + 8'-6" ABSOLUTE CLEARANCE (H)
- LIRR / AMTRAK HIGH CLEARANCE (V) + 16'-0" FOULING CLEARANCE (H)

NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date

Key Plan



Discipline:

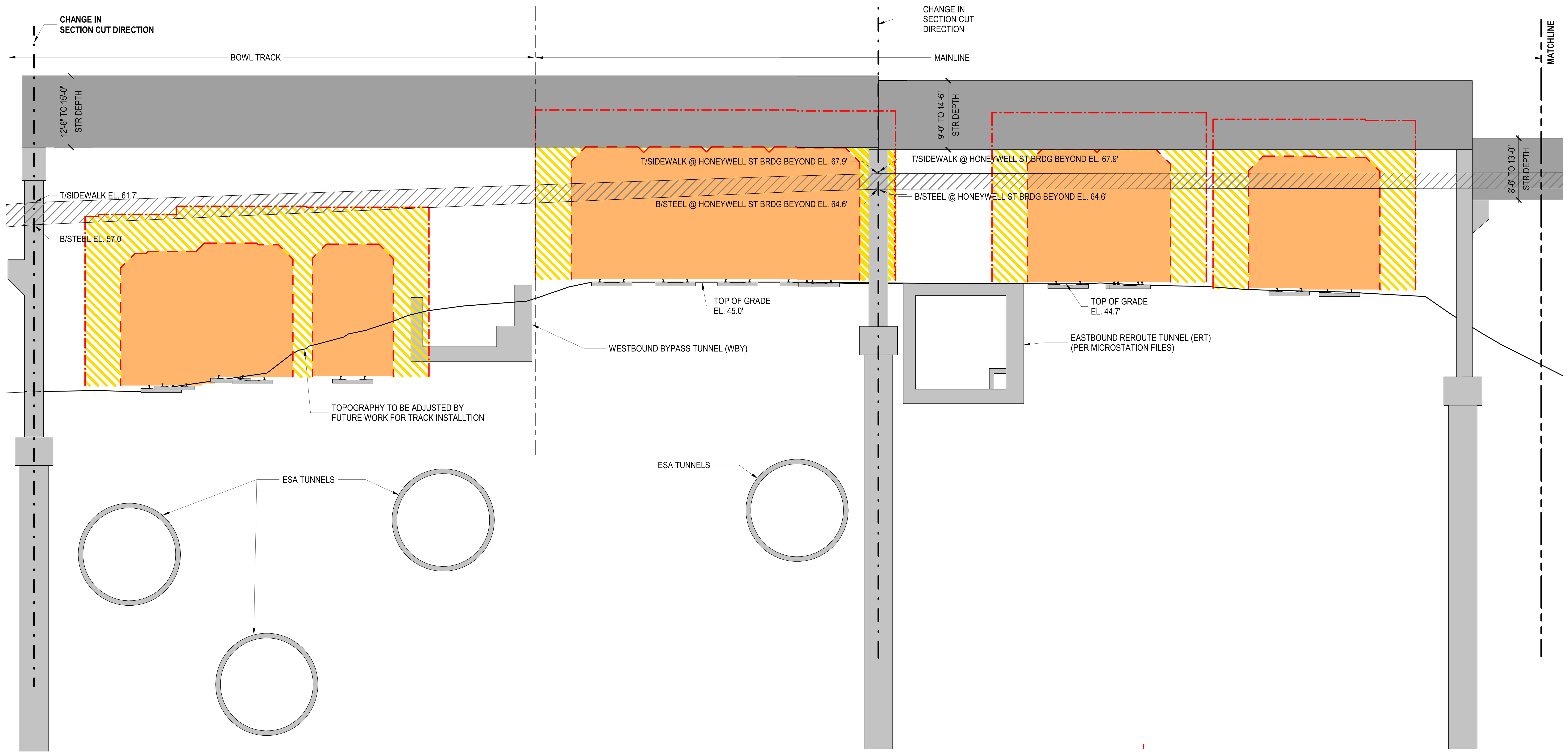
STRUCTURE

Title

CROSS SECTION - BETWEEN QUEENS BOULEVARD AND HONEYWELL STREET

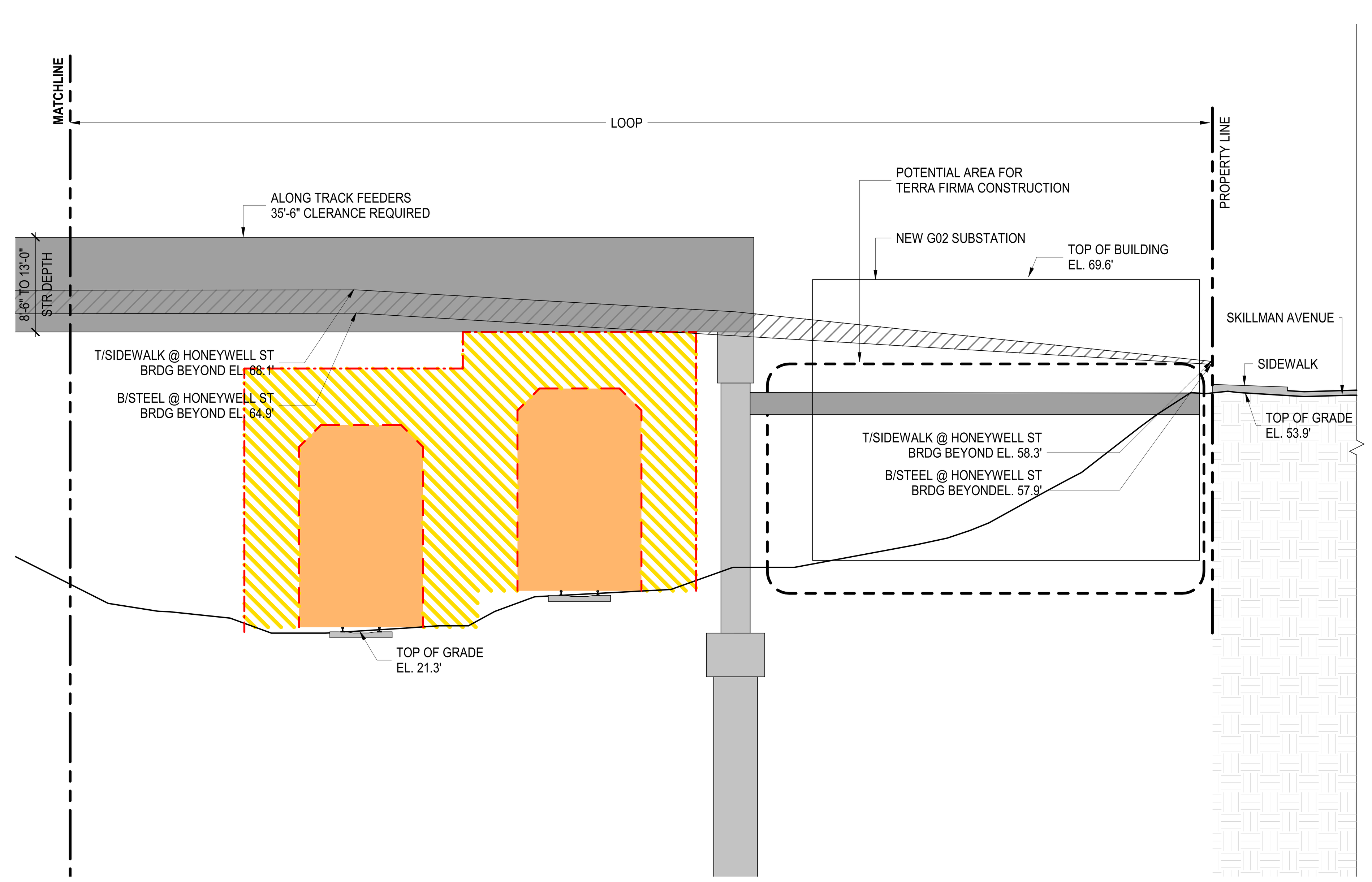
Thornton Tomasetti

Designed by	CCG
Drawn by	AP
Checked by	JB
Date	09/14/2018
Drawing Number	S-302.00



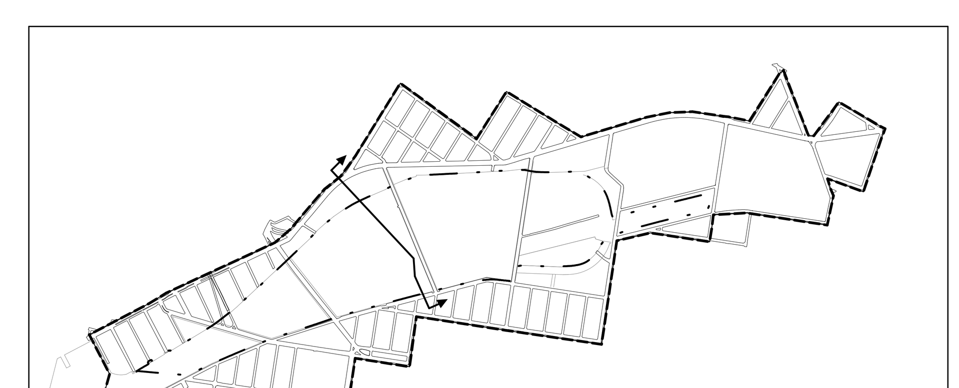
1 **CROSS SECTION - BETWEEN QUEENS BOULEVARD AND HONEYWELL STREET**

SCALE: 3/32" = 1'-0"



2 **CROSS SECTION - BETWEEN QUEENS BOULEVARD AND HONEYWELL STREET**

SCALE: 3/32" = 1'-0"



KEY PLAN

LEGEND

VERTICAL CLEARANCE

- BOTTOM OF STRUCTURE SET @27'-9" AMTRAK MIN. CLEARANCE
- BOTTOM OF STRUCTURE SET @22'-0" LIRR CLEARANCE
- BOTTOM OF STRUCTURE SET @SIGNAL BRIDGE ELEVATION (VARIES)
- BOTTOM OF STRUCTURE SET @35'-6" AMTRAK MAX. CLEARANCE DUE TO CROSS-TRACK FEEDERS

HORIZONTAL CLEARANCE

- 8'-6" ABSOLUTE CLEARANCE LINE
- 16'-0" FOULING LINE

CLEARANCE BOXES

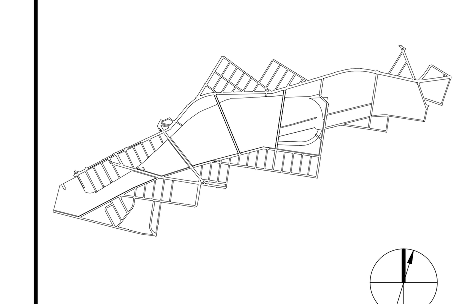
- LIRR / AMTRAK LOW CLEARANCE (V) + 8'-6" ABSOLUTE CLEARANCE (H)
- LIRR / AMTRAK HIGH CLEARANCE (V) + 16'-0" FOULING CLEARANCE (H)

NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date

Key Plan



Discipline:

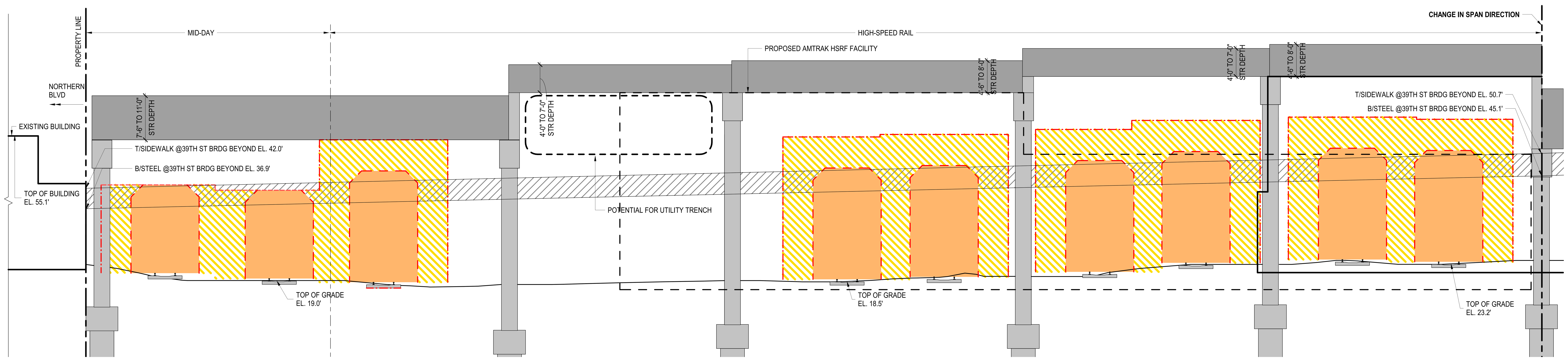
STRUCTURE

Title

CROSS SECTION - BETWEEN QUEENS BOULEVARD AND HONEYWELL STREET

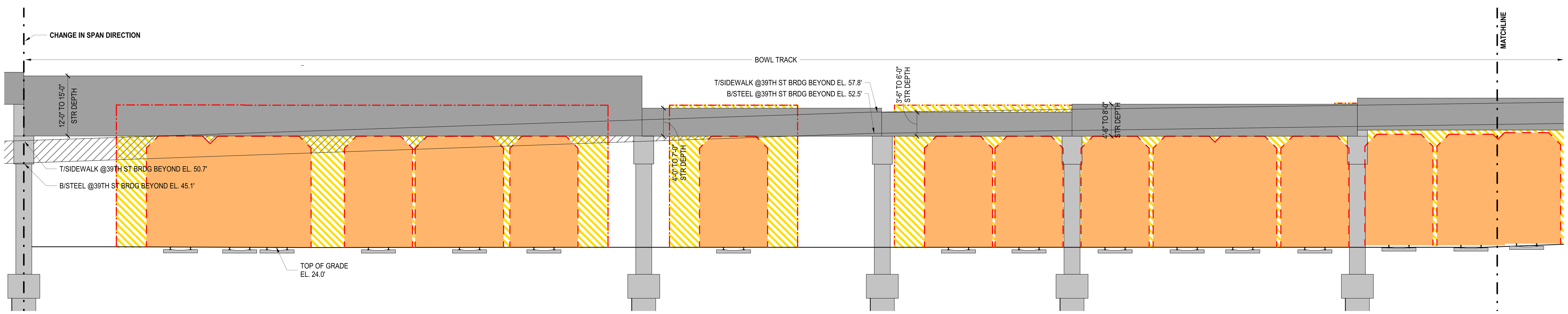
Thornton Tomasetti

Designed by	CCG
Drawn by	AP
Checked by	JB
Date	09/14/2018
Drawing Number	S-303.00



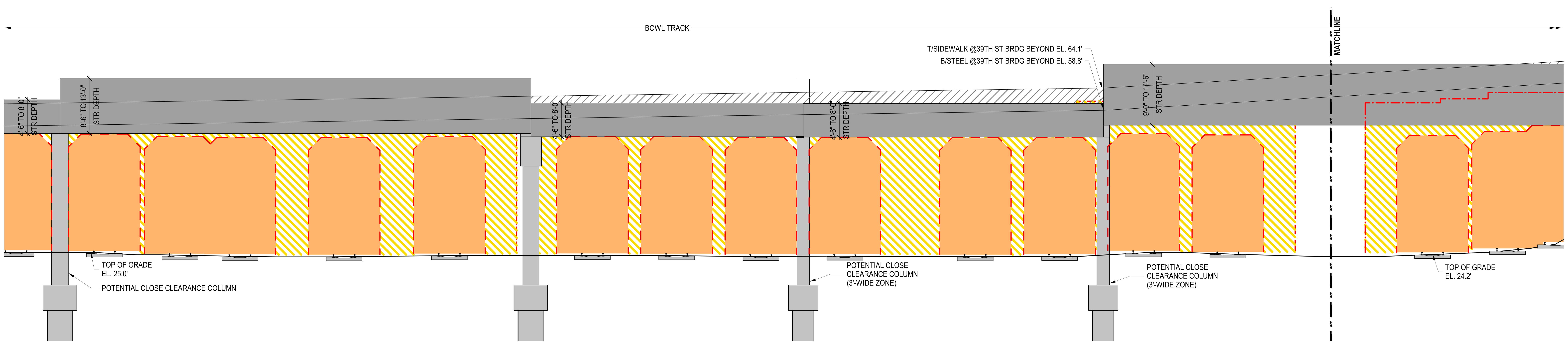
1 **CROSS SECTION - BETWEEN HONEYWELL STREET AND 39TH STREET**

SCALE: 3/32" = 1'-0"



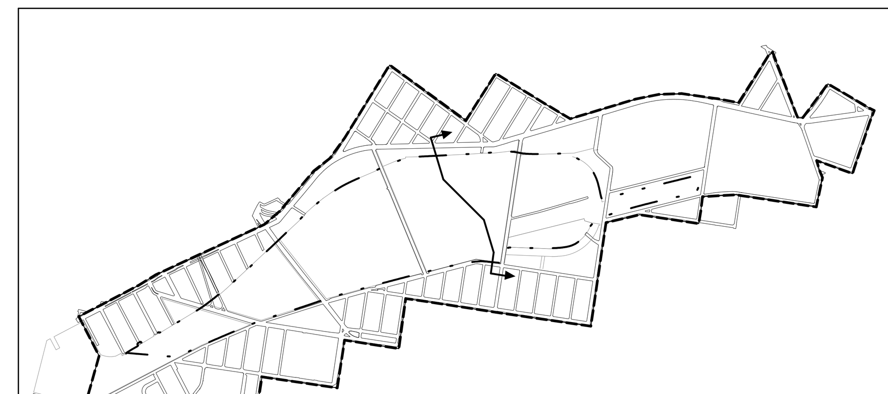
2 **CROSS SECTION - BETWEEN HONEYWELL STREET AND 39TH STREET**

SCALE: 3/32" = 1'-0"



3 **CROSS SECTION - BETWEEN HONEYWELL STREET AND 39TH STREET**

SCALE: 3/32" = 1'-0"



KEY PLAN

LEGEND

VERTICAL CLEARANCE

- BOTTOM OF STRUCTURE SET @27'-9" AMTRAK MIN. CLEARANCE
- BOTTOM OF STRUCTURE SET @22'-0" LIRR CLEARANCE
- BOTTOM OF STRUCTURE SET @SIGNAL BRIDGE ELEVATION (VARIES)
- BOTTOM OF STRUCTURE SET @35'-6" AMTRAK MAX. CLEARANCE DUE TO CROSS-TRACK FEEDERS

HORIZONTAL CLEARANCE

- 8'-6" ABSOLUTE CLEARANCE LINE
- 16'-0" FOULING LINE

CLEARANCE BOXES

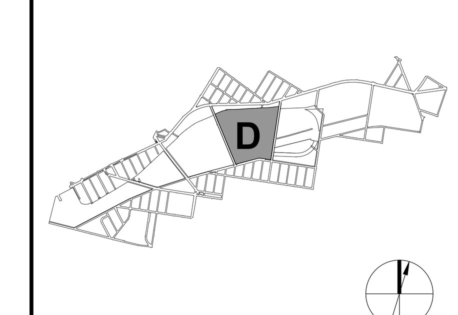
- LIRR / AMTRAK LOW CLEARANCE (V) + 8'-6" ABSOLUTE CLEARANCE (H)
- LIRR / AMTRAK HIGH CLEARANCE (V) + 16'-0" FOULING CLEARANCE (H)

NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date

Key Plan



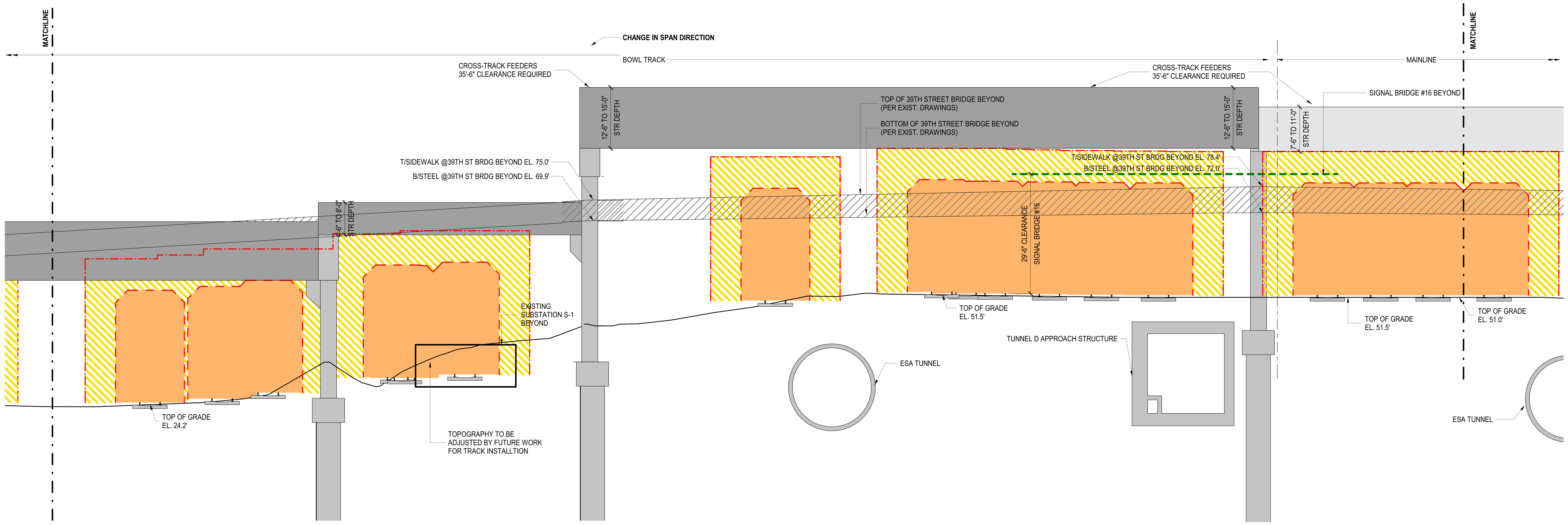
Discipline: **STRUCTURE**

Title

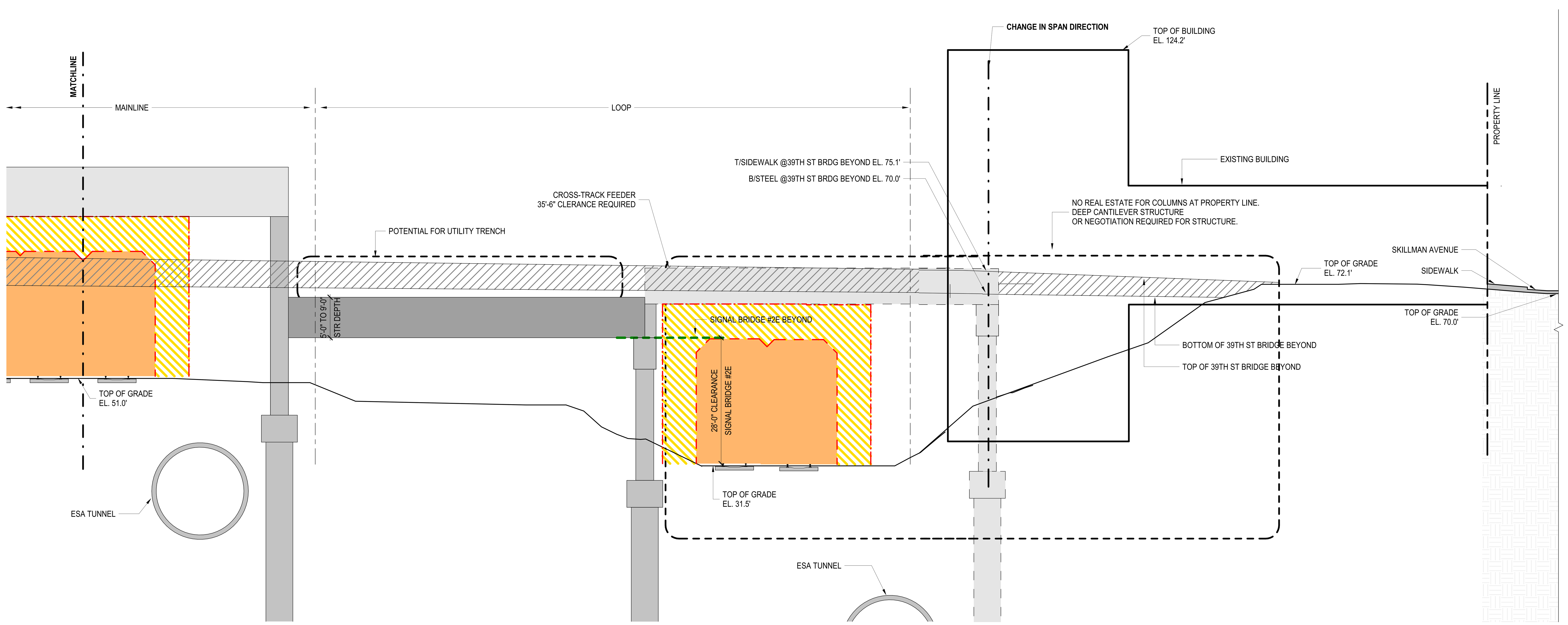
CROSS SECTION - BETWEEN HONEYWELL STREET AND 39TH STREET

Thornton Tomasetti

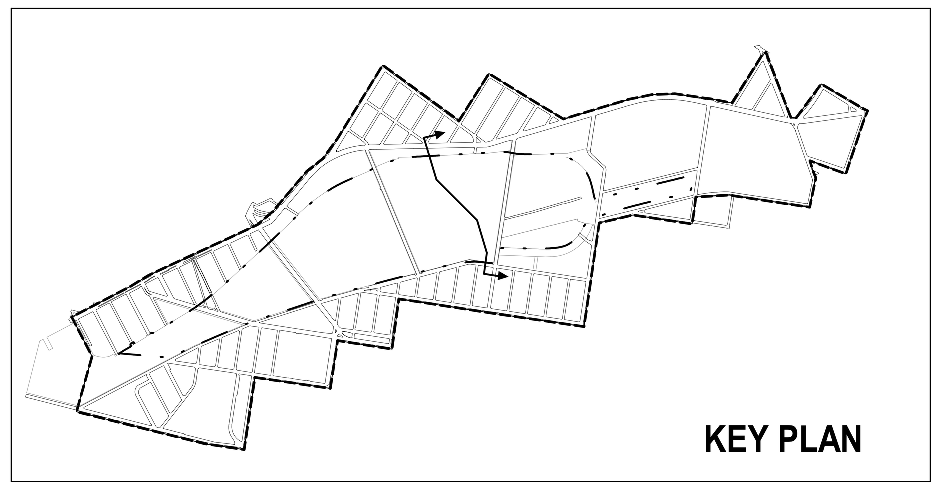
Designed by	CCG
Drawn by	AP
Checked by	JB
Date	09/14/2018
Drawing Number	S-304.00



1 **CROSS SECTION - BETWEEN HONEYWELL STREET AND 39TH STREET**
SCALE: 3/32" = 1'-0"



2 **CROSS SECTION - BETWEEN HONEYWELL STREET AND 39TH STREET**
SCALE: 3/32" = 1'-0"



LEGEND

VERTICAL CLEARANCE
- BOTTOM OF STRUCTURE SET @27'-9" AMTRAK MIN. CLEARANCE
- BOTTOM OF STRUCTURE SET @22'-0" LIRR CLEARANCE
- BOTTOM OF STRUCTURE SET @SIGNAL BRIDGE ELEVATION (VARIES)
- BOTTOM OF STRUCTURE SET @35'-6" AMTRAK MAX. CLEARANCE DUE TO CROSS-TRACK FEEDERS

HORIZONTAL CLEARANCE
- 8'-6" ABSOLUTE CLEARANCE LINE
- 16'-0" FOULING LINE

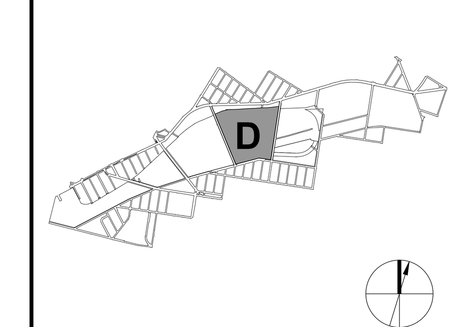
CLEARANCE BOXES
- LIRR / AMTRAK LOW CLEARANCE (V) + 8'-6" ABSOLUTE CLEARANCE (H)
- LIRR / AMTRAK HIGH CLEARANCE (V) + 16'-0" FOULING CLEARANCE (H)

NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date

Key Plan

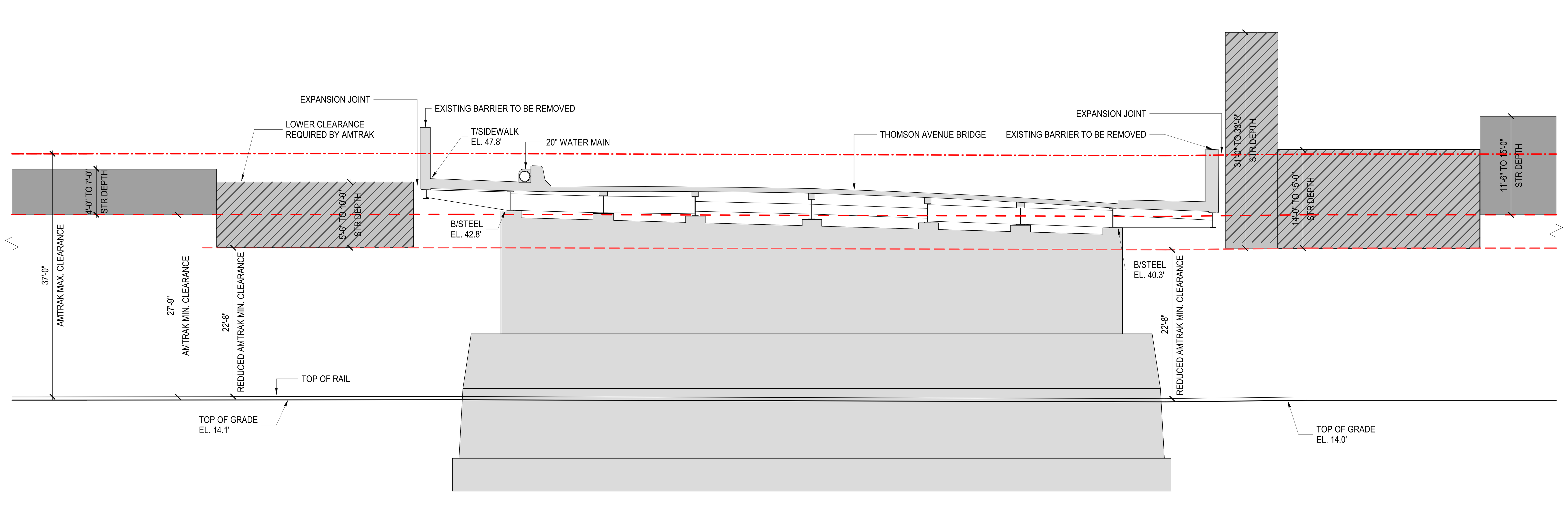


Discipline:
STRUCTURE

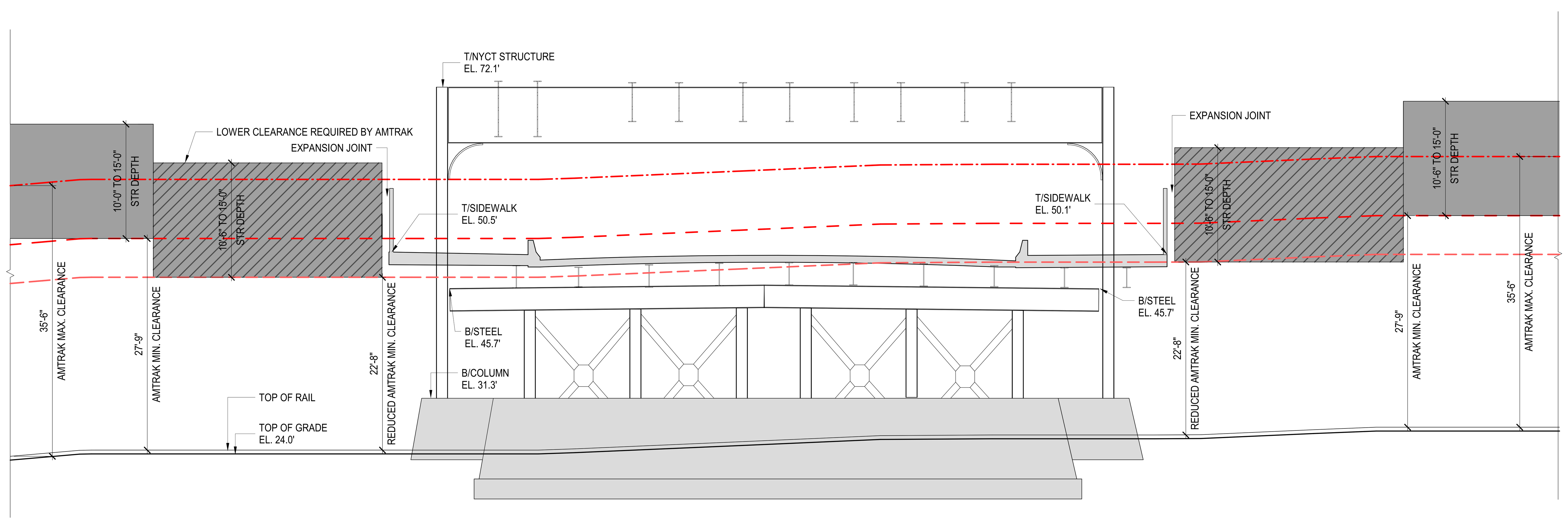
Title
CROSS SECTION - BETWEEN HONEYWELL STREET AND 39TH STREET

Thornton Tomasetti

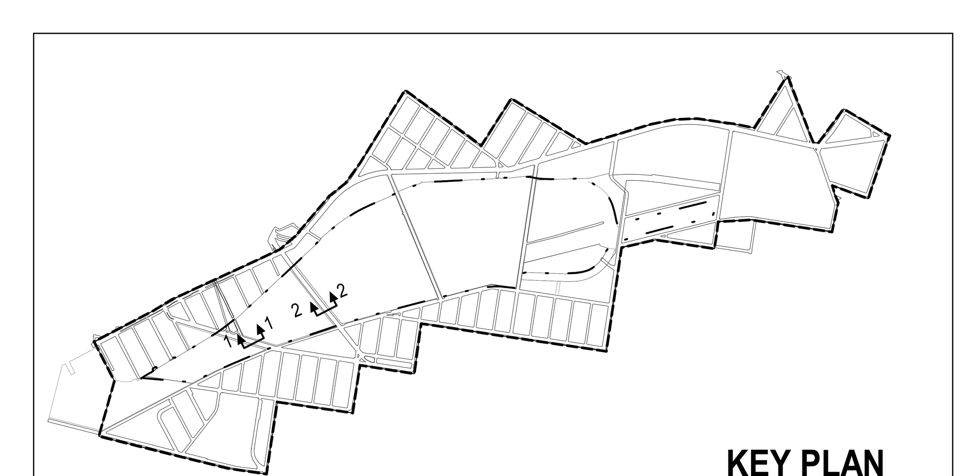
Designed by	CCG
Drawn by	AP
Checked by	JB
Date	09/14/2018
Drawing Number	S-305.00



1 **SECTION AT THOMSON AVENUE BRIDGE**
SCALE: 1/8" = 1'-0"



2 **SECTION AT QUEENS BOULEVARD BRIDGE**
SCALE: 1/8" = 1'-0"



LEGEND

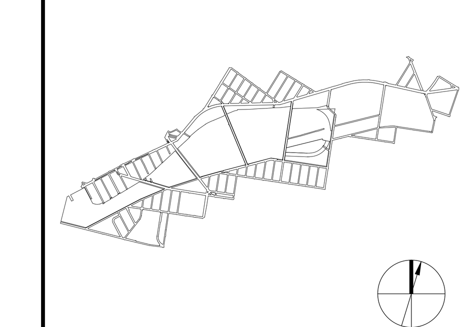
- EXISTING STRUCTURE
- NEW STRUCTURE
- NEW STRUCTURE @REDUCED AMTRAK MIN. CLEARANCE NEAR BRIDGES

NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date
1	DRAWINGS UPDATE	11/20/2018

Key Plan



Discipline:
STRUCTURE

Title
BRIDGE SECTIONS - THOMSON AVENUE AND QUEENS BOULEVARD

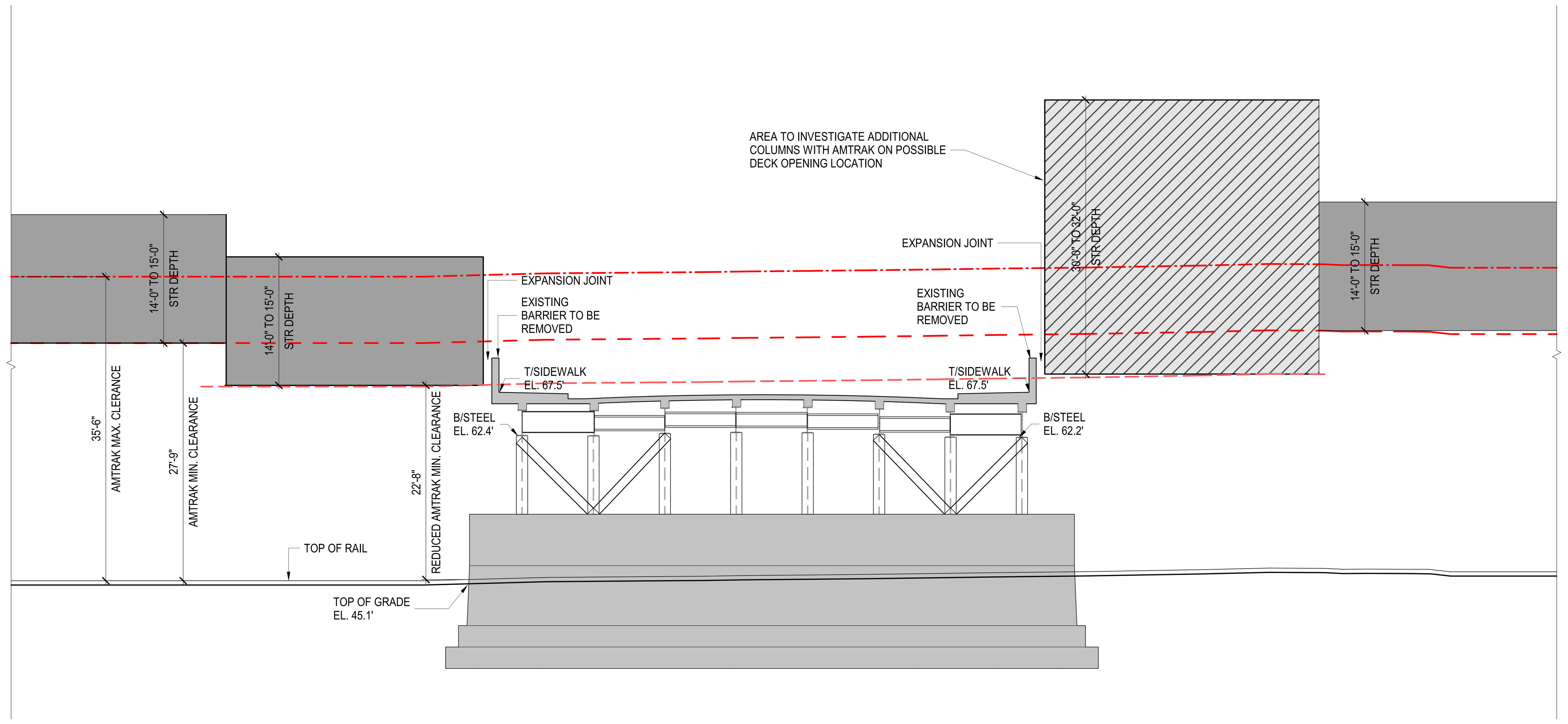
Thornton Tomasetti

Designed by	CCG
Drawn by	AP
Checked by	JB
Date	09/14/2018
Drawing Number	S-310.00

Appendix J

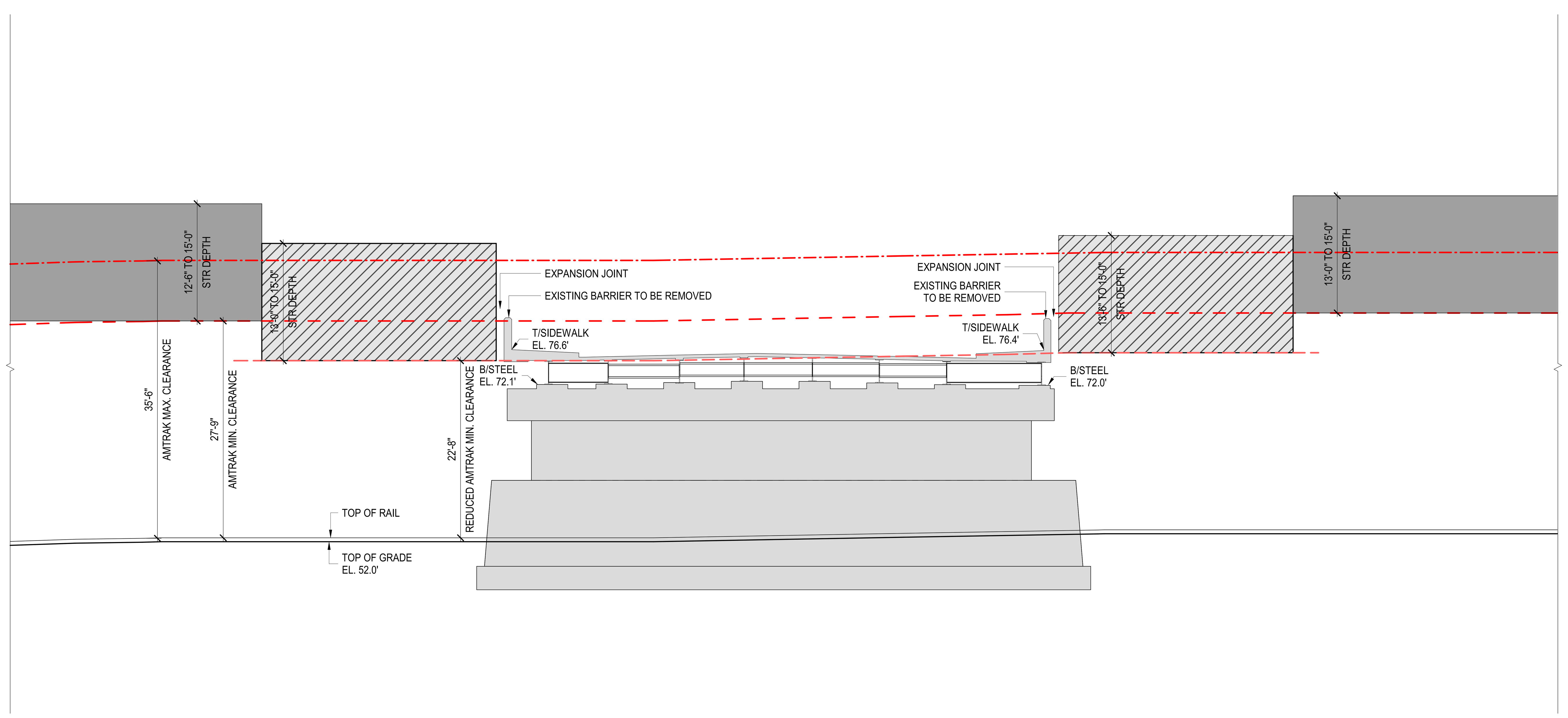
LEGEND

- EXISTING STRUCTURE
- NEW STRUCTURE
- NEW STRUCTURE @REDUCED AMTRAK MIN. CLEARANCE NEAR BRIDGES



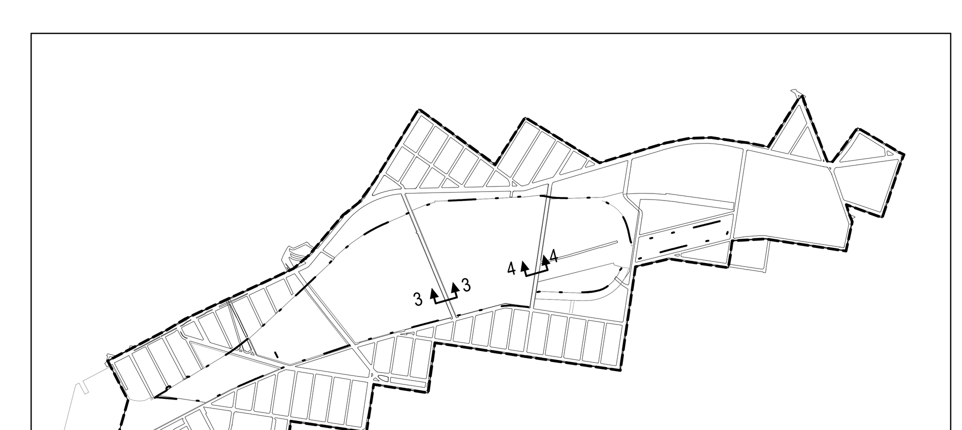
3 **SECTION AT HONEYWELL STREET BRIDGE**

SCALE: 1/8" = 1'-0"



4 **SECTION AT 39TH STREET BRIDGE**

SCALE: 1/8" = 1'-0"



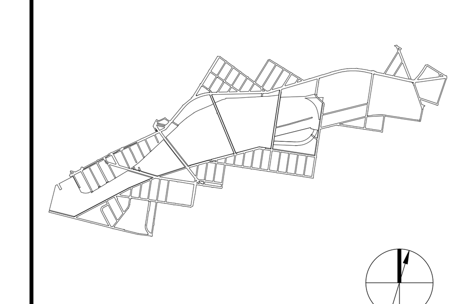
KEY PLAN

NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date
1	DRAWINGS UPDATE	11/20/2018

Key Plan



Discipline:

STRUCTURE

Title

BRIDGE SECTIONS - HONEYWELL STREET AND 39TH STREET

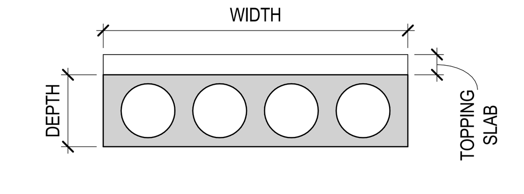
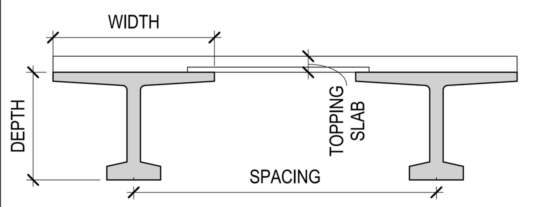
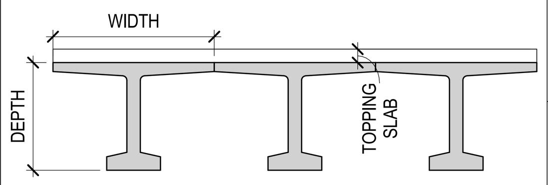
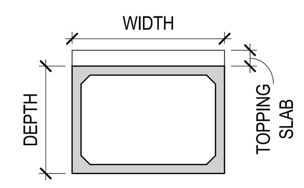
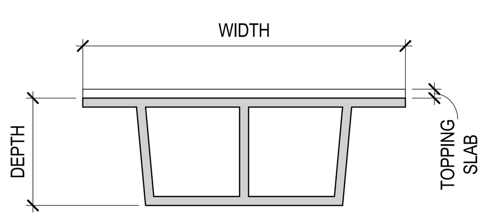
Thornton Tomasetti

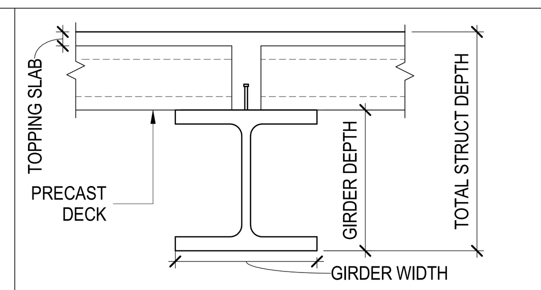
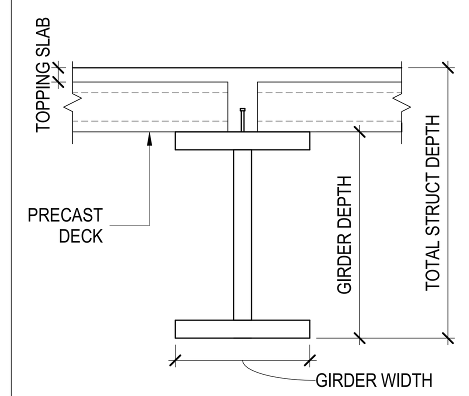
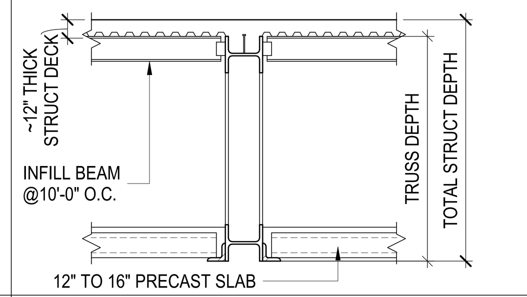
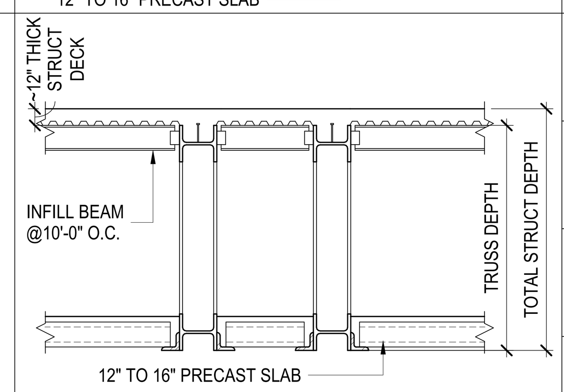
Designed by	CCG
Drawn by	AP
Checked by	JB
Date	09/14/2018
Drawing Number	S-311.00

Appendix J

APPENDIX A.5.K

STRUCTURAL MATRIX CHART

		PRECAST STRUCTURAL MATRIX							
		MAX SPAN	PRECAST WIDTH	PRECAST DEPTH	PRECAST SPACING	PICK WEIGHT	PRECAST DIST LOAD (w/o t.slab)	TOPPING SLAB	TOTAL STRUCTURAL DEPTH
HOLLOW CORE		30'-0"	4'-0"	18"	-	20,000 LBS	165 PSF	4"	22"
		40'-0"	4'-0"	21"	-	30,000 LBS	185 PSF	6"	27"
BULB TEE		30'-0"	3'-6"	63"	10'-0"	32,000 LBS	110 PSF	8"	71"
		40'-0"	3'-6"	72"	10'-0"	45,000 LBS	115 PSF	8"	80"
		50'-0"	4'-0"	79"	10'-0"	58,000 LBS	115 PSF	8"	87"
BULB TEE		50'-0"	4'-0"	36"	4'-0"	42,000 LBS	210 PSF	4"	40"
		70'-0"	4'-0"	45"	4'-0"	64,000 LBS	225 PSF	4"	49"
CONCRETE BOX GIRDER		90'-0"	30'-0"	54"	-	72,000 LBS	265 PSF	8"	62"
CONCRETE SEGMENTAL GIRDER		90'-0"	30'-0"	78"	-	40,000 LBS	135 PSF	8"	86"
		100'-0"	30'-0"	81"	-	67,000 LBS	225 PSF	8"	89"
		120'-0"	30'-0"	96"	-	70,000 LBS	235 PSF	8"	104"
		140'-0"	30'-0"	117"	-	75,000 LBS	250 PSF	8"	125"
		160'-0"	30'-0"	132"	-	79,000 LBS	265 PSF	8"	140"
		180'-0"	30'-0"	144"	-	82,000 LBS	275 PSF	8"	152"
		200'-0"	30'-0"	156"	-	86,000 LBS	285 PSF	8"	164"

		STEEL STRUCTURAL MATRIX							
		MAX SPAN	GIRDER / TRUSS WIDTH	GIRDER / TRUSS DEPTH	GIRDER / TRUSS SPACING	PICK WEIGHT	BEAM DIST LOAD	STRUCTURAL SLAB	TOTAL STRUCTURAL DEPTH
WIDE FLANGE BEAM		30'-0"	1'-6"	39"	30'-0"	19,600 LBS	655 PLF	22"	61"
PLATE GIRDER		40'-0"	2'-0"	48"	30'-0"	28,240 LBS	710 PLF	22"	70"
		50'-0"	2'-0"	48"	30'-0"	42,650 LBS	855 PLF	22"	70"
		70'-0"	2'-0"	72"	30'-0"	84,000 LBS	1200 PLF	22"	94"
		90'-0"	2'-0"	96"	30'-0"	126,450 LBS	1405 PLF	22"	118"
		100'-0"	2'-0"	108"	30'-0"	184,800 LBS	1850 PLF	22"	130"
SINGLE TRUSS		70'-0"	1'-5"	137"	30'-0"	74,000 LBS	1060 PLF	12"	149"
		100'-0"	1'-6"	138"	30'-0"	162,000 LBS	1620 PLF	12"	150"
		120'-0"	1'-6"	162"	30'-0"	224,000 LBS	1870 PLF	12"	174"
DOUBLE TRUSS		140'-0"	1'-6"	168"	30'-0"	376,000 LBS TOTAL	2690 PLF TOTAL	12"	180"
		160'-0"	1'-6"	168"	30'-0"	502,200 LBS TOTAL	3140 PLF TOTAL	12"	180"
		180'-0" * **	1'-6"	168"	30'-0"	568,400 LBS TOTAL	3160 PLF TOTAL	12"	180"
		200'-0" * **	1'-6"	168"	30'-0"	668,000 LBS TOTAL	3340 PLF TOTAL	12"	180"

* Fy = 65 ksi
** CAMBER REQUIRED

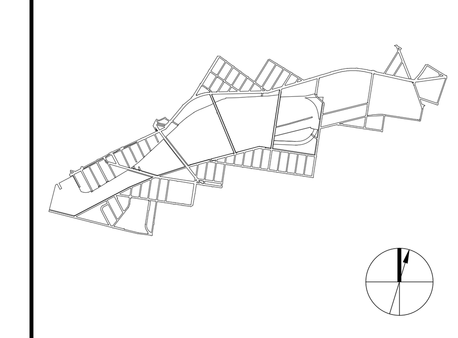
1 **PRECAST AND STEEL STRUCTURAL MATRIX - BASELINE LOADING**

NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date
1	DRAWINGS UPDATE	11/20/2018

Key Plan



Discipline:
STRUCTURE

Title
PRECAST AND STEEL STRUCTURAL MATRIX

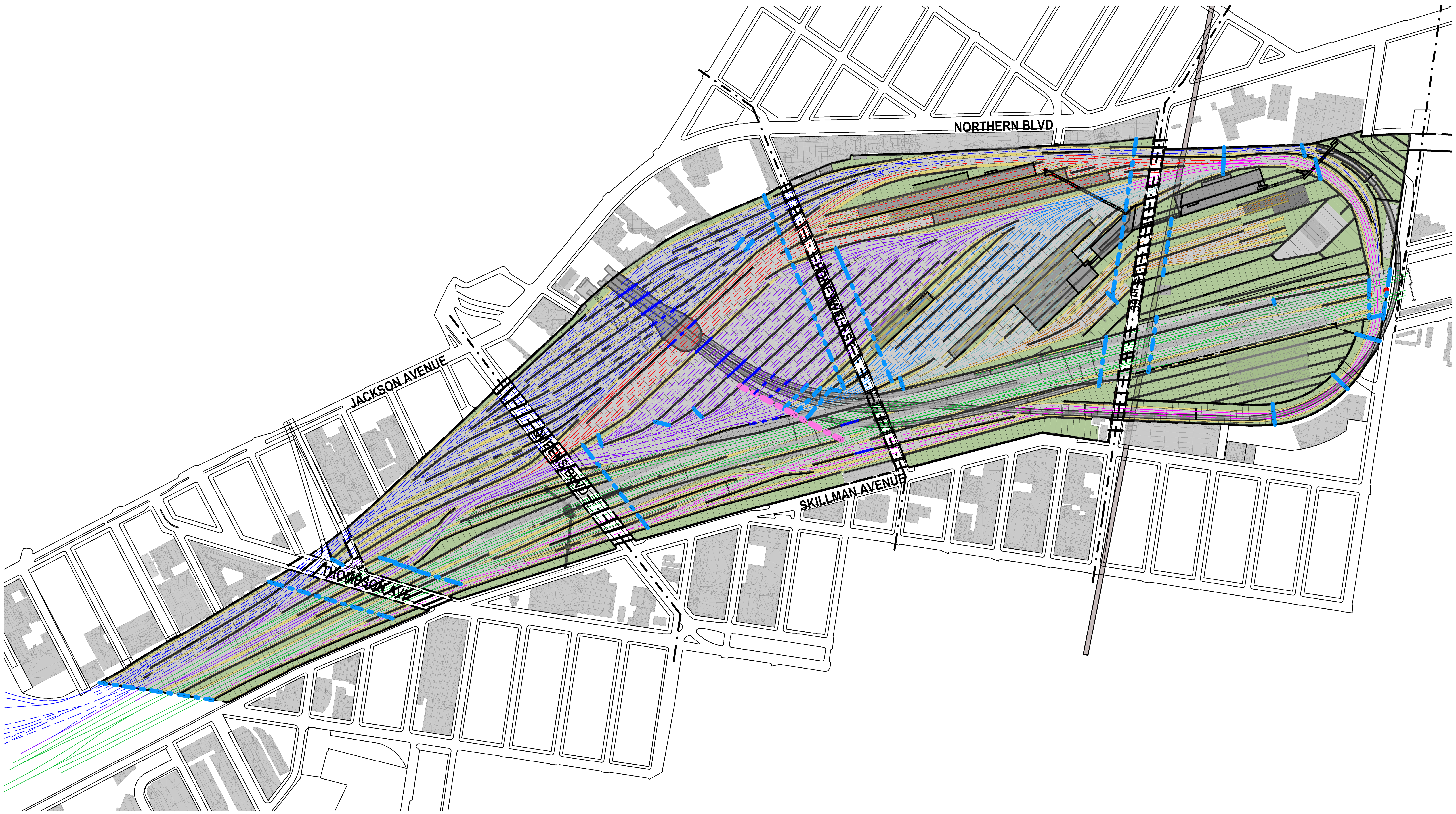
Thornton Tomasetti

Designed by CCG
Drawn by AP
Checked by JB
Date 09/14/2018
Drawing Number S-010.00

Appendix K

APPENDIX A.5.L

FRAMING PLAN



LEGEND

HORIZONTAL CLEARANCE

- 8'-6" ABSOLUTE CLEARANCE LINE
  3' CLEARANCE CUT AND COVER TUNNELS
  10' CLEARANCE ESA TUNNELS
- 16'-0" FOULING LINE

TRACKS

- EXISTING TRACK
- PROPOSED TRACK
- CROSS TRACK FEEDER

TRACK ZONES

- TRACK ZONE 1
- TRACK ZONE 2
- TRACK ZONE 3
- TRACK ZONE 4
- TRACK ZONE 5
- TRACK ZONE 6
- TRACK ZONE 7
- TRACK ZONE 8

STRUCTURE

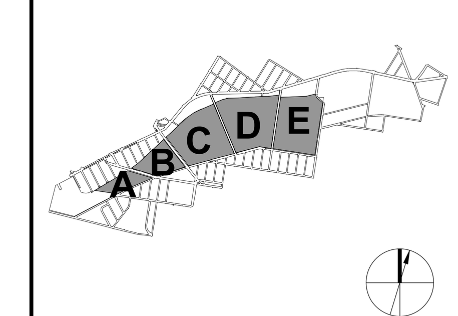
- TRUSSES PARALLEL TO TRACKS
- TRUSSES PERPENDICULAR TO TRACKS
- MEGATRUSS
- MEGACOLUMN
- EXISTING BUILDINGS
- PROPOSED BUILDINGS

NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date

Key Plan



Discipline:

STRUCTURE

Title

FRAMING PLAN

Thornton Tomasetti

Designed by	CCG
Drawn by	HK / GS
Checked by	JB
Date	11/21/18
Drawing Number	S-190.00

LEGEND

HORIZONTAL CLEARANCE

- 8'-6" ABSOLUTE CLEARANCE LINE
  3' CLEARANCE CUT AND COVER TUNNELS
  10' CLEARANCE ESA TUNNELS
- 16'-0" FOULING LINE

TRACKS

- EXISTING TRACK
- PROPOSED TRACK
- CROSS TRACK FEEDER

TRACK ZONES

- TRACK ZONE 1
- TRACK ZONE 2
- TRACK ZONE 3
- TRACK ZONE 4
- TRACK ZONE 5
- TRACK ZONE 6
- TRACK ZONE 7
- TRACK ZONE 8

STRUCTURE

- TRUSSES PARALLEL TO TRACKS
- TRUSSES PERPENDICULAR TO TRACKS
- MEGATRUSS
- MEGACOLUMN
- EXISTING BUILDINGS
- PROPOSED BUILDINGS

NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date

Key Plan

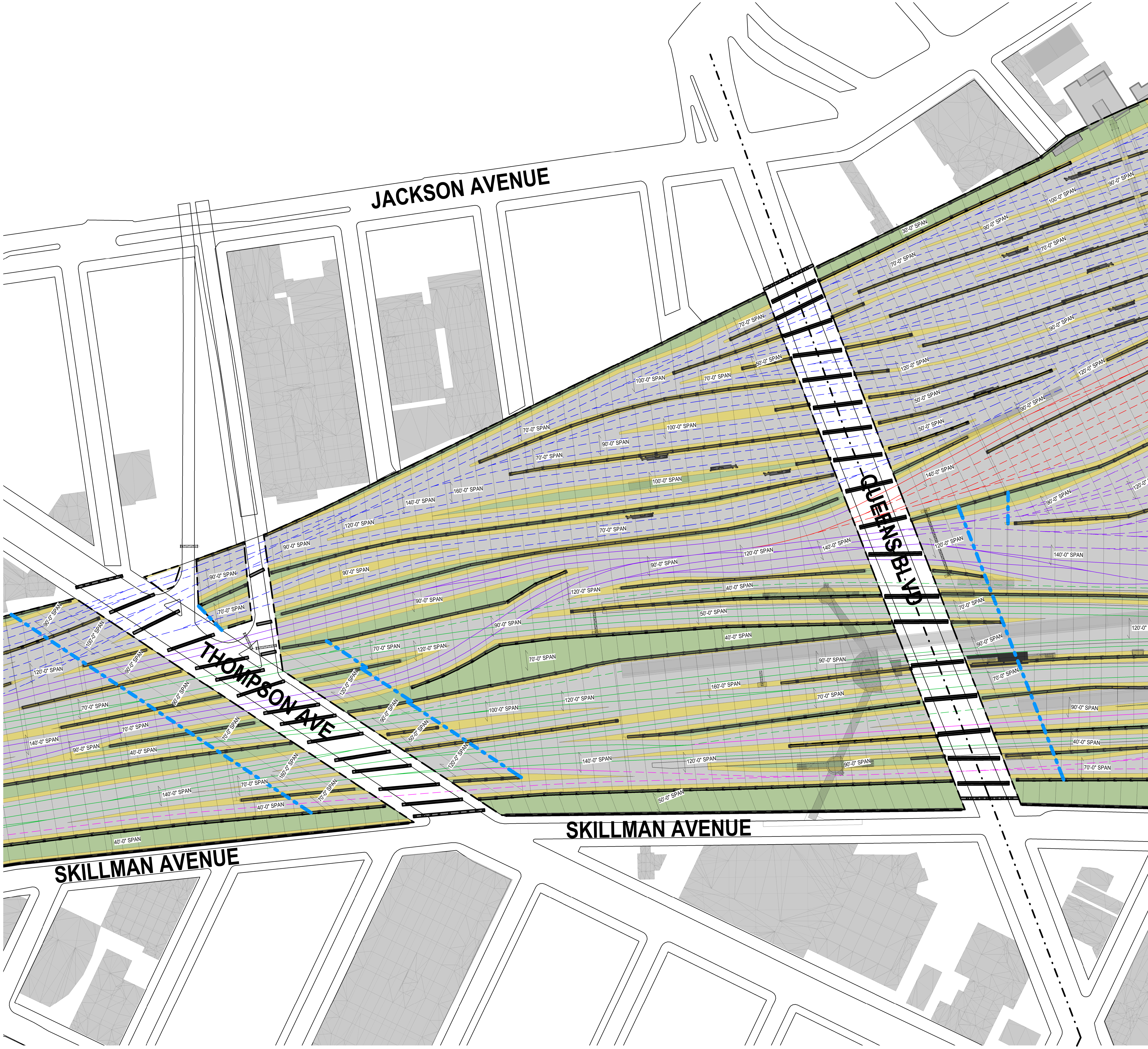
Discipline: STRUCTURE

Title

FRAMING PLAN - SECTOR A

Thornton Tomasetti

Designed by	CCG
Drawn by	HK / GS
Checked by	JB
Date	11/21/18
Drawing Number	S-190A.00



LEGEND

HORIZONTAL CLEARANCE

- 8'-6" ABSOLUTE CLEARANCE LINE
  3' CLEARANCE CUT AND COVER TUNNELS
  10' CLEARANCE ESA TUNNELS
- 16'-0" FOULING LINE

TRACKS

- EXISTING TRACK
- PROPOSED TRACK
- CROSS TRACK FEEDER

TRACK ZONES

- TRACK ZONE 1
- TRACK ZONE 2
- TRACK ZONE 3
- TRACK ZONE 4
- TRACK ZONE 5
- TRACK ZONE 6
- TRACK ZONE 7
- TRACK ZONE 8

STRUCTURE

- TRUSSES PARALLEL TO TRACKS
- TRUSSES PERPENDICULAR TO TRACKS
- MEGATRUSS
- MEGACOLUMN
- EXISTING BUILDINGS
- PROPOSED BUILDINGS

NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date

Key Plan

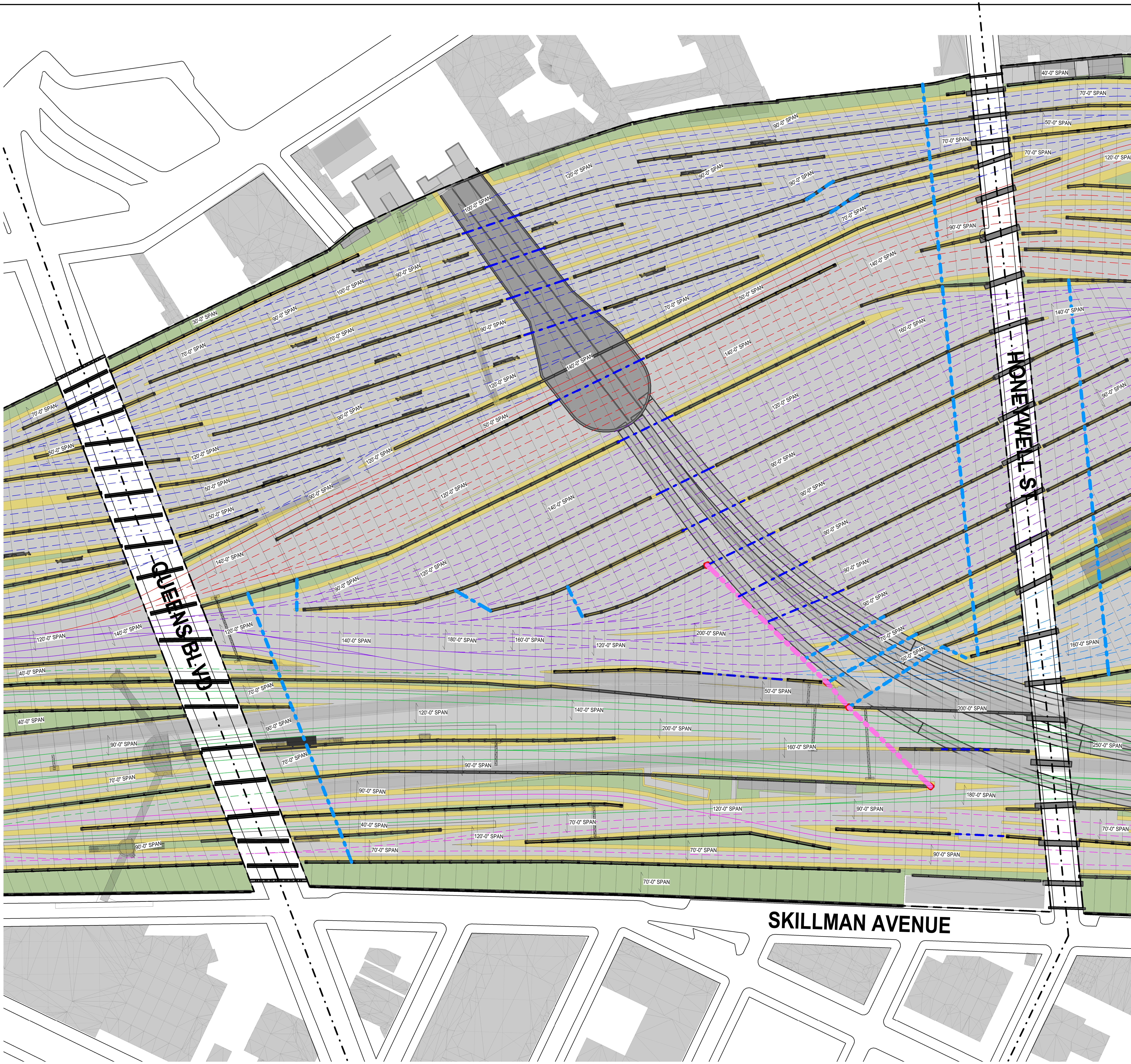
Discipline:
STRUCTURE

Title

FRAMING PLAN - SECTOR B

Thornton Tomasetti

Designed by	CCG
Drawn by	HK / GS
Checked by	JB
Date	11/21/18
Drawing Number	S-190B.00



LEGEND

HORIZONTAL CLEARANCE

- 8'-6" ABSOLUTE CLEARANCE LINE 3' CLEARANCE CUT AND COVER TUNNELS 10' CLEARANCE ESA TUNNELS
- 16'-0" FOULING LINE

TRACKS

- EXISTING TRACK
- PROPOSED TRACK
- CROSS TRACK FEEDER

TRACK ZONES

- TRACK ZONE 1
- TRACK ZONE 2
- TRACK ZONE 3
- TRACK ZONE 4
- TRACK ZONE 5
- TRACK ZONE 6
- TRACK ZONE 7
- TRACK ZONE 8

STRUCTURE

- TRUSSES PARALLEL TO TRACKS
- TRUSSES PERPENDICULAR TO TRACKS
- MEGATRUSS
- MEGACOLUMN
- EXISTING BUILDINGS
- PROPOSED BUILDINGS

NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date

Key Plan

Discipline:
STRUCTURE

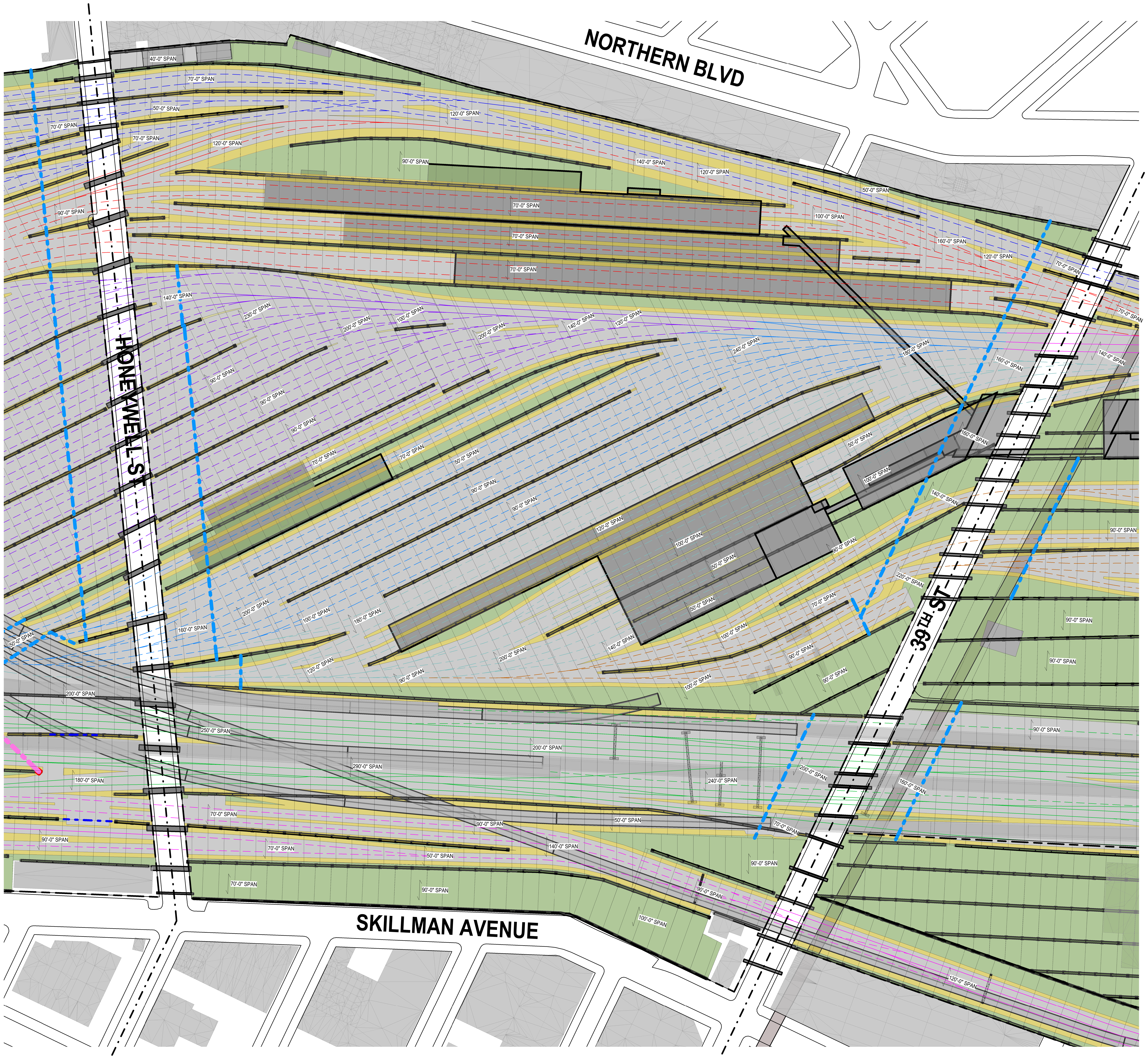
Title

FRAMING PLAN - SECTOR C

Thornton Tomasetti

Designed by	CCG
Drawn by	HK / GS
Checked by	JB
Date	11/21/18
Drawing Number	S-190C.00

Appendix L



LEGEND

HORIZONTAL CLEARANCE

- 8'-6" ABSOLUTE CLEARANCE LINE
  3' CLEARANCE CUT AND COVER TUNNELS
  10' CLEARANCE ESA TUNNELS
- 16'-0" FOULING LINE

TRACKS

- EXISTING TRACK
- PROPOSED TRACK
- CROSS TRACK FEEDER

TRACK ZONES

- TRACK ZONE 1
- TRACK ZONE 2
- TRACK ZONE 3
- TRACK ZONE 4
- TRACK ZONE 5
- TRACK ZONE 6
- TRACK ZONE 7
- TRACK ZONE 8

STRUCTURE

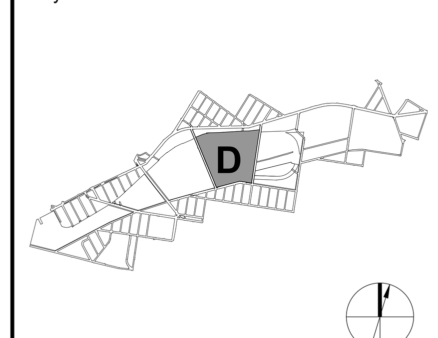
- TRUSSES PARALLEL TO TRACKS
- TRUSSES PERPENDICULAR TO TRACKS
- MEGATRUSS
- MEGACOLUMN
- EXISTING BUILDINGS
- PROPOSED BUILDINGS

NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date

Key Plan



Discipline:

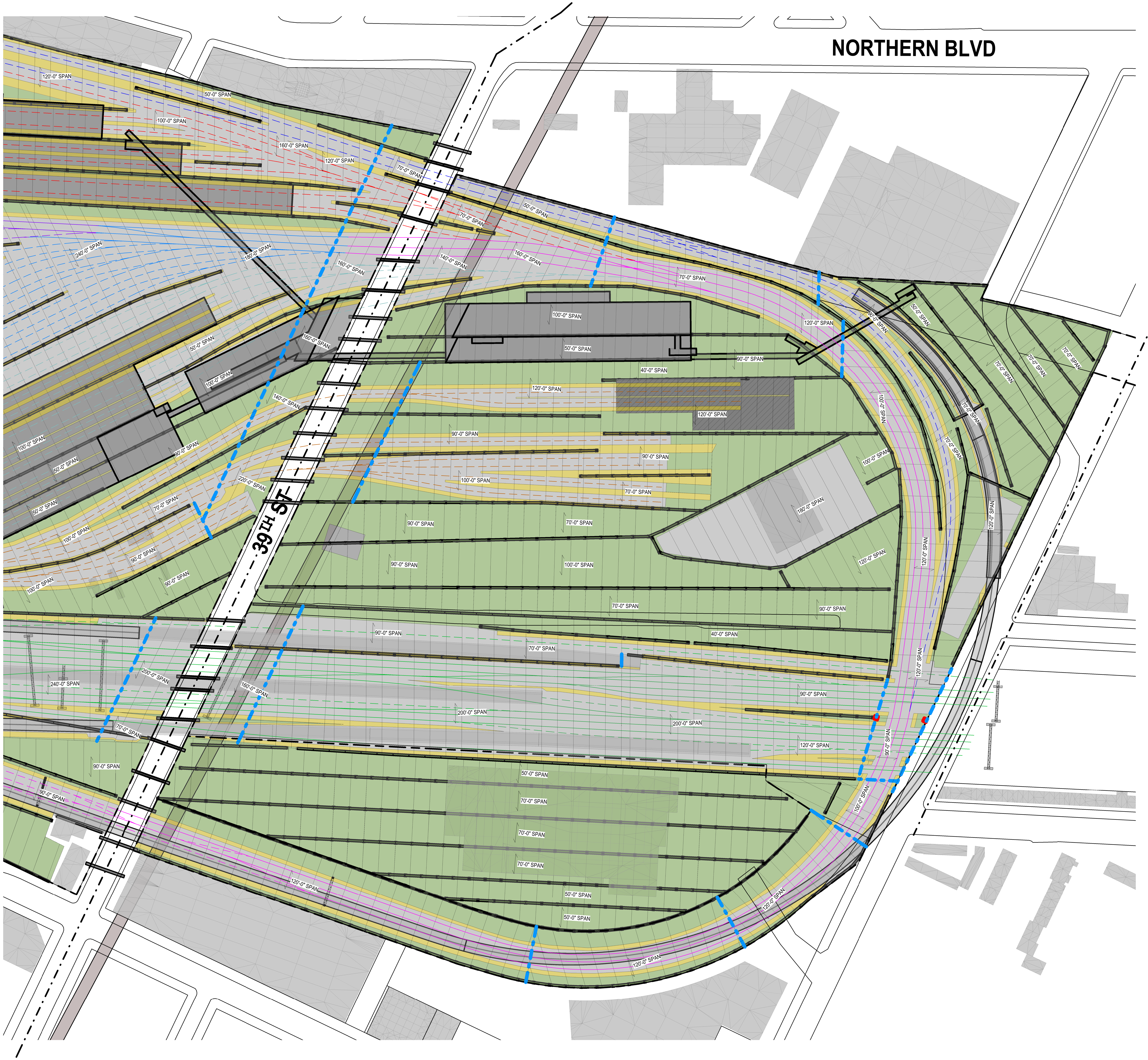
STRUCTURE

Title

FRAMING PLAN - SECTOR D

Thornton Tomasetti

Designed by	CCG
Drawn by	HK / GS
Checked by	JB
Date	11/21/18
Drawing Number	S-190D.00



LEGEND

HORIZONTAL CLEARANCE

- 8'-6" ABSOLUTE CLEARANCE LINE
3' CLEARANCE CUT AND COVER TUNNELS
10' CLEARANCE ESA TUNNELS
- 16'-0" FOULING LINE

TRACKS

- EXISTING TRACK
- PROPOSED TRACK
- CROSS TRACK FEEDER

TRACK ZONES

- TRACK ZONE 1
- TRACK ZONE 2
- TRACK ZONE 3
- TRACK ZONE 4
- TRACK ZONE 5
- TRACK ZONE 6
- TRACK ZONE 7
- TRACK ZONE 8

STRUCTURE

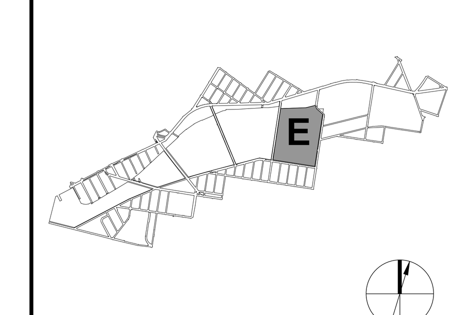
- TRUSSES PARALLEL TO TRACKS
- TRUSSES PERPENDICULAR TO TRACKS
- MEGATRUSS
- MEGACOLUMN
- EXISTING BUILDINGS
- PROPOSED BUILDINGS

NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date

Key Plan



Discipline: **STRUCTURE**

Title

FRAMING PLAN - SECTOR E

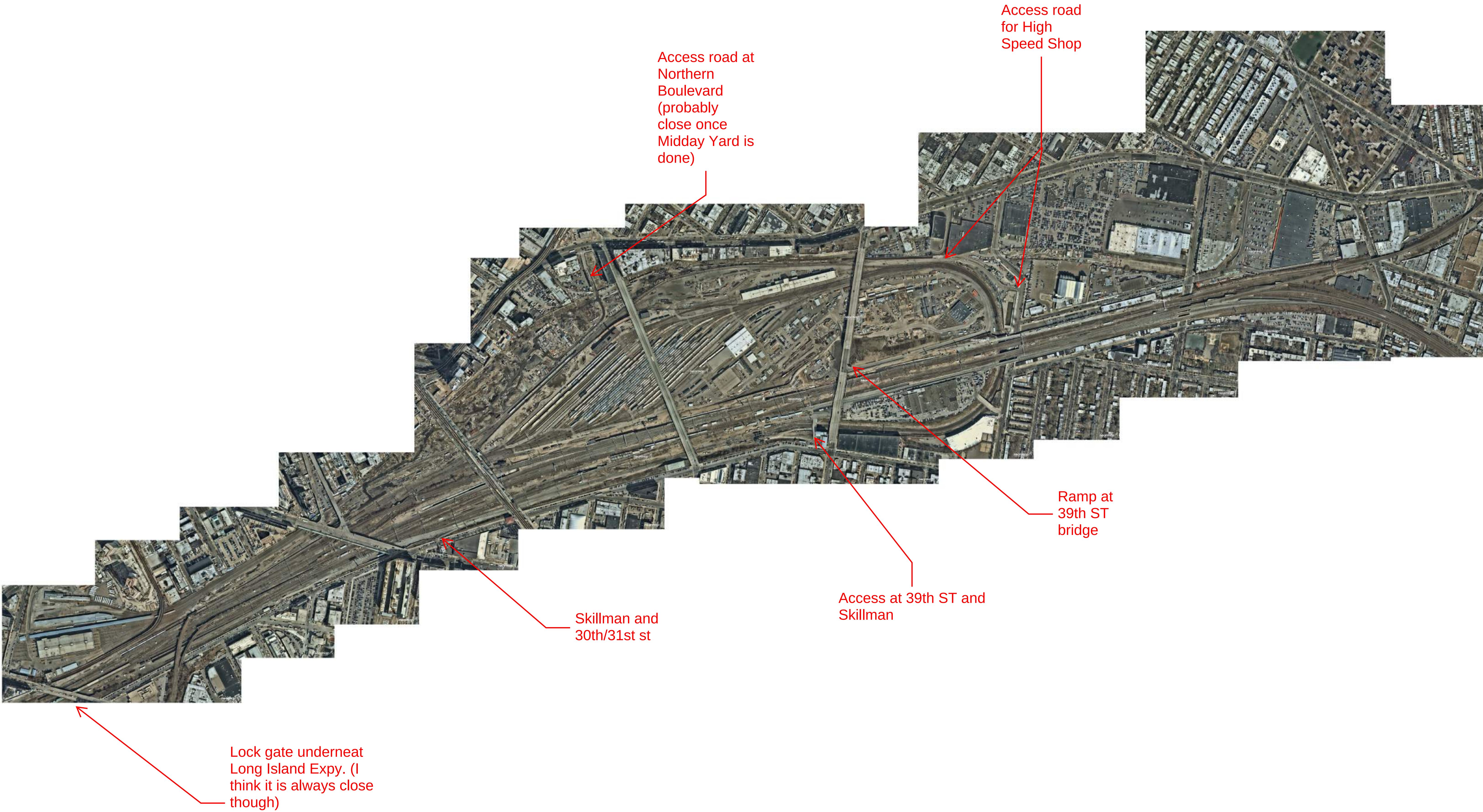
Thornton Tomasetti

Designed by	CCG
Drawn by	HK / GS
Checked by	JB
Date	11/21/18
Drawing Number	S-190E.00

APPENDIX A.5.M

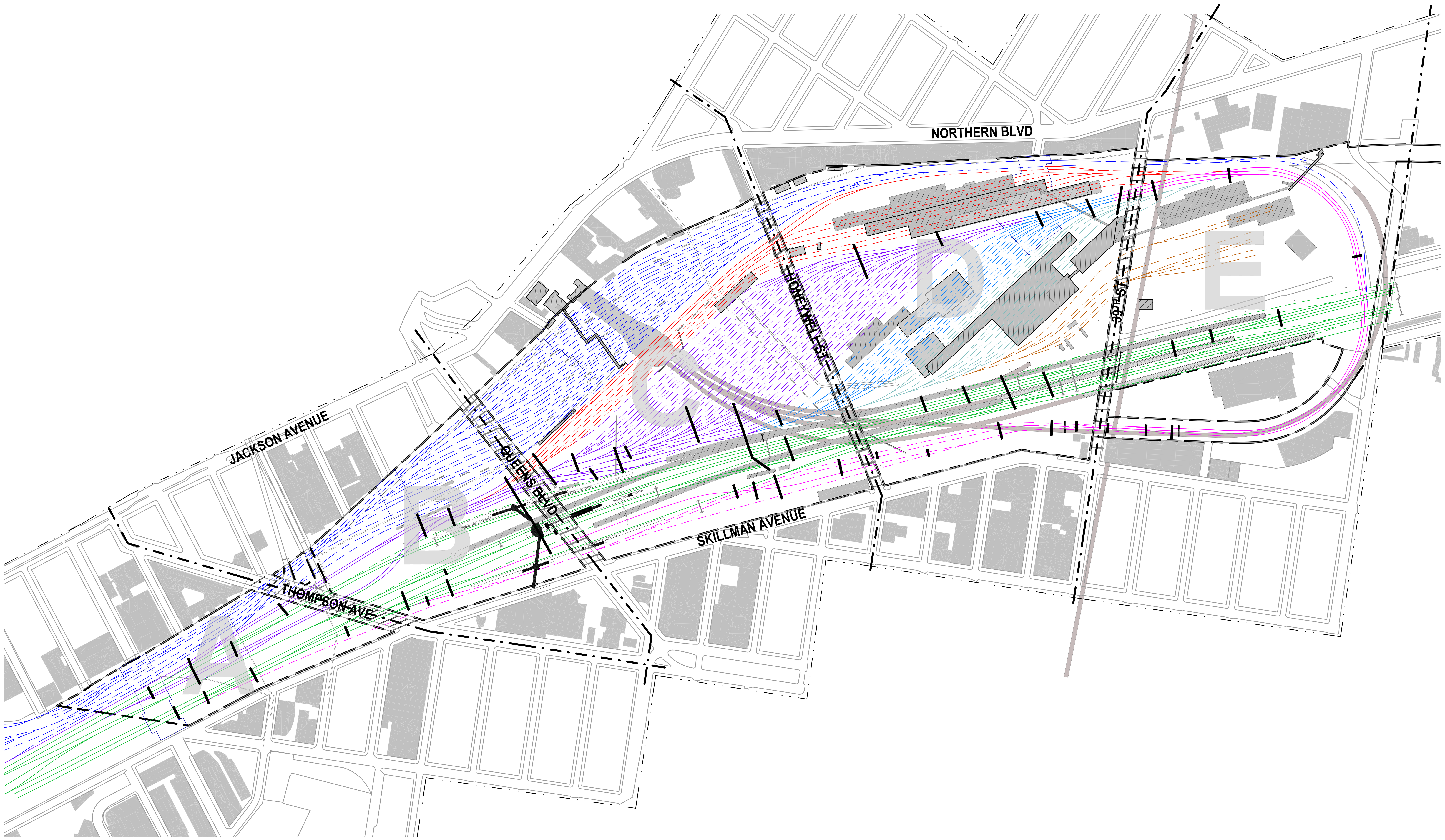
YARD ACCESS POINTS

VEHICULAR ACCESS



APPENDIX A.5.O

EXISTING AND PROPOSED STRUCTURES



LEGEND

- EXISTING TRACK
- PROPOSED TRACK
- CROSS TRACK FEEDER

TRACK ZONES

- TRACK ZONE 1
- TRACK ZONE 2
- TRACK ZONE 3
- TRACK ZONE 4
- TRACK ZONE 5
- TRACK ZONE 6
- TRACK ZONE 7
- TRACK ZONE 8

BUILDINGS

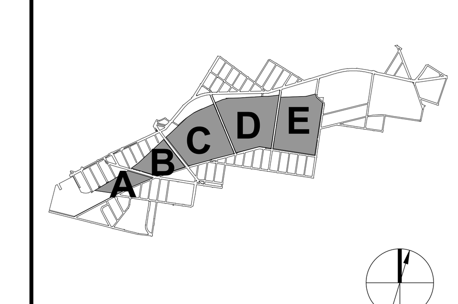
- EXISTING BUILDINGS
- PROPOSED BUILDINGS
- DEMOLISHED BUILDINGS

NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date

Key Plan



Discipline:

STRUCTURE

Title

OVERALL SITE PLAN - EXISTING AND PROPOSED STRUCTURES

Thornton Tomasetti

Designed by	CC
Drawn by	AP
Checked by	JB
Date	11/20/2018
Drawing Number	S-100.00

LEGEND

EXISTING TRACK
PROPOSED TRACK
CROSS TRACK FEEDER

TRACK ZONES

TRACK ZONE 1
TRACK ZONE 2
TRACK ZONE 3
TRACK ZONE 4
TRACK ZONE 5
TRACK ZONE 6
TRACK ZONE 7
TRACK ZONE 8

BUILDINGS

EXISTING BUILDINGS
PROPOSED BUILDINGS
DEMOLISHED BUILDINGS

NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date

Key Plan

A

Discipline:

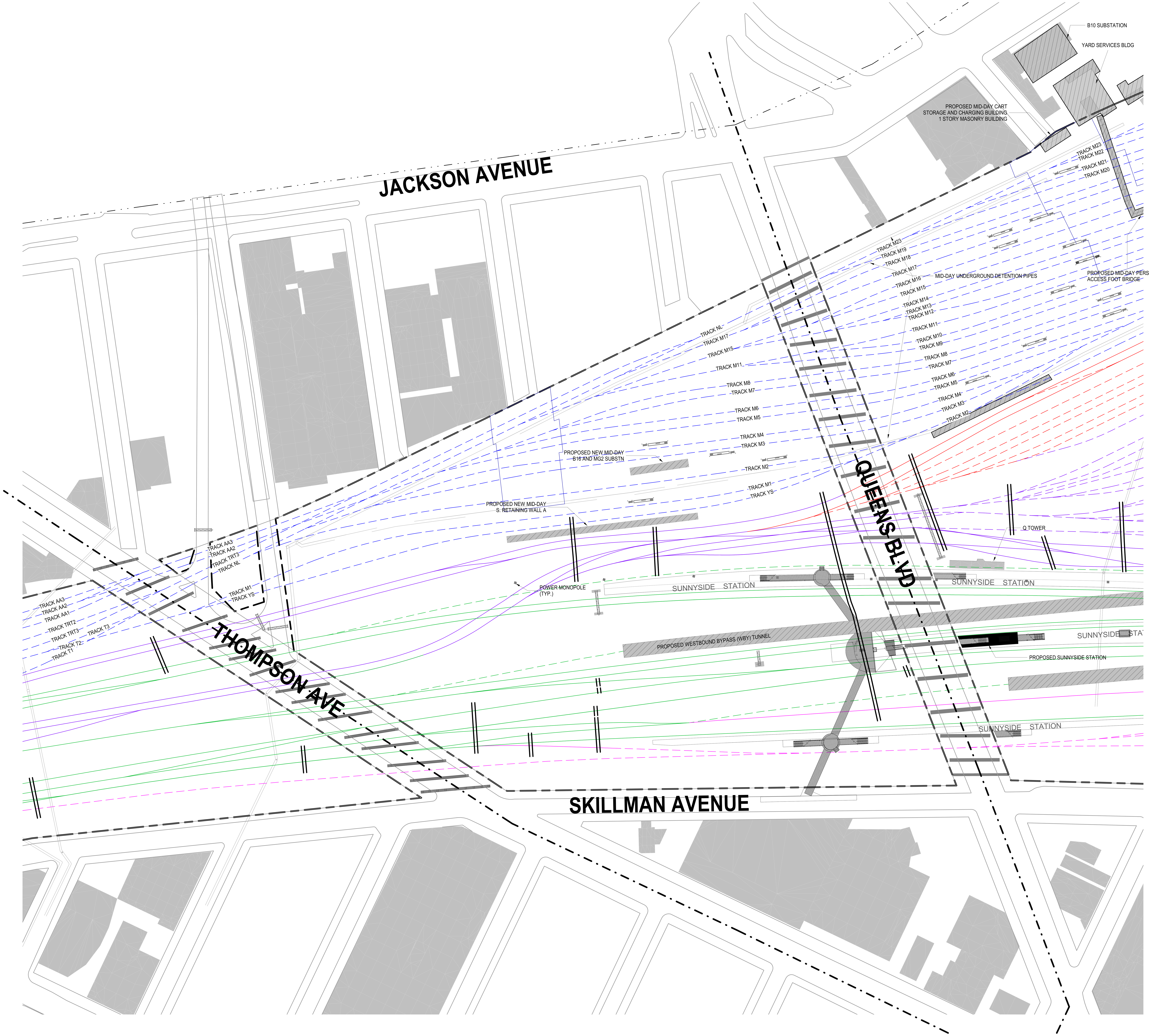
STRUCTURE

Title

OVERALL SITE PLAN - EXISTING AND PROPOSED STRUCTURES - SECTOR A

Thornton Tomasetti

Designed by CC
Drawn by AP
Checked by JB
Date 11/20/2018
Drawing Number S-100A.00



LEGEND

- EXISTING TRACK
- PROPOSED TRACK
- CROSS TRACK FEEDER

TRACK ZONES

- TRACK ZONE 1
- TRACK ZONE 2
- TRACK ZONE 3
- TRACK ZONE 4
- TRACK ZONE 5
- TRACK ZONE 6
- TRACK ZONE 7
- TRACK ZONE 8

BUILDINGS

- EXISTING BUILDINGS
- PROPOSED BUILDINGS
- DEMOLISHED BUILDINGS

NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date

Key Plan

Discipline:

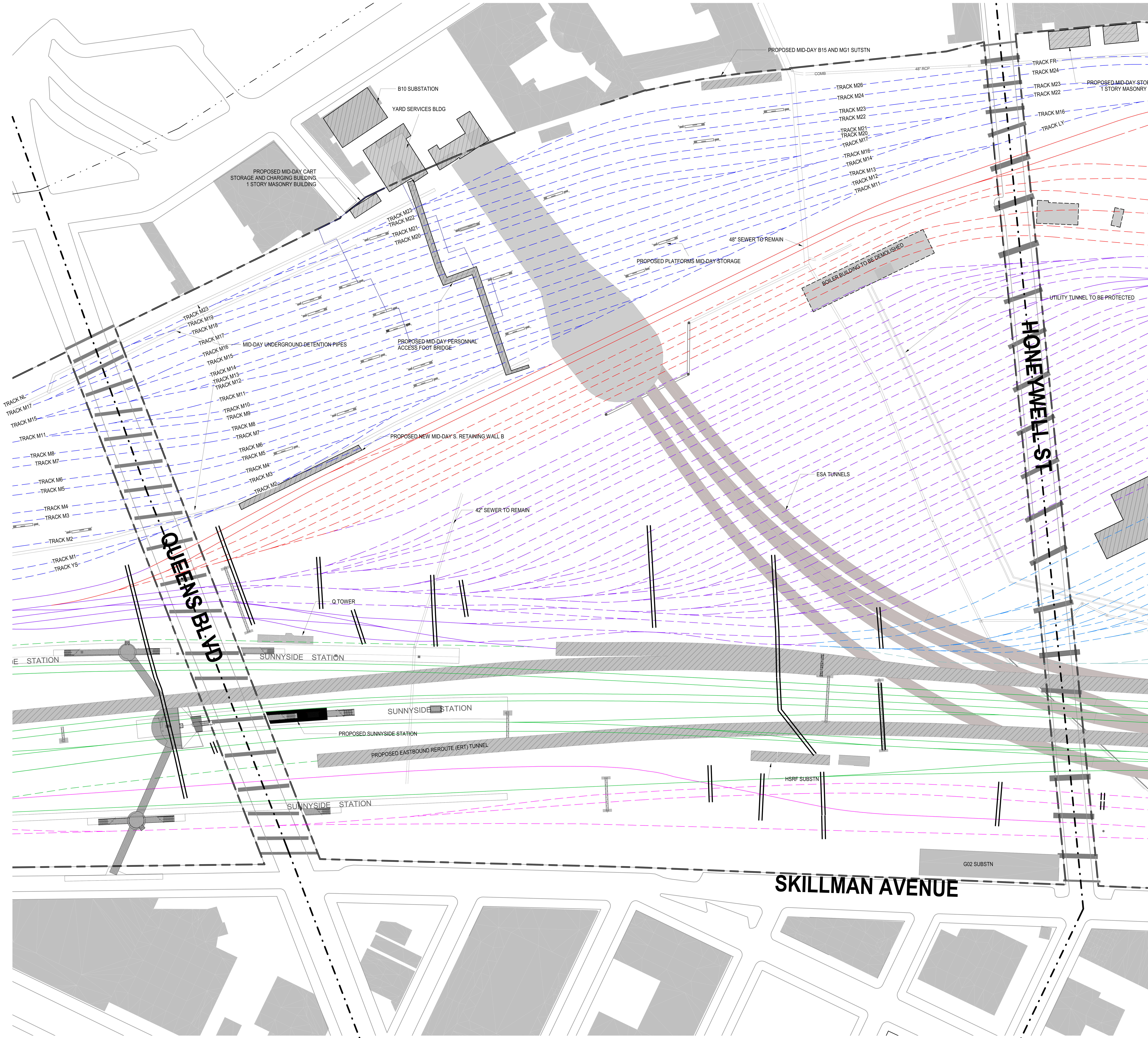
STRUCTURE

Title

OVERALL SITE PLAN - EXISTING AND PROPOSED STRUCTURES - SECTOR B

Thornton Tomasetti

Designed by	CC
Drawn by	AP
Checked by	JB
Date	11/20/2018
Drawing Number	S-100B.00



LEGEND

- EXISTING TRACK
- PROPOSED TRACK
- CROSS TRACK FEEDER

TRACK ZONES

- TRACK ZONE 1
- TRACK ZONE 2
- TRACK ZONE 3
- TRACK ZONE 4
- TRACK ZONE 5
- TRACK ZONE 6
- TRACK ZONE 7
- TRACK ZONE 8

BUILDINGS

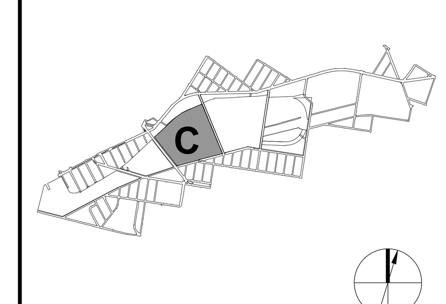
- EXISTING BUILDINGS
- PROPOSED BUILDINGS
- DEMOLISHED BUILDINGS

NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date

Key Plan



Discipline:

STRUCTURE

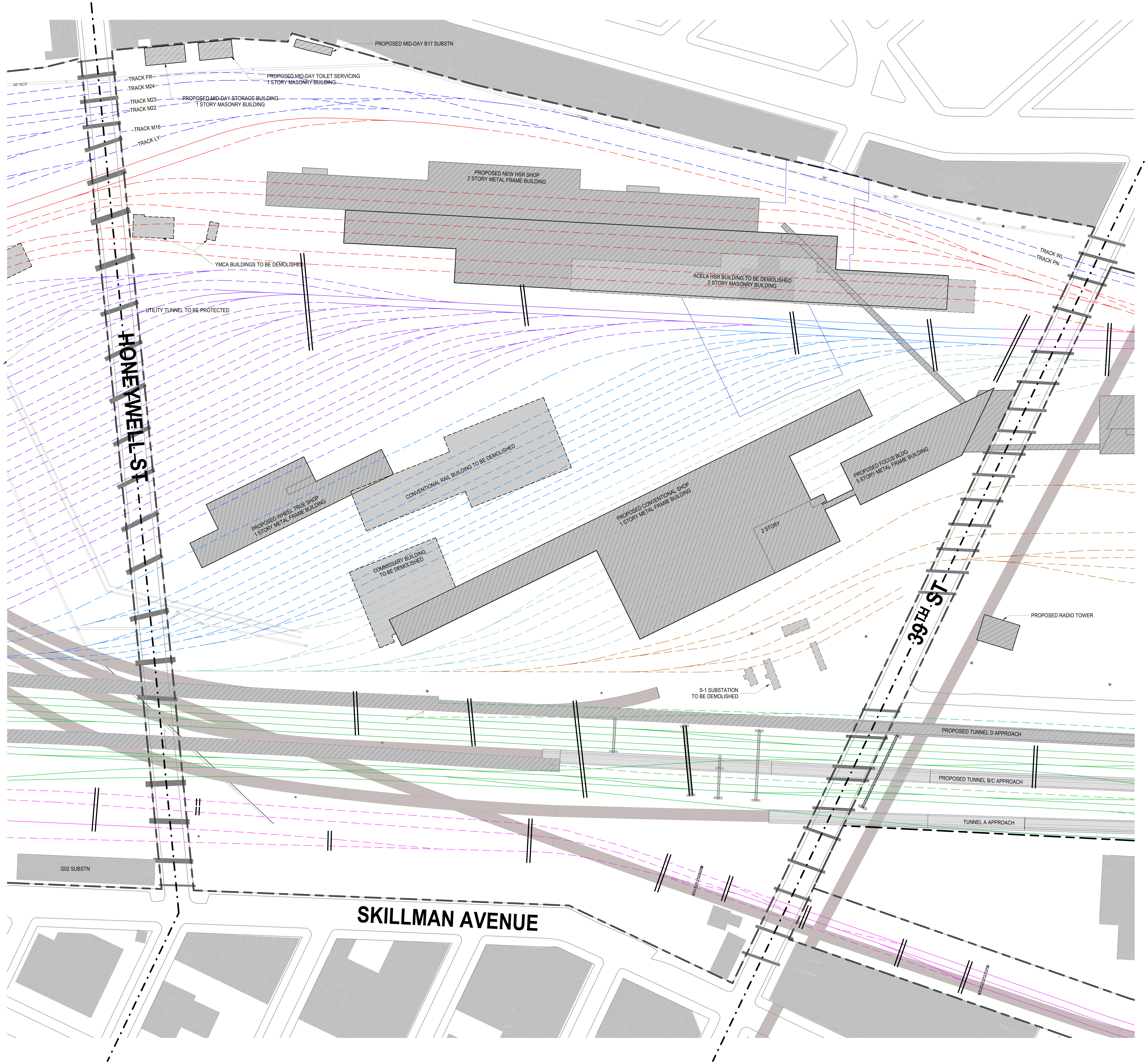
Title

OVERALL SITE PLAN - EXISTING AND PROPOSED STRUCTURES - SECTOR C

Thornton Tomasetti

Designed by CC
Drawn by AP
Checked by JB
Date 11/20/2018
Drawing Number S-100C.00

Appendix O



LEGEND

- EXISTING TRACK
- PROPOSED TRACK
- CROSS TRACK FEEDER

TRACK ZONES

- TRACK ZONE 1
- TRACK ZONE 2
- TRACK ZONE 3
- TRACK ZONE 4
- TRACK ZONE 5
- TRACK ZONE 6
- TRACK ZONE 7
- TRACK ZONE 8

BUILDINGS

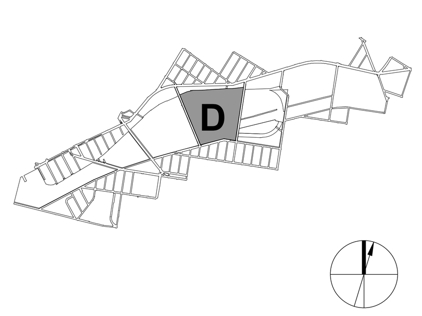
- EXISTING BUILDINGS
- PROPOSED BUILDINGS
- DEMOLISHED BUILDINGS

NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date

Key Plan



Discipline:

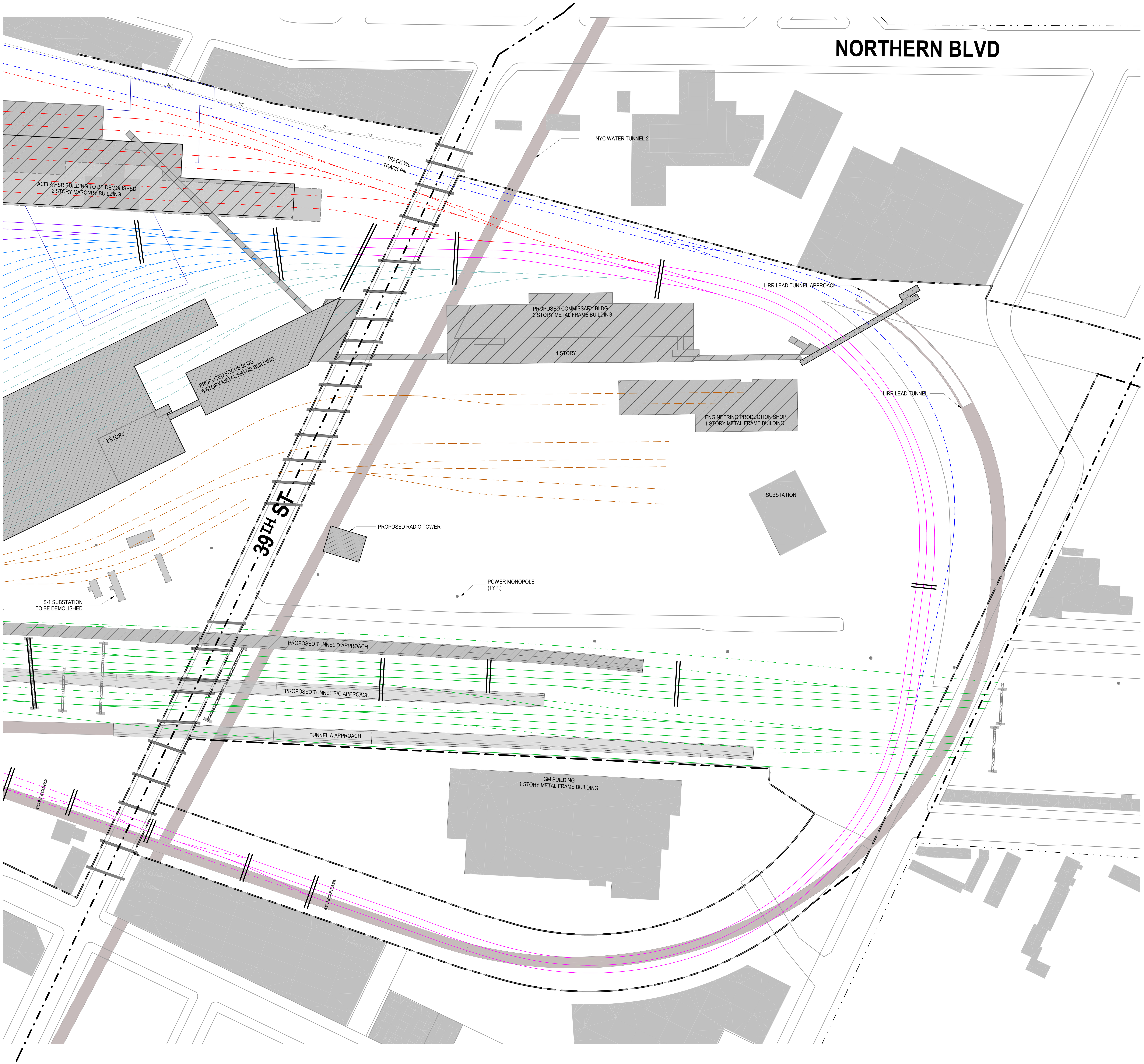
STRUCTURE

Title

OVERALL SITE PLAN - EXISTING AND PROPOSED STRUCTURES - SECTOR D

Thornton Tomasetti

Designed by	CC
Drawn by	AP
Checked by	JB
Date	11/20/2018
Drawing Number	S-100D.00



LEGEND

- EXISTING TRACK
- PROPOSED TRACK
- CROSS TRACK FEEDER

TRACK ZONES

- TRACK ZONE 1
- TRACK ZONE 2
- TRACK ZONE 3
- TRACK ZONE 4
- TRACK ZONE 5
- TRACK ZONE 6
- TRACK ZONE 7
- TRACK ZONE 8

BUILDINGS

- EXISTING BUILDINGS
- PROPOSED BUILDINGS
- DEMOLISHED BUILDINGS

NYCEDC

SUNNYSIDE YARDS MASTER PLAN

No.	Description	Date

Key Plan

E

Discipline:

STRUCTURE

Title

OVERALL SITE PLAN - EXISTING AND PROPOSED STRUCTURES - SECTOR E

Thornton Tomasetti

Designed by	CC
Drawn by	AP
Checked by	JB
Date	11/20/2018
Drawing Number	S-100E.00